VERMONT'S GMO LEGACY: PESTICIDES, POLLUTED WATER & CLIMATE DESTRUCTION

Toward a new agricultural paradigm.

REGENERATION VERMONT

Vermont's GMO Addiction:
Pesticides, Polluted Water, and Climate Destruction

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About the publisher: Regeneration Vermont is a nonprofit educational and advocacy organization that is working to halt the catastrophic consequences of Vermont's adoption of degenerative, toxic and climate-threatening agricultural techniques, particularly within the dominant dairy sector. We are affiliated with Regeneration International, a bold new organization working to educate, unify and mobilize movements around agricultural-based solutions to the world's climate, hunger and environmental crises.

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Executive Summary

Vermont has proven itself to be a leader when it comes to showing its concern over the use of genetically-modified organisms (GMOs) in agriculture and food production. It was the first state in the nation to pass GMO-labeling legislation, forcing food corporations nationwide to scramble and prepare to meet the law's requirements when it takes effect in July 2016. But, in many ways, the passage of this historic law has left a false impression that it "solved" the GMO problem in the state. Nothing could be further from the truth.

Vermont agriculture is dominated by GMOs, especially within the commodity dairy sector, which represents more than 70% of the state agricultural economy. Currently, there are more than 92,000 acres of GMO feed corn that are grown in Vermont, making it – by far – the state's number one crop. More than 96% of all feed corn grown in Vermont is genetically modified, and almost all of this GMO corn is used to feed dairy cows.

Ironically, Vermont's GMO addiction is exempt from its own GMO labeling law, as the law specifically exempts dairy and meat products. So while the law will force mainstream food corporations to label GMOs in products like Cheetos and Spaghettios before coming into the state, it turns a blind eye to the GMO-derived dairy that is the primary ingredient in, for example, Ben & Jerry's ice cream and Cabot's cheddar cheese.

This is about more than the consumer's right to know. It's also about the impact GMO-centered agriculture is having on Vermont's environment and wildlife, its role in the continued monopolization of the food supply, and the roadblocks it creates in the path toward a truly regenerative, eco-sensitive, and socially-just form of agriculture in the state. The current domination of GMOs and industrial agriculture in Vermont dairy is, quite frankly, the elephant on the farm that few want to acknowledge.

The history of Vermont's heavy adoption of industrial – or degenerative – forms of agriculture is also the history of its failure and decline. At every stage, beginning with chemical agriculture in the post-WWII era, the new techniques being promoted by the increasingly corporate and industrial agriculture came with mighty promises: Labor would be saved, yields would increase, bugs and insects would be eliminated, and profits would soar. Just get in line, and follow the edicts coming out of the USDA and the agricultural extension centers.

But, more often than not, the promises were false – or short lived – while the damage was deep, most notably in the way further industrialization all but mandated the consolidation of Vermont's farms. "Get big or get out" has been the dominant mantra in agriculture since the late 1950s. And it worked. Many did get big, but most got out. Vermont lost a staggering number of farmers as commodity dairy took over. More than 10,000 dairy farms were gone within a sixty-year period from the 1950s to today.

This huge loss – over 700 farms per county – also meant a precipitous decline in a rural economy and culture that revolved around the small, family farmer. The once thriving towns

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mirrored the agricultural decline, most reduced to near-ghost towns, mere pass-throughs, with buildings boarded up and general stores either gone or teetering on the economic brink.

Aristotle wrote that the nature of anything can be discerned only after it has reached or passed its maturation. Industrial – or degenerative – agriculture has certainly matured, showing its nature clearly after decades of domination of Vermont's farm economy. And it's not only a story of decline, but also toxicity, as our watersheds, soils, farm animals and food products are awash in the chemicals and synthetic fertilizers used on Vermont's industrialized farmland. Hundreds of millions of dollars have been spent in the last several decades alone just trying to remedy the pollution of Lake Champlain and its watershed as a result of the techniques of industrial dairy farming.

Despite its record, industrial agriculture keeps marching along, still coddled by government regulators and politicians alike, and still making promises it can't deliver. GMO techniques are its latest – and, we hope, last – degenerative gimmick, one that, like all of them before, Vermont agriculture has wholeheartedly embraced.

GMOs were introduced in the mid-1990s with a fleet of promises, most notably the "dramatic decrease" in the amount of pesticides and fertilizers that would be required. They also trotted out the well-worn promises of rising farmer incomes via higher yields and, of course, solving world hunger, something they've been claiming to solve since the 1950s with the only results being more – not less – of it.

But GMO use has matured, and we know its nature. In Vermont, our 92,000 acres of GMO feed corn has meant more pesticide use, more fertilizer use, more fuel use because of more applications, and more trips over the field. And our hunger issues have grown worse.

The true nature of GMO agriculture in Vermont today is a stark and dangerous difference from the promises of its corporate advocates. According to data collected by the Vermont Agency of Agriculture, pesticide use is up 39% and increasing rapidly while, at the same time, new pesticides are being added to the arsenal. Climate-threatening nitrogen fertilizers have been up about 17% per year in the decade of GMO's rise to dominance (2002-2012) and climbing as our denuded soils require more and more inputs for high production. And the pollution to our climate, water and soil from these increases continues to rise, keeping us on a steady degenerative decline, environmentally, economically and culturally.

Labeling GMOs was a great act of concern by Vermont. It will provide valuable information to consumers. But it did nothing to address the state's deep addiction to GMO agriculture and all that comes with it. The industrialization of our farm sector threatens Vermont's brand, which was built upon an image of bucolic and natural -- the very opposite of the way today's milk is being produced for Ben & Jerry's ice cream and Cabot's cheese. It's a disconnect between branding and reality that will, eventually, come to haunt them.

It's time for Vermont to get off the industrial superhighway of commodity agriculture. We've seen enough, frankly, from pesticides to GMOs, a legacy rich in damage – social and ecological – one false promise at a time. We should work to make GMOs the last in a long line of agricultural mistakes, born from short-sightedness, a commodity-driven lust for quantity over quality, with economic supremacy as its guiding purpose, and with little regard for the long-term damage. We should make right now the great line of demarcation between the degenerative agriculture of the failed past and a future of regenerative agriculture. It won't just make for a better agriculture, it will also make for a better culture and a better planet.

The GMO Explosion in Vermont

Biotechnology corporations have never been conservative with their public relations efforts, especially when trotting out new techniques aimed at market domination. Huge claims are made, and many people – scientists, lawyers, marketing professional and journalists – are paid, directly or indirectly, to make a great show of the claims. World hunger will be solved. Labor will be saved. And your bank accounts will explode. If only you adopt the latest and greatest methods, which, it just so happens, they're selling. And so goes the story of modern industrial agriculture.

The advent of genetically-modified organisms (GMOs) in agricultural crops came with a rush of corporate promises. But it was the promise of the reduction in toxic inputs – pesticides, fertilizers, etc. – that was the most featured rallying cry for GMO corporations, clearly seizing on a nation's unease with their growing threats.

They weren't shy about their claims:

> "The benefits of biotechnology are many and include providing resistance to crop pests to improve production and reduce chemical pesticide usage, thereby making major improvements in both food quality and nutrition."[1]
>
> "Genetic engineering is our best hope for reducing reliance on harmful pesticides and herbicides without sacrificing high crop yields."[2]
>
> "We'll soon be able to produce more crops with less pesticide, less fuel, less fertilizer, fewer trips over the field."[3]
>
> "GM crops can provide farmers with the means to improve yields under weed and insect pressure; decrease tillage to protect soil and water resources; and reduce pesticide applications, thereby decreasing the use of fossil fuels."[4]

They also got much more creative, throwing in the old standby – solving world hunger – and some not even in the wheelhouse of sanity: envisioning a plant that would produce pork chops. Anything, it seemed, to get a foothold in the market, with clear plans of eventual monopolization of everything from the seeds to the pesticides and fertilizers required to grow them.

The sales job worked. Vermont fell for it, following national trends, and rushing into GMO production.

THE DATA: GMO USE

In 2002, only 8% of Vermont's corn acreage was planted with GMO seed. But, by 2012, well more than 90% was genetically engineered (109% in 2011 due to replanting). Dairy lobbyists in Vermont claimed that 96% of Vermont corn was GMO in 2014. In this short span of thirteen years, there was at least a 12-fold increase in the adoption of GMO corn in Vermont. The acreage of Vermont farmland used to grow corn for animal feed remained relatively constant during 2002-12, averaging 91,200 (85,000-96,000) acres per year.

Vermont GMO Corn Usage

YEAR	GMO%
2002	**8**
2003	**16**
2004	**19**
2005	**28**
2006	**37**
2007	**46**
2008	**67**
2009	**77**
2010	**89**
2011	**109**
2012	**90**
2012	**103**

Compiled from VT Agency of Agriculture Reporting Data.

CORN HERBICIDES

From 2002, when GMO corn was planted on only 8% of all Vermont corn acreage, until 2007, when GMO corn acreage was 47%, herbicide use averaged 160,201 pounds per year. From 2008-12, when GMO corn was planted on 67-90% of corn acreage, herbicide use increased by an average of 101,860 pounds per year over the period from 2002-7, and averaged 262,0961 pounds per year, a 39% increase.

In 2002-3 herbicide use on corn averaged 1.5 pounds per acre, per year. From 2008-12, herbicide use averaged 2.86 pounds per acre, per year.

Herbicide Use on Vermont Corn, 2002-12

YEAR	GMO%	#/AC POUNDS		ACRES
2002	8	1.54	142164	92000
2003	16	1.46	139679	96000
2004	19	1.94	174410	90000
2005	28	2.25	202109	90000
2006	37	1.72	146395	85000
2007	46	1.7	156448	92000
2008	67	2.9	272742	94000
2009	77	2.49	228710	91000
2010	89	2.43	223599	92000
2011	109	3.46	311058	90000
2012	90	3.01	274197	91000

Compiled from VT Agency of Agriculture Reporting Data.

