THE CONVERSATION
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This cow has the right idea. Cow image from www.shutterstock.com

Seaweed could hold the key to cutting methane emissions from cow burps

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When Canadian farmer Joe Dorgan noticed about 11 years ago that cattle in a paddock by the sea were more productive than his other cows, he didn't just rediscover an Ancient Greek and Icelandic practice.

While the Ancient Greeks didn't have to contend with global warming, it turns out that this practice could significantly reduce greenhouse gas emissions from 21st-century livestock farming.

Cows and sheep produce methane, a greenhouse gas that is 28 times more powerful than carbon dioxide. Despite misconceptions, most cow methane comes from burps (90%) rather than farts (10%). Livestock produce the equivalent of 5% of human-generated greenhouse gases each year, or five times Australia's total emissions.

From Canada to the world

Dorgan's cattle were eating storm-tossed seaweed. Canadian researchers Rob Kinley and Alan Fredeen have since found that seaweed not only helped improve the cows' health and growth, but also reduced their methane production by about 20%.

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This and other lines of evidence led Kinley, who by then had moved to CSIRO, to team up with other CSIRO scientists and marine algae specialists at James Cook University to test a wide range of seaweeds.

They tested 20 seaweed species and found that they reduce methane production in test-tube samples from cow stomachs by anything from zero to 50%. But to do this required high amounts of seaweed (20% by weight of the sample) which was likely to present digestion issues for animals.

But when the researchers tested a particular type of seaweed collected from Queensland's coastal waters, they thought their instruments were broken and ran the tests again. It turns out that *Asparagopsis taxiformis* reduces methane production by more than 99% in the lab. And unlike other seaweeds where the effect diminishes at low doses, this species works at doses of less than 2%.

Asparagopsis produces a compound called bromoform ($CHBr_3$), which prevents methane production by reacting with vitamin B12 at the last step. This disrupts the enzymes used by gut microbes that produce methane gas as waste during digestion.

Asparagopsis reduces methane in the lab by up to 99%. Michael Battaglia, Author provided

Fighting climate change, feeding people

Globally, 1.3 billion people depend, partially or entirely, on livestock for their livelihoods. Livestock

provides protein and micronutrients to many of the world's 830 million people experiencing food insecurity.

Livestock methane production is not just an environmental problem. All this burped methane is wasted energy that could be going to make animals produce more food. Around 15% of feed expenses are lost in methane emissions. As feed is the primary expense for livestock farmers, this is no small problem.

It's not just the cost, either. As wealthier consumers become more aware of environmental issues around agriculture, some are choosing to eat less meat.

If farmers could supplement their feed with seaweed, this might just help with two of the biggest challenges of our time: fighting climate change and growing more food with fewer resources.

In Australia, if we could develop a way to include seaweed feed in the Emissions Reduction Fund (as for dairy farmers), farmers might even be able to get carbon credits at the same time.

CSIRO and partners James Cook University, with funding from Meat and Livestock Australia, are currently conducting further experiments to examine how feeding seaweed to cattle affects production. These experiments aim to confirm the effects measured in the lab and in live sheep experiments. Confirmation through these experiments could create a new industry in growing seaweed as a feed supplement for livestock.

Where can we grow all the seaweed?

Seaweed production globally is booming, with more than 25 million tonnes (measured when wet) farmed each year, which is about double the global commercial production of lemons.

Producing enough *Asparagopsis* to feed 10% of the almost 1 million feedlot and 1.5 million dairy cattle in Australia would require about 300,000 tonnes a year, and millions of tonnes if it were to be scaled up globally.

With selection and breeding of seaweed varieties for higher bioactivity, this figure could come down, but perhaps only by half, and it would still require large areas of land and water. With typical seaweed production rates at 30-50 tonnes of dry matter per hectare, this suggests that to supply 10% of the Australian livestock industry will require at least 6,000 hectares of seaweed farms.

The booming seaweed industry is already aware of the pitfalls experienced in fish farming.

There are likely to be many indirect benefits, including creating alternative livelihoods in many developing countries where fishing may be in decline, and the use of seaweed as a means to filter detrimental nutrients from rivers or effluent from fish farms.

But seaweed farms more generally will be part of our increasing demands on the marine environment and will need to be part of integrated ecosystem wide management and marine spatial planning.

But for now, Joe Dorgan, of Seacow Pond in Prince Edward Island, Canada, will continue to feed seaweed to all of his cattle and reap the rewards of improved health and production.