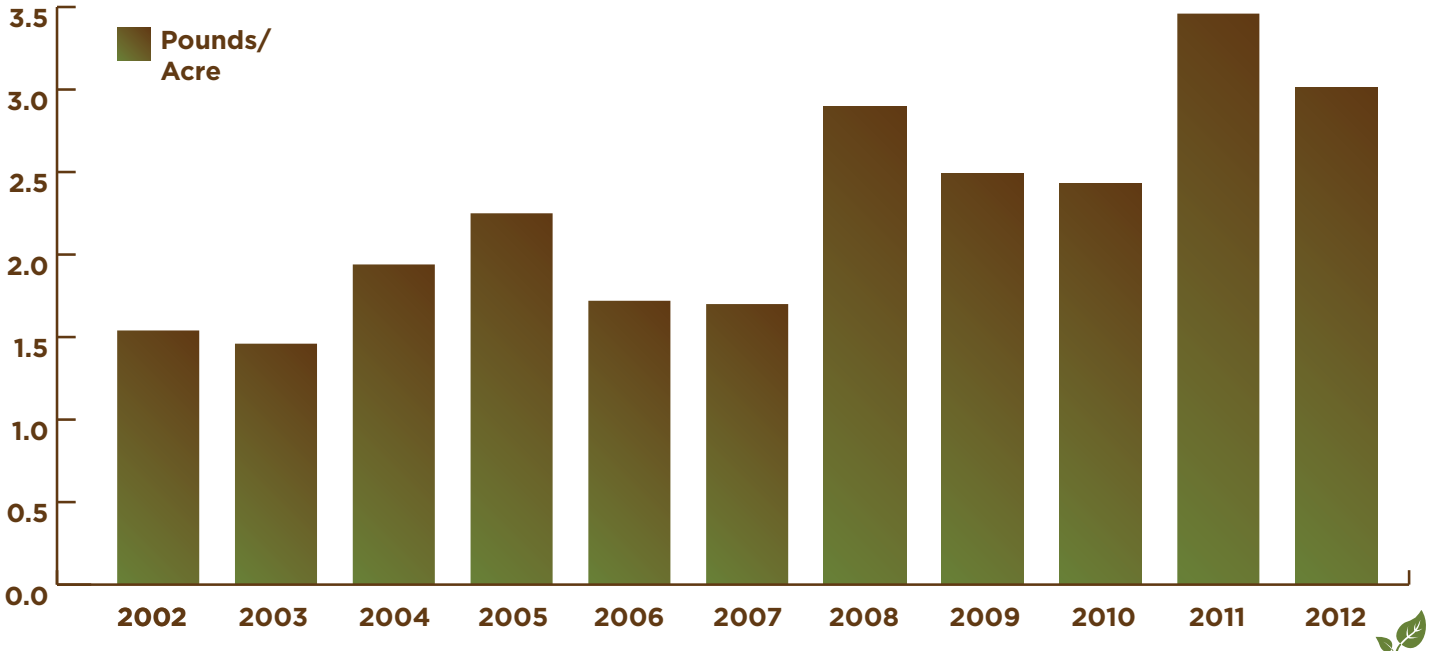
HIGHLY TOXIC HERBICIDES

During the period from 1999-2012, 8 highly toxic herbicides dominated pesticide use on Vermont corn crops. Those herbicides were atrazine,[5] metholachlor,[6] simazine,[7] pendimethalin,[8] glyphosate,[9] acetochlor,[10] dicamba,[11] and alachlor.[12]

Regulators have determined that five of these eight most used herbicides are possible or probable human carcinogens, the remaining three are suspected carcinogens. Seven of the eight are possible or probable endocrine disruptors (the other one is a suspected to be an endocrine disruptor). All eight have been determined by regulators and academics to cause birth or developmental defects and contaminate drinking water and public waters with dangerous chemicals that have long-term persistence. Atrazine, simazine, acetachlor, and alachlor have lost their registration in the EU, and are effectively banned.[13]

In the most recent data set (including 1999-2012), all of the eight herbicides listed above were used, however, just two herbicides, metolochlor and atrazine dominated usage from 2002-12. In 2002, atrazine and metolachlor accounted for 70.14% of corn pesticide use; and from 2008-12, metolachlor and atrazine, accounted for 86.46% of use.

Graph of Herbicide Use on Vermont Corn, 2002-12



Compiled from VT Agency of Agriculture Reporting Data.

Even as stacked GMO corn varieties became widely adopted (with both herbicide tolerance to Roundup/glyphosate and Bt for insect control), farmers did not use large quantities of glyphosate to take advantage of the herbicide tolerant modification. Throughout the period of study, 2002-12, glyphosate was a minor use pesticide, accounting for only 4.14% of average use per year for the entire period. From 2008-12 glyphosate only accounted for an average of 7.02% of pesticides used per year on corn.

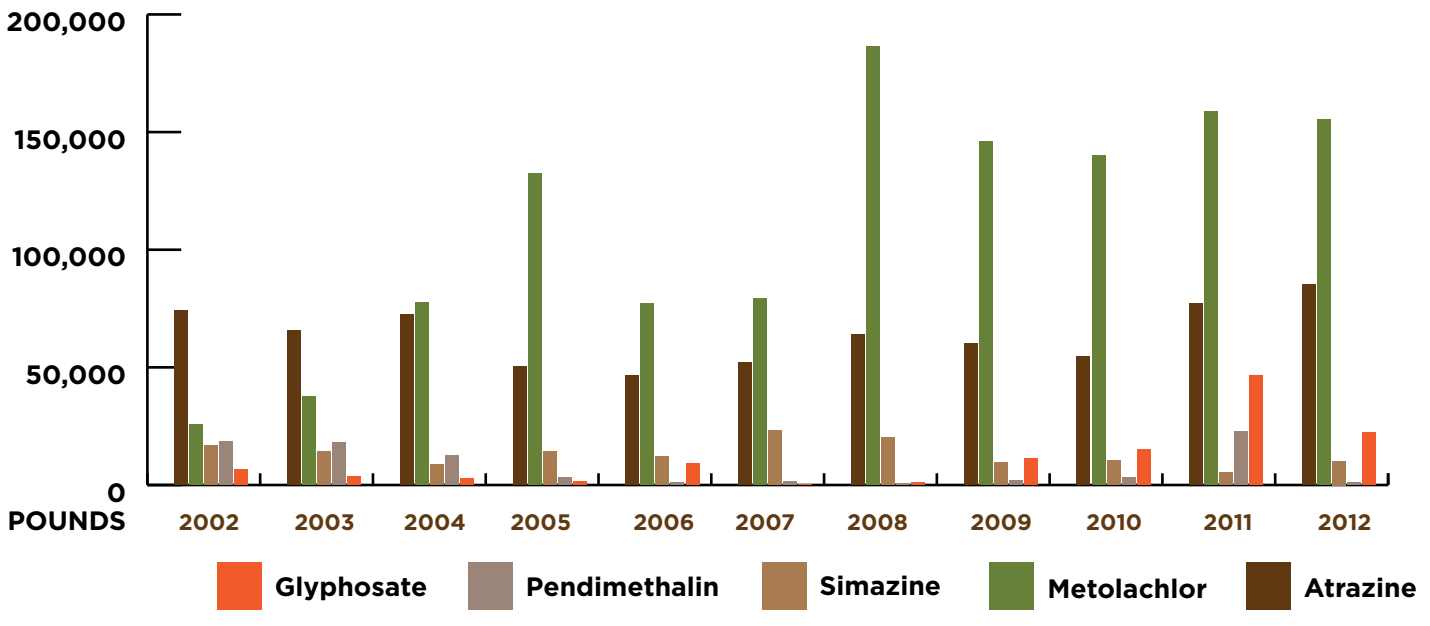
Instead of depending on glyphosate, farmers continued to depend on metolachlor and atrazine for weed control just as they had prior to adopting GMOs. Apparently, with Vermont's capricious weather, farmers and applicators determined that atrazine and metolochlor would provide more residual control of weeds than glyphosate. The pattern in Vermont has not seen glyphosate (the supposedly less toxic weed killer) replace more toxic herbicides. Instead, highly toxic herbicide use increased dramatically.

Five Highly Toxic Herbicides Used on Vermont Corn, 2002-12, in Pounds

Year	Atrazine	Metolachlor	Simazine	Pendimethalin	Glyphosate	GMO%
2002	73996	25722	16936	18543	6550	8
2003	65837	37796	14052	18118	3728	16
2004	72433	77686	8743	12383	2783	19
2005	50487	132436	14223	3011	1519	28
2006	46500	77021	12014	1195	9223	37
2007	52097	79248	23158	1384	279	46
2008	63859	186259	20291	614	952	67
2009	60225	145796	9607	1882	11147	77
2010	54672	139954	10278	3060	15022	89
2011	77232	158583	5299	22733	46730	109
2012	85083	155371	10205	1038	22261	90

Compiled from VT Agency of Agriculture Reporting Data.

Top Five Herbicides Used on Vermont Corn, 2002-2012



Compiled from VT Agency of Agriculture Reporting Data.

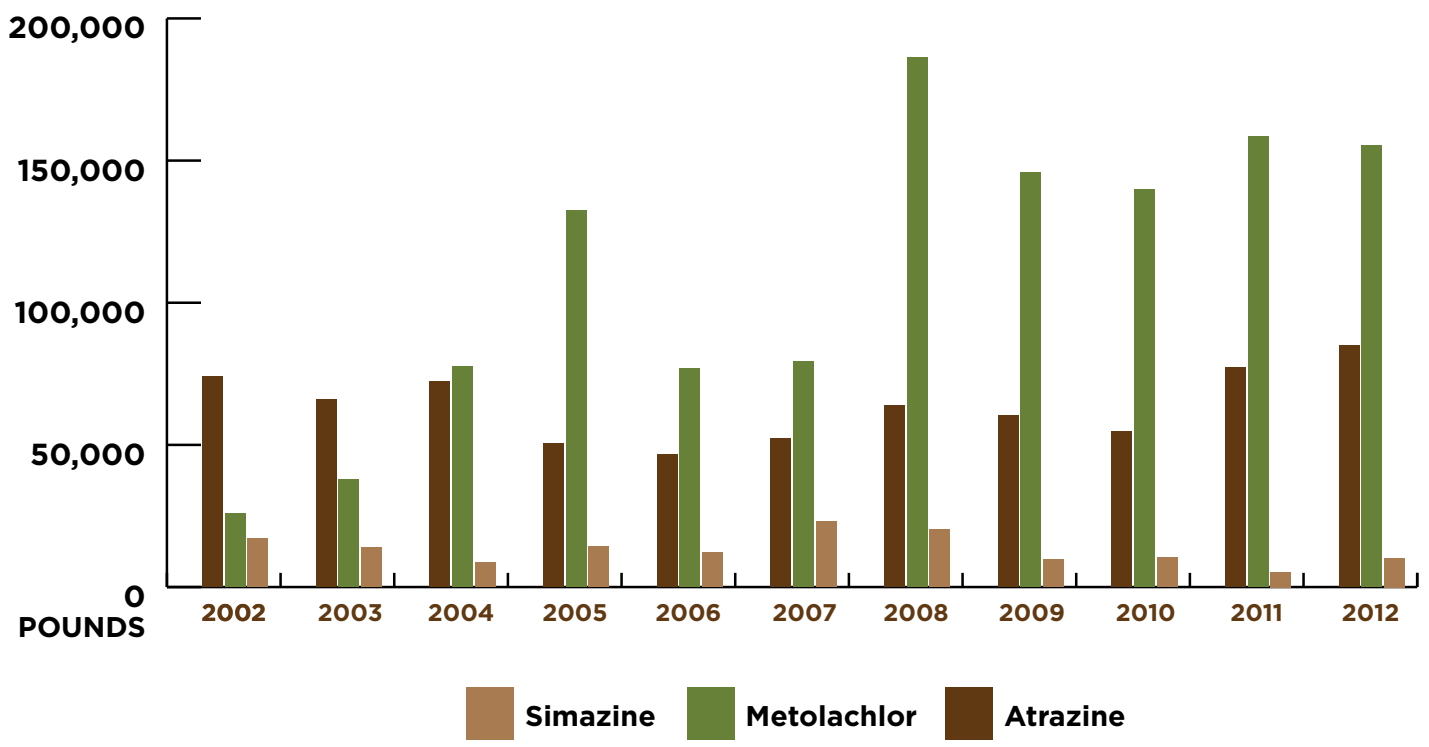
Percentage of Vermont Corn Treated with Top Herbicides, 2002-12					
YEAR	% METOLACHLOR	% ATRAZINE	% SIMAZINE	% GLYPHOSATE	% PENDIMETHALIN
2002	18.09%	52.05%	11.90%	4.61%	13.04%
2003	27.06%	47.13%	10.06%	2.67%	12.97%
2004	44.54%	41.53%	5.01%	1.60%	7.10%
2005	65.52%	24.98%	7.04%	0.75%	1.49%
2006	52.61%	31.76%	8.21%	0.63%	0.82%
2007	50.65%	33.30%	14.80%	0.18%	0.88%
2008	68.29%	23.41%	7.44%	0.35%	0.23%
2009	63.75%	26.33%	4.20%	4.87%	0.82%
2010	62.59%	24.45%	4.60%	6.72%	0.36%
2011	50.98%	24.83%	1.70%	15.02%	7.31%
2012	56.66%	31.03%	3.72%	8.12%	0.38%
Avg. '02-12	**50.97%**	**32.80%**	**7.15%**	**4.14%**	**4.12%**
Avg. '08-12	**60.45%**	**26.01%**	**4.33%**	**7.02%**	**1.82%**

Compiled from VT Agency of Agriculture Reporting Data.

Percentage of Vermont Corn Treated with Most Used Herbicides, 2002-12			
YEAR	TOP 2	TOP 3	TOP 5
2002	70.14%	82.04%	99.65%
2003	74.19%	84.25%	99.89%
2004	86.07%	91.08%	99.78%
2005	87.50%	97.54%	99.78%
2006	84.37%	92.58%	94.03%
2007	83.95%	98.75%	99.81%
2008	91.70%	99.14%	99.72%
2009	90.08%	94.28%	99.97%
2010	87.04%	91.64%	98.72%
2011	75.81%	77.51%	99.84%
2012	87.69%	90.41%	98.91%
Avg./yr	**83.50%**	**90.20%**	**99.10%**
Avg. '08-'12	**86.46%**	**90.60%**	**99.43%**

As previously noted, the top two herbicides from 2002-12 were metolachlor and atrazine, accounting for 86.46% of total use on corn. The top three herbicides were metolachlor, atrazine, and simazine, accounting for 90.60% of use. The top five herbicides were metolachlor, atrazine, simazine, glyphosate, and pendimethalin, accounting for 99.43% of use from 2002-12.

Graph of the Top Three Herbicides used on Vermont Corn, 2002-12



Compiled from VT Agency of Agriculture Reporting Data.

Apparently weeds treated with atrazine and metolachlor have not developed a level of resistance that has restricted their use, even though there are recorded instances of resistance (especially lambsquarter and red root pigweed) to both atrazine and simazine in Vermont and New York. Lumax, Syngenta's mixture of metolochlor, atrazine, and mesotrione, has been used for more than a decade as the major weed control herbicide mixture in Vermont. In 2002, the major herbicide in the Lumax mixture was atrazine at 52%. From 2008-12, however, metolachlor accounted for 60.45% of the Lumax mixture.

In addition to the pesticides that are applied on cornfields and corn seed, Vermont data shows that more than 74% of the GMO corn grown in Vermont in 2012 was modified with Bacillus thuringiensis (Bt) genes. This genetic insertion stimulates the plants to produce more genetically modified Bt than non GMO Bt insecticides which would normally be sprayed on the plants to control worms and beetles (such as the Corn Root Worm and European Corn Borer).

For example, SmartStax, Monsanto's genetically modified corn synthesizes six Bt toxin proteins, three targeting the European Corn Borer, and three for Corn Root Worm. Total Bt toxin protein production for SmartStax is estimated at 3.7 pounds/acre, which is 19 times the average conventional Bt insecticide rate of application in 2010.[14]

Recent reports have concluded that studies claiming that GMO Bt crops have decreased insecticide use "do not seem to have considered seed treatments or the Bt expressed by the genetically manipulated plants, and so may have overstated reductions in insecticide use."[15, 16] Both the Vermont AAF&M and the USDA should evaluate the additional pesticides produced by the GMO plants and the seed treatments when compiling annual pesticide use reports. This would allow a more accurate determination of the real amount of pesticides being broadcast into our rural environment. At present, no state or federal agencies are tracking and compiling this data.

Since more than 80% of Vermont corn is grown for forage, European Corn Borer (which some of the GMO Bt is designed to control) is not a major problem because most of the corn is not grown for seed, and corn borers damage the seed not the leaves or stalk. The seed-treatment pesticides designed to control corn rootworm are also not necessary, since rootworm is not a major pest in Vermont.

Whether the pesticides are needed to control pests or not, they are still being broadcast on the soil, in the air, and end up in our public water systems. The five most used herbicides are among the most dangerous chemicals used on corn in the U.S., atrazine, metolochlor, simazine, glyphosate, and pendimethalin—and they are all water polluters. The other chemicals that are part of the genetically modified and seed treatment package on Vermont corn include the bee-killing clothianidin (a neonicitinoid), excessive expressions of Bt, and biocide-like fungicides. The increase in toxic herbicide use coupled with genetically inserted and seed treatment pesticides that are not even used to control pests is irresponsible.

NITROGEN FERTILIZER

Most of the synthetic and animal fertilizer used in the state is on dairy farms, which account for the largest number of non-forested acres in Vermont (about one million). According to the Vermont AAF&M data from 2002-8, nitrogen fertilizer use averaged 14.4 million pounds (7,215 tons) per year throughout the state, while the three-year average from 2009-12 was 16.8 million pounds (8423 tons).[17]

Nitrogen fertilizer use did not drop with GMO adoption, as promised in the ads and editorials. Instead, nitrogen use increased over the 2002-8 average by 2.4 million pounds per year (17% per year) for the 2009-12 period. In 2002, when GMO corn was planted on only 8% of corn acres, nitrogen use was 8.9 million pounds (4462 tons). Average nitrogen use from 2009-12 almost doubled (increased by 1.9 times) the 2002 usage.

Vermont has 185 dairies that are designated by the USDA as Animal Feeding Operations (AFOs with 200-699 cows) and 25 Concentrated Animal Feeding Operations (CAFOs with more than 700 cows).[18] As dairies added more cows and became AFOs or CAFOs, Vermont farmers had to contain ever-increasing amounts of manure waste in lagoons, and then spread the slurry on their farmland. The dairy slurry contains pesticides, antibiotics, hormones, nitrogen, phosphorus, and potash.

The combination of lagoon wastes and synthetic nitrogen used annually on Vermont corn crops is usually in excess of what is required, or recommended by University of Vermont advisories, to produce a high quality, high yield corn seed or forage crop.[19]

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NITROGEN FERTILIZER INCREASES IN VERMONT, 2002-12, IN POUNDS

YEAR	NITROGEN	PCT. GMO CORN
2002	8,924,000	8
2003	14,864,000	16
2004	14,170,000	19
2005	12,362,000	28
2006	16,188,000	37
2007	21,436,000	46
2008	12,048,000	67
2009	16,928,000	77
2010	*	89
2011	17,072,000	109
2012	16,538,000	90

Compiled from VT Agency of Agriculture Reporting Data.

The excess nitrogen and phosphorus not used by the plants ends up polluting our rivers, lakes, and the ocean and worsens global warming problems, because nitrogen manufacture and use emits nitrous oxide, which is 300 times more damaging as a greenhouse gas than CO2.

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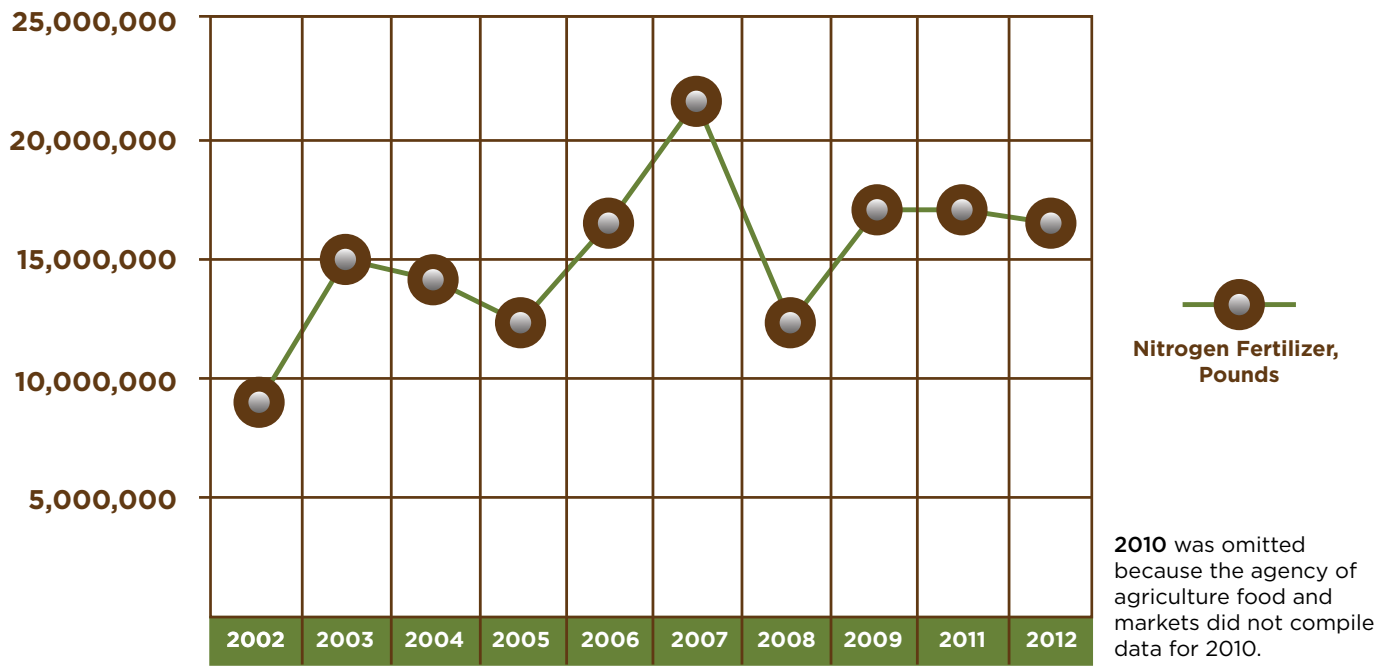
Most of the dairies in Vermont are near rivers, lakes, and streams. Since the slopes of many Vermont corn, grass, and hay lands are steep, the dairy contaminants often end up running off fields and polluting public waterways. Estimates are that Vermont dairy is responsible for 40-79% of the water polluting chemicals that are contaminating our public water systems.[20]

While phosphorous pollution has been targeted as the most damaging effluent entering Vermont's public waters, several experts have noted that synthetic nitrogen is also responsible for a significant portion of the water-contaminating effluent coming from dairies.[21] The data on nitrogen use indicates that the runoff from this source of pollution is probably increasing.

NITROGEN FERTILIZER USE IN VERMONT 2002-12



2010 was omitted because the agency of agriculture food and markets did not compile data for 2010.

Compiled from VT Agency of Agriculture Reporting Data.

Vermont AAF&M. Fertilizer Use Data not available for 2010.

Conclusions

While the availability of such state use-data is refreshingly transparent and unusual, the results are not positive for Vermont's brand. The Vermont brand has been built on a bucolic image of cows grazing on endless pastures. Cabot Cheese, Ben & Jerry's ice cream and other Vermont companies have used this idyllic imagery to sell their products. Gone are the days, however, when most of Vermont's cows were grazing in spectacularly scenic landscapes. Now, a majority of Vermont's dairy cows are locked up in what regulators call "confined animal feeding operations" – or CAFOs - with the cows grazing on concrete with a diet rich in GMO corn and pesticide residues.

The data show that the milk that these iconic Vermont brands use to create their popular award-winning products comes from dairies that pollute our public waterways. The milk used to make these products comes from cows fed corn and forage crops that are grown with increasing amounts of dangerously toxic pesticides and excessive amounts of nitrogen fertilizer. In contrast to advertising efforts of Vermont corporations like Ben & Jerry's and Cabot Creamery, their milk doesn't come from happily grazing cows.

The most striking result of herbicide use during the adoption of GMO corn in Vermont is not increased usage of glyphosate, it is the long-term, almost complete dependence on two highly toxic and water polluting herbicides, atrazine and metolachlor. These two chemicals, combined to dominate use at more than 70.14% when GMO adoption was at only 8% of acreage in 2002. And, their use has increased as GMOs came to dominate Vermont corn acreage. Together, they accounted for 86.46% of use from 2008-12.

Vermont dairies produce about 63% of the milk consumed in New England according to an AAF&M report published in February 2015.[22] The increased confinement of cows and the excessive amounts of feed the cows receive per day (132 pounds of feed to produce one hundred pounds of milk per cow, about 11.6 gallons per day), has led to an increase in milk supplies that is greater

than the New England market can consume. As a result of this glut and the decline in the price of milk from $26.00 per hundred-weight in 2014 to the current price of about $13.60, dairy farmers are dumping low-fat milk into their lagoons that they cannot sell.

The increases in pesticide, fertilizer, and water pollution detailed in this paper, and the recent dumping of milk, show that industrial agriculture solutions to dairy management in Vermont are failing. In spite of these failures, farmers have continued to spend up to double the amount on GMO seed compared to non-GMO seed and still not take advantage of or even need the GMO technology. Whether the almost total adoption of an expensive technology that is not widely used is the result of industry claimed non-GMO supply shortages or clever advertising promises is unknown.

Dairy farmers are paying the price of the failed CAFO/AFO experiment in up-and-down milk prices, and higher pesticide, seed, and fertilizer costs; and while we lament the trap they seem to be in, it is the public that is burdened with even greater costs from this failed dairy farming experiment. The confined dairy strategy in Vermont and other states has produced unsafe dairy products (from toxic pesticides and fertilizers), encouraged bad farming practices, caused significant damage to the environment, and increased pollution of our public lakes, rivers, streams, and drinking water.

Currently, Vermont is attempting to comply with clean water mandates from the EPA to stop the pollution of Vermont's public waters by dairies, milk processing facilities, sewage treatment plants, and municipalities. Until recently, legislators and regulators have not considered the data analyzed in this paper in crafting legislation aimed at curbing the pollution of our public waters because no one had evaluated the state's own important collection of pesticide, fertilizer, and GMO data from the dairies.

Many Vermonters have begun to realize that it will be impossible to address Vermont's dirty water problems without changing the dominant confined animal dairy strategies, which encourage the use of large volumes of extremely toxic pesticides and fertilizers that end up in public water systems.

It is important to stress again that the toxic runoff and effluent from Vermont dairies, according to several scientific studies, is responsible for at least half of the pollution of Vermont's public waters (as we have noted, some researchers have estimated as much as 79%).

The results are clear: Vermont's dairies are much more toxic than any of the critics imagined. If dairy, as the state's dirtiest water polluter, is not regulated with respect to pesticides and nitrogen fertilizer, then it will be impossible to clean up Vermont's water. If Vermont's dairies are allowed a continuation of their decades long regulatory free-pass on water pollution and toxic pesticide and fertilizer use, Vermont's bucolic brand could be terminally tarnished.

It doesn't have to be this way. About 200 of the 970 Vermont dairy farms have adopted sophisticated organic rotational grazing systems, which enhance the quality of the forage, and sequester large amounts of carbon that can help reverse climate change. More than 20% of Vermont's dairies are organic (the highest percentage in the U.S.) These farm leaders have realized the urgency in rejecting the failed confined dairy farming system that depends on toxic fertilizers and pesticides, pollutes our lakes and waterways, and contributes to global warming. Ironically, while there is a glut of CAFO and AFO milk that is being dumped, there is a projected long-term shortage of organic milk.

Vermont is blessed with abundant water, lush pastures, and an environment where pastured cows can thrive. All of Vermont's dairies could adopt a more sustainable form of dairy management, and the government and private businesses could help farmers make the transition and curb the pollution. We have the technical knowledge to make these management changes, but we urgently need to accelerate the transition to cleaner, safer, and more environmentally friendly dairy farming systems.

Appendix A:
Methods of Analysis

The Vermont Agency of Agriculture, Food, and Markets (AAF&M) publishes annual reports of pesticide use, GMO use, and fertilizer use. The AAF&M requires farmers and licensed applicators to file actual use reports, which are designed to provide an accurate picture of pesticide and fertilizer use and GMO adoption rates for forage and seed corn. This data set was analyzed to evaluate whether industry predictions and lobbyists' claims were valid.

Unfortunately, the Vermont data set, which was analyzed and shared with several legislators, the Secretary of Agriculture, and staff from Ben & Jerry's was found to have been corrupted by faulty data entry and a poorly designed computer program. According to officials at the AAF&M, the data entry staff miscalculated the quantity of chemicals, and the computer programmers were only counting the amount of the primary pesticide in mixed products that have multiple pesticides as active ingredients since 2008. Since a great majority of the pesticides used in Vermont are mixtures of two or more chemicals, this oversight was very significant. The data entry errors overestimated the recent use of some pesticides, but more importantly, the computer programming errors significantly underestimated the total tonnage of pesticides applied on Vermont corn.

In a commendable effort to correct these errors, a second set of data was provided by the AAF&M and analyzed for this report. All of the pesticide data analyzed in this paper is derived from the second set of data.

The pesticide, fertilizer, and GMO data were analyzed and copied onto spreadsheets so that the data from each category and each year could be compared and evaluated.

Data for pesticide use began being compiled in 1986 by the AAF&M, and annual reports of pesticide use by commercial pesticide applicators and farmers with applicator permits have been available on-line since 1999.

Fertilizer and GMO data were only available from the AAF&M since 2002. Data for GMO use is compiled by the AAF&M, which publishes annual reports of seed usage, acreage involved, as well as varieties and amounts of genetically altered crops in Vermont.[23] Data for fertilizer use in Vermont has been compiled for several years, however, in 2002, the AAF&M revised their format for collecting and annually reporting on fertilizer use. Data using that format were the only available data on fertilizers from the AAF&M. Nitrogen fertilizer use was analyzed from 2002-12, which covers most of the period when GMO corn was adopted by Vermont dairy farmers.[24]

Our comparative analysis of pesticides, nitrogen fertilizer, and GMO data begins in 2002, the first year when GMO data was compiled.[25] Pesticides include insecticides, herbicides, fungicides, fumigants, miticides, slimicides, and aquacides. However, the pesticides analyzed in this paper are predominantly herbicides, because more than 99% of the pesticides applied on Vermont corn acreage and reported to the AAF&M are used to control weeds.

Data on pesticides were analyzed in relation to the percentage of GMO corn acreage. When GMO corn acreage was below 60%, pesticide use was analyzed and averaged for those six years, 2002-7. When pesticide use increased significantly after GMO corn was grown on 67% to more than 90% of the acreage from 2008-2012, use was analyzed and averaged for those six years. Pesticide use averages from 2002-7 were compared to average usage from 2008-12.

While the corn pesticides analyzed in this paper only include herbicides applied in Vermont, most corn seed arrives at the seed dealer treated extensively with herbicides, insecticides, and fungicides, which are applied by the seed corporations, before being shipped to Vermont seed dealers. For example, Monsanto's Acceleron corn seed treatments include ipconazole, metalaxl, and trifloxystrobin as fungicides, clothianidin, a neonicitinoid, as an insecticide, and Poncho VOTiVO—a Bacillus firmus for nematodes.[26] These seed treatment pesticides are not currently tallied by any regulatory agencies.

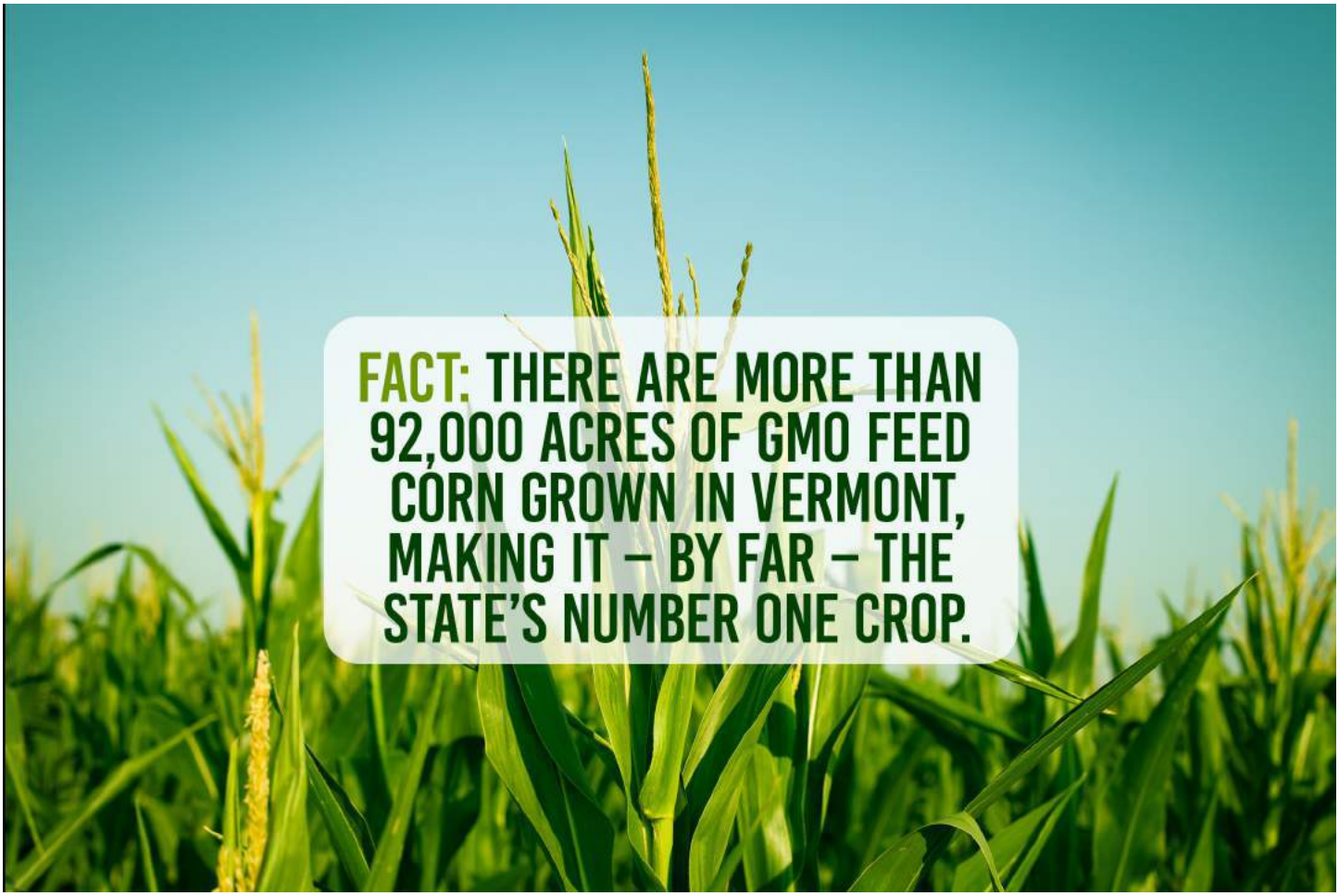
Data on nitrogen fertilizer was also analyzed in relation to the percentage of GMO corn acreage, but also in terms of the increase in use from 2002, when use was low in comparison to all the years that followed when average nitrogen use from 2003-12 was dramatically higher. Nitrogen fertilizer average use from 2002-8 was compared to average use from 2009-12, when GMO corn ranged from 77% to more than 90% of acreage. Fertilizer data from 2010 is missing from the AAF&M reports.

After use of pesticides and fertilizers from 2002-12 was analyzed, a review of the toxicity and impact of the most used pesticides was conducted. A review of the University of Vermont advisories for use of and the impacts from nitrogen fertilizer was also conducted.

To determine the toxicological profiles of the most used corn herbicides, the following regulatory authorities' and academic lists were consulted and cited where appropriate: U.S. EPA; International Agency for Cancer Research (IARC); California EPA, Department of Pesticide Regulation (Cal EPA/DPR) Proposition 65 list, and the Birth Defects Prevention Act Priority Risk Lists of Chemicals; E.U. List of Toxic Chemicals, Pesticide Action Network List of Toxic Pesticides; Our Stolen Future website—the Colborn List; the Lawrence Keith List; the Benbrook List; the U.S. EPA Toxic release Inventory List; and the Illinois EPA List. Other articles on pesticide toxicology were also consulted and are referred to in the text or in footnotes 12-19.

Vermont AAF&M has made a concerted effort to collect and publish pesticide, fertilizer, and GMO data for several years. When the staff at the AAF&M realized that they had published erroneous pesticide data they provided reconfigured data for the most recent years. We need data like Vermont's in every state. We need agency leaders and staff that make the data available and make every effort to correct errors. The analysis of state use-data can provide a clearer picture of use-trends, problem areas, and how to craft regulatory solutions.

Only a few states track actual farm pesticide use, including California, New York, New Jersey, and New Hampshire. Some of these states also track purchased fertilizer. Almost all the other states rely on survey data of pesticide, fertilizer and GMO use that the United States Department of Agriculture (USDA) conducts. The USDA data is valuable, but not usually as accurate as the state data and is not compiled for all states.



Endnotes

1 Quoted in "The Benefits of Biotechnology," Joint FAO/WHO Expert Consultation on Biotechnology and Food Safety. Rome, Italy, 30 September to 4 October 1996. Dr. H. de Haen, p.2.

2 Dr. Abigail Salyers, , Professor of Microbiology at Univ. of Illinois, Urbana. Genetically Engineered Plants are Safe and Necessary. Christian Science Monitor, Jan. 28, 1997. http://www.csmonitor.com/1997/0128/012897.opin.opin.1.html

3 Quoted in "Agriculture Genomics May Bring Benefits Faster Than Human Genomics: Tips from Top Plant, Animal Experts at Purdue," Dr. Ray Bressan, professor of horticulture. October 27, 2003.

4 International Food Information Council Foundation, 2013. http://www.monsanto.com/newsviews/pages/what-experts-say-about-gm-crops.aspx

5 Atrazine resources: According to the EPA Toxic Release Inventory, atrazine is carcinogenic. http://www2.epa.gov/toxics-release-inventory-tri-program/cancer-data-tri-listed-chemicals

Atrazine causes neuroendocrine, reproductive, and reproductive developmental effects in experimental animals. Animal studies have shown that atrazine disrupts estrus cyclicity (i.e., irregular ovarian cycling and changes in the number and/or percentage of days in estrus and diestrus) and alters plasma hormone levels in rats and pigs. P. 37 www.atsdr.cdc.gov/interactionprofiles/IP-10/ip10-a.pdf

Albanito, Lidia, Rosamaria Lappano, Antonio Madeo, Adele Chimento, Eric R. Prossnitz, Anna Rita Cappello, Vincenza Dolce, Sergio Abonante, Vincenzo Pezzi, and Marcello Maggiolini. May, 2015. Effects of Atrazine on Estrogen Receptor α– and G Protein–Coupled Receptor 30–Mediated Signaling and Proliferation in Cancer Cells and Cancer-Associated Fibroblasts. Results suggest a novel mechanism through which atrazine may exert relevant biological effects on cancer cells. Environmental Health Perspectives; DOI:10.1289/ehp.1408586. V. 123, Issue 5.

Bethsass, Jennifer, Aaron Colangelo. July, 2006. European Union Bans Atrazine, While the United States Negotiates Continued Use. International Journal of Occupational and Environmental Health. Volume 12, Issue 3, pp. 260-267. The U.S. EPA approved the continued use of atrazine in October, 2003, the same month the EU announced that in 2004 atrazine use would no longer be permitted because of ubiquitous and unpreventable water contamination. http://www.maneyonline.com/toc/oeh/12/3?mobileUi=0.

Donna, A. et al. 1989. Triazine herbicides and ovarian epithelial neoplasms. Scand. J. Work Environ. Health 15:47-53. www.sjweh.fi/do

Pesticide Action Network has labeled atrazine as a bad actor chemical. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

The Illinois EPA, the Keith List, the Benbrook List, the Colborn list and the EU list all determined that atrazine is an endocrine disruptor.

Keith List: Keith, Lawrence H. 1997. Environmental Endocrine Disruptors: A Handbook of Property Data, Wiley Interscience. New York. http://searchworks.stanford.edu/view/3743203

The Colborn List/Our Stolen Future List: Widespread pollutants with reproductive and endocrine-disrupting effects. June 13, 2005. http://www.ourstolenfuture.org/basics/chemlist.htm

Benbrook List: Benbrook, Charles M. September 1996. Growing Doubt: A Primer on Pesticides Identified as Endocrine Disruptors and/or Reproductive Toxicants, National Campaign for Pesticide Policy Reform. Washington, DC.

Illinois EPA List: These data were taken from the Report on Endocrine Disrupting Chemicals, Illinois EPA (February, 1997). http://www.idaillinois.org/cdm/compoundobject/collection/edi/id/174979/rec/3

EU List: Data on which the list is based were taken from the report Towards the Establishment of a Priority List of Substances for Further Evaluation of Their Role in Endocrine Disruption, Appendix 1, BKH Consulting Engineers and TNO Nutrition and Food Research. June 21, 2000. ec.europa.eu/environment/archives/docum/pdf/bkh_main.pdf

Atrazine is a possible cause of several types of cancer, and, according to many researchers, a proven endocrine disruptor. The Economics of Atrazine. Frank Ackerman, PhD. International Journal of Occupational and Environmental Health. 2007;13:441–449 www.ase.tufts.edu/gdae/Pubs/rp/EconAtrazine.pdf

Atrazine is the most commonly detected contaminant in US drinking water, and is the most serious water contaminant throughout the corn growing areas of the US. In 2010, sixteen cities sued Syngenta after finding atrazine levels exceeding the standards under the federal Safe Drinking Waterfile://localhost/message/%253C20151105-10364615-1060-0@SNE-IT-0J4V.sne1.net%253E Act. In 2012, Syngenta settled two class-action law suits brought by towns with atrazine contaminated drinking water. One of the lawsuits was reported by the Wall Street Journal: Berry, Ian. May 25, 2012. Syngenta Settles Weed Killer Lawsuit, Wall Street Journal. www.wsj.com/.../SB10001424052702304840904 90.

The Environmental Working Group Drinking Water Data Base reports that 28 states and 490 water systems serving 17.39 million people had water with atrazine contamination above health guidelines and that 6 states and 37 water systems serving more than 861 thousand people had atrazine concentrations above the legal limits set by the EPA. The EWG also expresses the following health concerns for atrazine: endocrine disruption, allergies/immunotoxicity, developmental/reproductive toxicity, cancer, organ system toxicity (non-reproductive), persistence and bioaccumulation, occupational hazards, irritation (skin, eyes, lungs), and ecotoxicity. http://www.ewg.org/tap-water/chemical-contaminants.

6 Metolachlor resources: Weight-of-Evidence Characterization of metolachlor by the U.S. EPA as classification C; possible human carcinogen. http://www.epa.gov/iris/subst/0074.htm

Metolachlor is listed as an endocrine disruptor in the Keith list. Lawrence H. Keith's, Environmental Endocrine Disruptors: A Handbook of Property Data, Wiley Interscience (New York, 1997). http://searchworks.stanford.edu/view/3743203

Mathias, Francielle Tatiane, Renata Marino Romano, Hanan Kaled Sleiman, Claudio Alvarenga de Oliveira, and Marco Aurelio Romano. Accepted 28 February 2012. Herbicide Metolachlor Causes Changes in Reproductive Endocrinology of Male Wistar Rats, ISRN Toxicology Volume, Article ID 130846, 7 pages. Academic Editors: S. M. Waliszewski and K. Yamasaki. http://dx.doi.org/10.5402/2012/130846

Appears on the California Priority Risk List, triggered by the Birth Defects Prevention Act of 1984 (SB 950) as being oncogenic (causes tumors), and causing chronic toxicity. http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Listed as a bad actor chemical by PAN, as a known groundwater contaminant by PAN and a potential groundwater contaminant by the California EPA. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

Environmental Working Group's National Drinking Water Database recognizes Metolachlor as a public water contaminant and the data indicate the following health concerns: cancer (possible human carcinogen), organ system toxicity (non reproductive), and irritation (skin, eyes, lungs). http://www.ewg.org/tap-water/chemical-contaminants

7 Simazine resources: Simazine has been classified by the California EPA/DPR on their priority risk lists derived from studies mandated by the California Birth Defect Prevention Act of 1984, as a medium priority pesticide, which showed oncogenic (causes tumors) and chronic toxicity in their combined study. http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Listed on the U.S. EPA Toxic Release Inventory as a developmental toxin.http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals

Simazine is on the Keith List and the EU List for endocrine disruptors.

Simazine is on PAN's list of Bad Actor chemicals and is listed as a known water polluter. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

The Environmental Working Group Drinking Water Data Base for Simazine found that it was a persistent water polluter, and because of that the EPA established a maximum legal limit for tapwater. The EWG also expressed the following health concerns: endocrine disruption, cancer, organ system toxicity (non-reproductive), irritation (skin, eyes, or lungs), ecotoxicity, and multiple, additive exposure sources. http://www.ewg.org/tap-water/chemical-contaminants.

8 Pendimethalin resources: Regulators and researchers have determined that pendimethalin is birth defect progenitor, and is a suspected carcinogen. Categorized by the California EPA/DPR Priority risk listing as a birth defect chemical of low priority rating, because of oncogenic (causes tumors) test results as required by the Birth Defect Prevention Act of 1984 (SB 950). http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Hurley, PM, RN Hill, and RJ Whiting. 1998. Mode of Carcinogenic Action of Pesticides Inducing Thyroid Follicular Cell Tumors in Rodents. Environmental Health Perspectives 106:437-445 It is also a suspected endocrine disruptor. Appears on the Colborn List/ Our Stolen Future List. Widespread pollutants with reproductive and endocrine-disrupting effects, June 13, 2005. http://www.ourstolenfuture.org/basics/chemlist.htm Colborn, T. F.S. Vom Saal and A.M. Soto, "Developmental effects of endocrine-disrupting chemicals in wildlife and humans,"Environmental Health Perspectives,1993, v. 101, pp. 378-384. Although pendimethalin is a suspected public water and drinking water pollutant, the EPA has not established a maximum legal limit for tapwater. The Environmental Working Group Drinking Water Database lists the following health concerns for pendimethalin: endocrine disruption, allergies/immunotoxicity, persistence and bioaccumulation, cancer, organ system toxicity (non-reproductive), ecotoxicity, and multiple, additive exposure sources. http://www.ewg.org/tap-water/chemical-contaminants

9 Glyphosate resources: In March, 2015, the International Agency for Research of Cancer determined that Glyphosate was a probable human carcinogen (Group 2A). Detailed evaluations are to be published in IARC Monographs Volume 112: Evaluation of Five Organophosphate Insecticides and Herbicides http://www.iarc.fr/en/media-centre/iarcnews/pdf/MonographVolume112.pdf A summary of the final evaluations together with a short rationale have now been published online: Guyton, Kathryn Z., Dana Loomis,Yann Grosse. Fatiha El Ghissassi, Lamia Benbrahim-Tallaa, Neela Guha, Chiara Scoccianti, Heidi Mattock, Kurt Straif. 20 March, 2015. Carcinogenicity of tetrachlorvinphos, parathion, malathion, diazinon, and glyphosate. Published Online on behalf of the International Agency for Research on Cancer Monograph Working Group, IARC, Lyon, France. The Lancet Oncology. http://www.thelancet.com/journals/lanonc/article/PIIS1470-2045%2815%2970134-8/abstract

Glyphosate has been identified as a birth defect progenitor.

Paganelli, A. et al. 2010: "Glyphosate-based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling". Chem Res Toxicol 23, no. 10, Aug. 9, 2010: 1586-95. www.glyphosate.eu/literature-database-developmental-and-reproductive-

Dallegrave, E.; Mantese, F.D.; Coelho, R.S.; Pereira, J.D.; Dalsenter, P.R. and Langeloh, A. 2003: The teratogenic potential of the herbicide glyphosate (Roundup) in Wistar rats. Toxicol. Lett., 142 (1-2), 45-52. www.ncbi.nlm.nih.gov/

Glyphosate has been identified as an endocrine disruptor.

Romano, Marco Aurelio, Renata Marino Romano, Luciana Dalazen Santos,
Patricia Wisniewski, Daniele Antonelo Campos, Paula Bargi de Souza,
Priscila Viau, , Maria Martha Bernardi, Maria Tereza Nunes, Claudio Alvarenga de Oliveira. 2012 Glyphosate impairs male offspring reproductive development by disrupting gonadotropin expression. Reproductive Toxicology. Arch Toxicol. April, 663-73. www.ncbi.nlm.nih.gov/...

Glyphosate is the most used herbicide in the U.S. and is a suspected water polluter.

The Environmental Working Drinking Water Database is concerned about the water pollution potential of glyphosate (which has not been evaluated by U.S. or international regulators) and expressed the following health concerns: developmental/reproductive toxicity, organ system toxicity (non-reproductive), cancer, neurotoxicity, irritation (skin, eyes, lungs), ecotoxicity, and persistence and accumulation in agricultural and household settings. http://www.ewg.org/tap-water/chemical-contaminants

10 Acetochlor resources: Listed by California's Proposition 65 as a known carcinogen. Case Number 34256-82-1 January 1, 1989. http://oehha.ca.gov/prop65/prop65_list/files/P65single051115.pdf

Listed by Colborn's list and the EU list as an endocrine disruptor. http://www.ourstolenfuture.org/basics/chemlist.htm

Listed by PAN as a Bad Actor Chemical. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759 Several river and groundwater studies have illustrated that acetochlor, the third most used pesticide in US corn production, and its metabolites, migrate into groundwater, rivers, lakes and ultimately the ocean. The Environmental Working Group National Drinking Water Database – Chemical Contminants. 2010, advises additionally that acetochlor triggers the following health concerns: endocrine disruption, cancer, organ system toxicity (non-reproductive), allergies/immunotoxicity, occupational hazards, irritation (skin, eyes, lungs), and ecotoxicity. http://www.ewg.org/tap-water/chemical-contaminants

11 Dicamba resources: Categorized by the California EPA/DPR as a high priority risk pesticide that showed neurotoxic, oncogenic (causes tumors), and chronic toxicity results in studies triggered by the Birth Defects Prevention Act of 1984 (SB 950). http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Listed on the U.S. EPA Toxic Release Inventory as a developmental toxin. http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals Listed as a bad actor chemical by PAN, a developmental toxin, and a ground water contaminant. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

The Environmental Working Group Drinking Water Data Base lists the following health concerns for dicamba: endocrine disruption, cancer, occupational hazards, organ system toxicity (non-reproductive), developmental/reproductive toxicity, irritation (skin, eyes, lungs), ecotoxicity, and multiple exposure sources (both agricultural and household). http://www.ewg.org/tap-water/chemical-contaminants

12 Alachlor resources: Alachlor has been classified B2 by the US EPA Category B: Probable human carcinogen. Known to cause cancer in animals but not yet definitively shown to cause cancer in humans. EPA found sufficient evidence of carcinogenicity from animal studies. An updated list was published in 2002. Office of Pesticide Programs List of Chemicals Evaluated for Carcinogenic Potential, March 15, 2002, not on-line. U.S. Environmental Protection Agency. Also appears on the Toxic Release Inventory List of carcinogenic chemicals. Classified as a known carcinogen by California's Proposition 65. http://oehha.ca.gov/prop65/prop65_list/files/P65single051115.pdf Listed as a low priority chemical by California EPA/DPR as oncogenic (causes tumors), causing chronic toxicity, and having toxic impacts at low dosages (low NOEL). http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf Classified as an endocrine disruptor by the Illinois EPA list, http://www.idaillinois.org/cdm/compoundobject/collection/edi/id/174979/rec/3 the Keith List http://searchworks.stanford.edu/view/3743203, the Colborn List http://www.ourstolenfuture.org/basics/chemlist.htm, and the EU List ec.europa.eu/environment/archives/docum/pdf/bkh_main.pdf. Appears on the EPA Toxic Release Inventory List of developmental toxins. http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals PAN lists it as a Bad Actor Chemical, and a known water pollutant. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

13 European Union Bans Atrazine, While the United States Negotiates Continued Use. 2006 Jul-Sep;12(3):260-7. International Journal of Occupational and Environmental Health. http://www.ncbi.nlm.nih.gov/pubmed/16967834 "Atrazine is a common agricultural herbicide with endocrine disruptor activity. There is evidence that it interferes with reproduction and development, and may cause cancer. Although the U.S. Environmental Protection Agency (EPA) approved its continued use in October 2003, that same month the European Union (EU) announced a ban of atrazine because of ubiquitous and unpreventable water contamination." Simazine lost its registration in the EU in 2004. Jan Gerritse, Bas van der Grift and Alette Langenhoff. 2009. Contaminant Behaviour of Micro-Organics in Groundwater pp.112-144, Simazine pp.134-5. http://media.johnwiley.com.au/product_data/excerpt/91/04707780/0470778091.pdf EU refuses to reregister alachlor, Regulation/Directive (Regulatory Decision excluding substance from Annex I of Directive 91/414). April 4, 2006 http://www.pan-europe.info/Archive/About%20pesticides/Banned%20and%20authorised.htm EU phase-out for acetochlor. The European Commission has decided not to re-register the herbicide, acetochlor. It has instructed EU member states to withdraw approvals by 23 June 2012. AgroNews http://news.agropages.com/News/NewsDetail---6107.htm

14 Benbrook, Charles. 2012, Impacts of Genetically Engineered Crops on Pesticide Use in the US—The First Sixteen Years. Environmental Sciences Europe, 24:24.

15 A Meta-Analysis of the Impacts of Genetically Modified Crops Klümper, Wilhelm, Matin Qaim. Nov. 3, 2014. "On average, GM technology adoption has reduced chemical pesticide use by 37%. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111629

16 Douglas, Margaret R. and John F. Tooker, March 20, 2015 Claims of Reduced Pesticide Use with GM crops are Baseless, Environ. Sci. Technol. http://pubs.acs.org/doi/abs/10.1021/es506141g Krupke, Christian, Brian Wallheimer Greg Hunt, Jan. 2012 Researchers: Honeybee deaths linked to seed insecticide exposure. Purdue Newsroom. http://www.purdue.edu/newsroom/research/2012/120111KrupkeBees.html Seeds of most annual crops are coated in neonicotinoid insecticides for protection after planting. All corn seed and about half of all soybean seed is treated in the US. Kuivila, Kathy, Alex Demas. 7/24/2014 Insecticides Similar to Nicotine Widespread in Midwest. U.S. Department of the Interior, U.S. Geological Survey. http://www.usgs.gov/newsroom/article.asp?id=3941&from=rss_home#.VV6WsBDF9xt Gurian-Sherman, Doug. January 10 2012. Genetically Engineered Crops in the Real World, Bt Corn, Insecticide Use, and Honey Bees. Union of Concerned Scientists.
http://blog.ucsusa.org/genetically-engineered-crops-in-the-real-world-bt-corn-insecticide-use-and-honeybees-2

17 AAF&M and UVM researchers estimate that about 90% of synthetic nitrogen is applied to forage and seed corn in Vermont, but in those cases where the phosphorous index is very high on grass fields, farmers are prevented from using slurry—which contains high amounts of phosphorous—and farmers apply synthetic nitrogen to get sufficient grass yields.

18 This ANR/DEC publication (no date) lists 19 dairies in Vermont as CAFOs and 155 AFOs. http://www.vtwaterquality.org/erp/htm/agriculture.htm However, Marli Rupe, the Vermont ANR/DEC dairy specialist, informed me that there were 25 CAFOs and 185 AFOs as of May 13, 2015.

19 The UVM recommendations are for farms trying to yield 150 Bushels of corn grain or 25 Tons of silage per acre. Recommended rates are 130-150 lbs of nitrogen per acre, but, according to UVM agronomists, farmers often apply more

in an effort to achieve higher yields and in response to recommendations from fertilizer suppliers. For example, for a typical corn starter fertilizer, including nitrogen, phosphorous, and potassium, UVM recommends 100 pounds, but farmers are commonly using 200 to 300 pounds per acre. UVM recommends that the remainder of nitrogen (not included in the starter fertilizer) be applied as a side dressing after the plant is 10-12 inches tall and after determining through soil sampling how much soil nitrogen is present. http://pss.uvm.edu/vtcrops/articles/VT_Nutrient_Rec_Field_Crops_1390.pdf, pp.3-6.

20 Troy, A. Updating the Lake Champlain basin land use data to improve prediction of phosphorus loading. Cited in Technical Report No.34; Wang, D., Ed.; Lake Champlain Basin Program: Grand Isle,VT, USA, 2007. 65%–79% of the total annual P load is attributed to agricultural runoff. http://plan.lcbp.org/ofa-database/chapters/reducing-phosphorus-pollution Stone Project, Final Report. ID 092156-G. December 15, 2011. Identification of Critical Source Areas of Phosphorous Within the Vermont Sector of the Missisquoi Bay Basin. This study concluded that dairy farming was responsible for 64% of the bay's pollutants. www.lcbp.org/wp-content/uploads/2013/04/63

21 Gobler, C.J.; Davis, T.W.; Coyne, K.J.; Boyer, G.L. 2007. Interactive influences of nutrient loading, zooplankton grazing, and microcystin synthetase gene expression on cyanobacterial bloom dynamics in a eutrophic New York lake. Harmful Algae, 6, 119–133. Gobler and colleagues suggest that N could play an equally important role to P in algae bloom promotion. http://www.somas.stonybrook.edu/~gobler/publications.htm

22 Milk Matters: The Role of Dairy in Vermont. A report compiled by the Vermont Dairy Promotion Council, The Vermont Agency of Commerce and Community Development, the Vermont AAF&M, and Castelton Polling. www.vermontdairy.com/download/VTDairy_MilkMattersReport.pdf

23 Reported Genetically Engineered Seed Sales in Vermont, 2002-12, Vermont AAF&M.

24 Annual Vermont Fertilizer Tonnage Reports, Farm Use, 2002-12. Mar. 25, 2014, Vermont AAF&M.

25 Annual Commercial Applicator Pesticide Usage Host Group Summary: Pounds of Active Ingredient Statewide, Corn. 2002-12. Vermont AAF&M.

26 From: Seed Treatment Options for Corn and Soybean, Monsanto Corporation Advisory. www.aganytime.com/Pages/Article.aspx?fields=article&article=309


Feeding the industrial cow has come at a heavy price. It's responsible for nearly 50% of Vermont's water woes, including the extensive pollution to Lake Champlain, one of 13 lakes in the state that the EPA considers "impaired".

Regeneration Vermont: An Agricultural Solution

Our goal is to redirect Vermont agriculture toward regenerative methods that provide economic justice to farmers and farm workers, protect and enhance the natural environment, produce healthy food products, promote animal welfare, and implement climate change remediation through an understanding of -- and commitment to – healthy, living soils. The regeneration movement is especially concerned with educating citizens about the high greenhouse gas emissions from the current, industrial style of agriculture, but more importantly, showing how changes in farming, ranching, and forestry are the most significant vehicles for sequestering carbon and reversing climate change.

To accomplish our goals, Regeneration Vermont is proposing an extensive public education effort followed by (if necessary) creative, grassroots campaigns that take direct aim at corporations profiting from toxic, climate-threatening agriculture. We will tell the tragic story of degenerative agriculture, identify its corporate enablers, and then put them in the spotlight of marketplace activism. In Vermont, that means the dairy corporations. And that means Ben & Jerry's and Cabot Creamery.

But it's about more than targeting and putting a stop to toxic, climate-threatening agriculture. The regenerative agriculture that will replace it will not only put a halt to GMOs, toxic pesticides and factory animal production, but also employ practices that enhance soil quality and, as a result, sequester more and more carbon from the atmosphere. We are seeking to hasten the necessary transition that puts agriculture in its rightful place as a solution to many of our ecological woes, rather than the cause.

Regeneration Vermont's founding team has extensive experience in the theory and practice of agriculture, forestry and ecology, living on the cutting-edge of regenerative change for decades. More than running successful organic farms, maple sugaring operations and practicing restorative forestry, we have also built and led grassroots movements, published books, magazines and articles, and designed and implemented educational and activist campaigns that have changed both the culture and agriculture. We live and speak regeneration, bringing both a reverence and understanding for what's necessary and possible for our planet's survival.

REGENERATION VERMONT

The Regeneration Pledge

Regeneration Vermont is initiating dialogues with the dominant national and international food corporations within Vermont that control the region's agriculture, most notably Ben & Jerry's and Cabot Creamery. We are asking them to work with us in helping their farmers transition toward regenerative forms of agriculture, including the adoption of these seven principles:

- Transition away from GMO crops;
- Transition away from toxic pesticides/fertilizers and toward regenerative organic agricultural methods;
- Fair wages for farmers, including premiums based on regeneration benchmarks and assistance in the transition toward regenerative methods;
- Economic justice for farm workers, fair and livable wages, decent housing and social and cultural dignity;
- Adoption of climate remediation techniques, beginning with an emphasis on healthy soils and cover-cropping for carbon sequestration and erosion control;
- Humane treatment of farm animals, a phase-out of confinement dairies and a transition back to grassland grazing and grass-based feed for ruminants;
- Cleaning up and protecting our watersheds, streams, rivers, ponds, lakes, and groundwater.

Vermont's GMO Addiction:
Pesticides, Polluted Water, and Climate Destruction

Published by Regeneration Vermont, 2016.

About the publisher: Regeneration Vermont is a nonprofit educational and advocacy organization that is working to halt the catastrophic consequences of Vermont's adoption of degenerative, toxic and climate-threatening agricultural techniques, particularly within the dominant dairy sector. We are affiliated with Regeneration International, a bold new organization working to educate, unify and mobilize movements around agricultural-based solutions to the world's climate, hunger and environmental crises.

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Executive Summary

Vermont has proven itself to be a leader when it comes to showing its concern over the use of genetically-modified organisms (GMOs) in agriculture and food production. It was the first state in the nation to pass GMO-labeling legislation, forcing food corporations nationwide to scramble and prepare to meet the law's requirements when it takes effect in July 2016. But, in many ways, the passage of this historic law has left a false impression that it "solved" the GMO problem in the state. Nothing could be further from the truth.

Vermont agriculture is dominated by GMOs, especially within the commodity dairy sector, which represents more than 70% of the state agricultural economy. Currently, there are more than 92,000 acres of GMO feed corn that are grown in Vermont, making it – by far – the state's number one crop. More than 96% of all feed corn grown in Vermont is genetically modified, and almost all of this GMO corn is used to feed dairy cows.

Ironically, Vermont's GMO addiction is exempt from its own GMO labeling law, as the law specifically exempts dairy and meat products. So while the law will force mainstream food corporations to label GMOs in products like Cheetos and Spaghettios before coming into the state, it turns a blind eye to the GMO-derived dairy that is the primary ingredient in, for example, Ben & Jerry's ice cream and Cabot's cheddar cheese.

This is about more than the consumer's right to know. It's also about the impact GMO-centered agriculture is having on Vermont's environment and wildlife, its role in the continued monopolization of the food supply, and the roadblocks it creates in the path toward a truly regenerative, eco-sensitive, and socially-just form of agriculture in the state. The current domination of GMOs and industrial agriculture in Vermont dairy is, quite frankly, the elephant on the farm that few want to acknowledge.

The history of Vermont's heavy adoption of industrial – or degenerative – forms of agriculture is also the history of its failure and decline. At every stage, beginning with chemical agriculture in the post-WWII era, the new techniques being promoted by the increasingly corporate and industrial agriculture came with mighty promises: Labor would be saved, yields would increase, bugs and insects would be eliminated, and profits would soar. Just get in line, and follow the edicts coming out of the USDA and the agricultural extension centers.

But, more often than not, the promises were false – or short lived – while the damage was deep, most notably in the way further industrialization all but mandated the consolidation of Vermont's farms. "Get big or get out" has been the dominant mantra in agriculture since the late 1950s. And it worked. Many did get big, but most got out. Vermont lost a staggering number of farmers as commodity dairy took over. More than 10,000 dairy farms were gone within a sixty-year period from the 1950s to today.

This huge loss – over 700 farms per county – also meant a precipitous decline in a rural economy and culture that revolved around the small, family farmer. The once thriving towns

Labeling GMOs was a great act of concern by Vermont. It will provide valuable information to consumers. But it did nothing to address the state's deep addiction to GMO agriculture and all that comes with it.

mirrored the agricultural decline, most reduced to near-ghost towns, mere pass-throughs, with buildings boarded up and general stores either gone or teetering on the economic brink.

Aristotle wrote that the nature of anything can be discerned only after it has reached or passed its maturation. Industrial – or degenerative – agriculture has certainly matured, showing its nature clearly after decades of domination of Vermont's farm economy. And it's not only a story of decline, but also toxicity, as our watersheds, soils, farm animals and food products are awash in the chemicals and synthetic fertilizers used on Vermont's industrialized farmland. Hundreds of millions of dollars have been spent in the last several decades alone just trying to remedy the pollution of Lake Champlain and its watershed as a result of the techniques of industrial dairy farming.

Despite its record, industrial agriculture keeps marching along, still coddled by government regulators and politicians alike, and still making promises it can't deliver. GMO techniques are its latest – and, we hope, last – degenerative gimmick, one that, like all of them before, Vermont agriculture has wholeheartedly embraced.

GMOs were introduced in the mid-1990s with a fleet of promises, most notably the "dramatic decrease" in the amount of pesticides and fertilizers that would be required. They also trotted out the well-worn promises of rising farmer incomes via higher yields and, of course, solving world hunger, something they've been claiming to solve since the 1950s with the only results being more – not less – of it.

But GMO use has matured, and we know its nature. In Vermont, our 92,000 acres of GMO feed corn has meant more pesticide use, more fertilizer use, more fuel use because of more applications, and more trips over the field. And our hunger issues have grown worse.

The true nature of GMO agriculture in Vermont today is a stark and dangerous difference from the promises of its corporate advocates. According to data collected by the Vermont Agency of Agriculture, pesticide use is up 39% and increasing rapidly while, at the same time, new pesticides are being added to the arsenal. Climate-threatening nitrogen fertilizers have been up about 17% per year in the decade of GMO's rise to dominance (2002-2012) and climbing as our denuded soils require more and more inputs for high production. And the pollution to our climate, water and soil from these increases continues to rise, keeping us on a steady degenerative decline, environmentally, economically and culturally.

Labeling GMOs was a great act of concern by Vermont. It will provide valuable information to consumers. But it did nothing to address the state's deep addiction to GMO agriculture and all that comes with it. The industrialization of our farm sector threatens Vermont's brand, which was built upon an image of bucolic and natural -- the very opposite of the way today's milk is being produced for Ben & Jerry's ice cream and Cabot's cheese. It's a disconnect between branding and reality that will, eventually, come to haunt them.

It's time for Vermont to get off the industrial superhighway of commodity agriculture. We've seen enough, frankly, from pesticides to GMOs, a legacy rich in damage – social and ecological – one false promise at a time. We should work to make GMOs the last in a long line of agricultural mistakes, born from short-sightedness, a commodity-driven lust for quantity over quality, with economic supremacy as its guiding purpose, and with little regard for the long-term damage. We should make right now the great line of demarcation between the degenerative agriculture of the failed past and a future of regenerative agriculture. It won't just make for a better agriculture, it will also make for a better culture and a better planet.

The GMO Explosion in Vermont

Biotechnology corporations have never been conservative with their public relations efforts, especially when trotting out new techniques aimed at market domination. Huge claims are made, and many people – scientists, lawyers, marketing professional and journalists – are paid, directly or indirectly, to make a great show of the claims. World hunger will be solved. Labor will be saved. And your bank accounts will explode. If only you adopt the latest and greatest methods, which, it just so happens, they're selling. And so goes the story of modern industrial agriculture.

The advent of genetically-modified organisms (GMOs) in agricultural crops came with a rush of corporate promises. But it was the promise of the reduction in toxic inputs – pesticides, fertilizers, etc. – that was the most featured rallying cry for GMO corporations, clearly seizing on a nation's unease with their growing threats.

They weren't shy about their claims:

> "The benefits of biotechnology are many and include providing resistance to crop pests to improve production and reduce chemical pesticide usage, thereby making major improvements in both food quality and nutrition."[1]
>
> "Genetic engineering is our best hope for reducing reliance on harmful pesticides and herbicides without sacrificing high crop yields."[2]
>
> "We'll soon be able to produce more crops with less pesticide, less fuel, less fertilizer, fewer trips over the field."[3]
>
> "GM crops can provide farmers with the means to improve yields under weed and insect pressure; decrease tillage to protect soil and water resources; and reduce pesticide applications, thereby decreasing the use of fossil fuels."[4]

They also got much more creative, throwing in the old standby – solving world hunger – and some not even in the wheelhouse of sanity: envisioning a plant that would produce pork chops. Anything, it seemed, to get a foothold in the market, with clear plans of eventual monopolization of everything from the seeds to the pesticides and fertilizers required to grow them.

The sales job worked. Vermont fell for it, following national trends, and rushing into GMO production.

THE DATA: GMO USE

In 2002, only 8% of Vermont's corn acreage was planted with GMO seed. But, by 2012, well more than 90% was genetically engineered (109% in 2011 due to replanting). Dairy lobbyists in Vermont claimed that 96% of Vermont corn was GMO in 2014. In this short span of thirteen years, there was at least a 12-fold increase in the adoption of GMO corn in Vermont. The acreage of Vermont farmland used to grow corn for animal feed remained relatively constant during 2002-12, averaging 91,200 (85,000-96,000) acres per year.

Vermont GMO Corn Usage

YEAR	GMO%
2002	**8**
2003	**16**
2004	**19**
2005	**28**
2006	**37**
2007	**46**
2008	**67**
2009	**77**
2010	**89**
2011	**109**
2012	**90**
2012	**103**

Compiled from VT Agency of Agriculture Reporting Data.

CORN HERBICIDES

From 2002, when GMO corn was planted on only 8% of all Vermont corn acreage, until 2007, when GMO corn acreage was 47%, herbicide use averaged 160,201 pounds per year. From 2008-12, when GMO corn was planted on 67-90% of corn acreage, herbicide use increased by an average of 101,860 pounds per year over the period from 2002-7, and averaged 262,0961 pounds per year, a 39% increase.

In 2002-3 herbicide use on corn averaged 1.5 pounds per acre, per year. From 2008-12, herbicide use averaged 2.86 pounds per acre, per year.

Herbicide Use on Vermont Corn, 2002-12

YEAR	GMO%	#/AC POUNDS		ACRES
2002	8	1.54	142164	92000
2003	16	1.46	139679	96000
2004	19	1.94	174410	90000
2005	28	2.25	202109	90000
2006	37	1.72	146395	85000
2007	46	1.7	156448	92000
2008	67	2.9	272742	94000
2009	77	2.49	228710	91000
2010	89	2.43	223599	92000
2011	109	3.46	311058	90000
2012	90	3.01	274197	91000

Compiled from VT Agency of Agriculture Reporting Data.

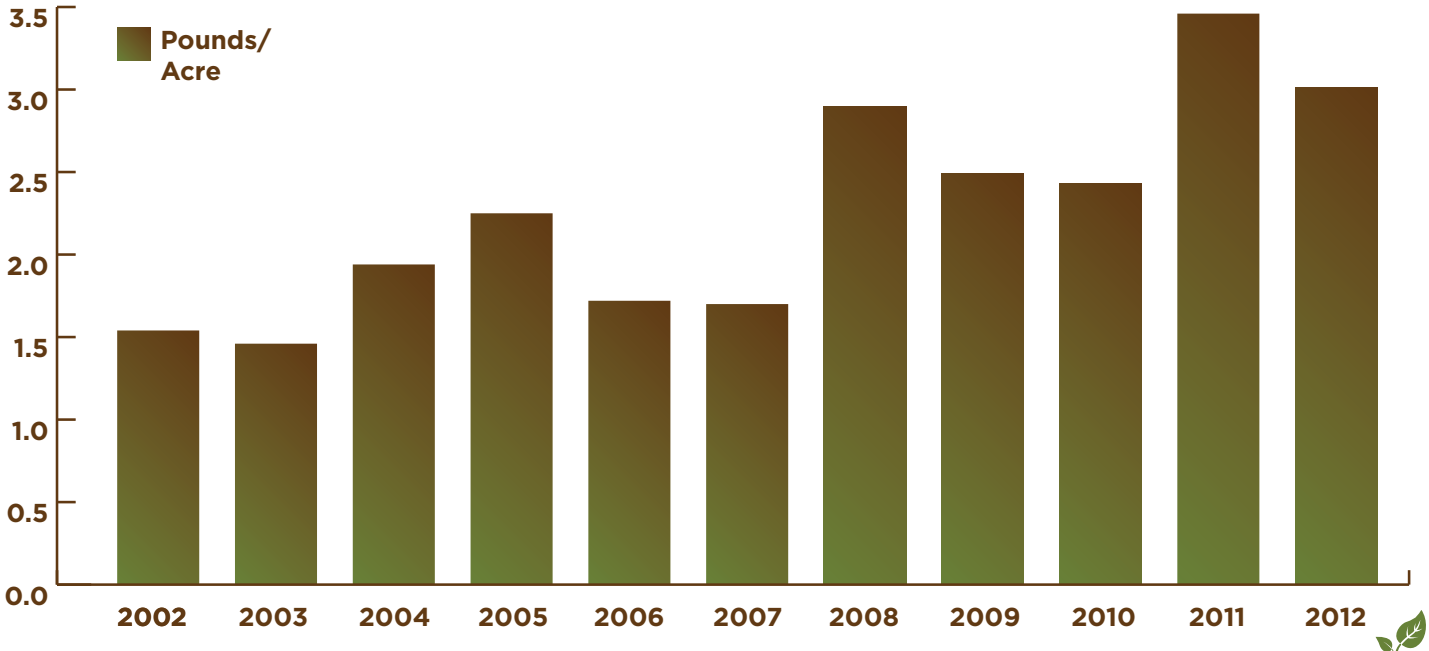
HIGHLY TOXIC HERBICIDES

During the period from 1999-2012, 8 highly toxic herbicides dominated pesticide use on Vermont corn crops. Those herbicides were atrazine,[5] metholachlor,[6] simazine,[7] pendimethalin,[8] glyphosate,[9] acetochlor,[10] dicamba,[11] and alachlor.[12]

Regulators have determined that five of these eight most used herbicides are possible or probable human carcinogens, the remaining three are suspected carcinogens. Seven of the eight are possible or probable endocrine disruptors (the other one is a suspected to be an endocrine disruptor). All eight have been determined by regulators and academics to cause birth or developmental defects and contaminate drinking water and public waters with dangerous chemicals that have long-term persistence. Atrazine, simazine, acetachlor, and alachlor have lost their registration in the EU, and are effectively banned.[13]

In the most recent data set (including 1999-2012), all of the eight herbicides listed above were used, however, just two herbicides, metolochlor and atrazine dominated usage from 2002-12. In 2002, atrazine and metolachlor accounted for 70.14% of corn pesticide use; and from 2008-12, metolachlor and atrazine, accounted for 86.46% of use.

Graph of Herbicide Use on Vermont Corn, 2002-12



Compiled from VT Agency of Agriculture Reporting Data.

Even as stacked GMO corn varieties became widely adopted (with both herbicide tolerance to Roundup/glyphosate and Bt for insect control), farmers did not use large quantities of glyphosate to take advantage of the herbicide tolerant modification. Throughout the period of study, 2002-12, glyphosate was a minor use pesticide, accounting for only 4.14% of average use per year for the entire period. From 2008-12 glyphosate only accounted for an average of 7.02% of pesticides used per year on corn.

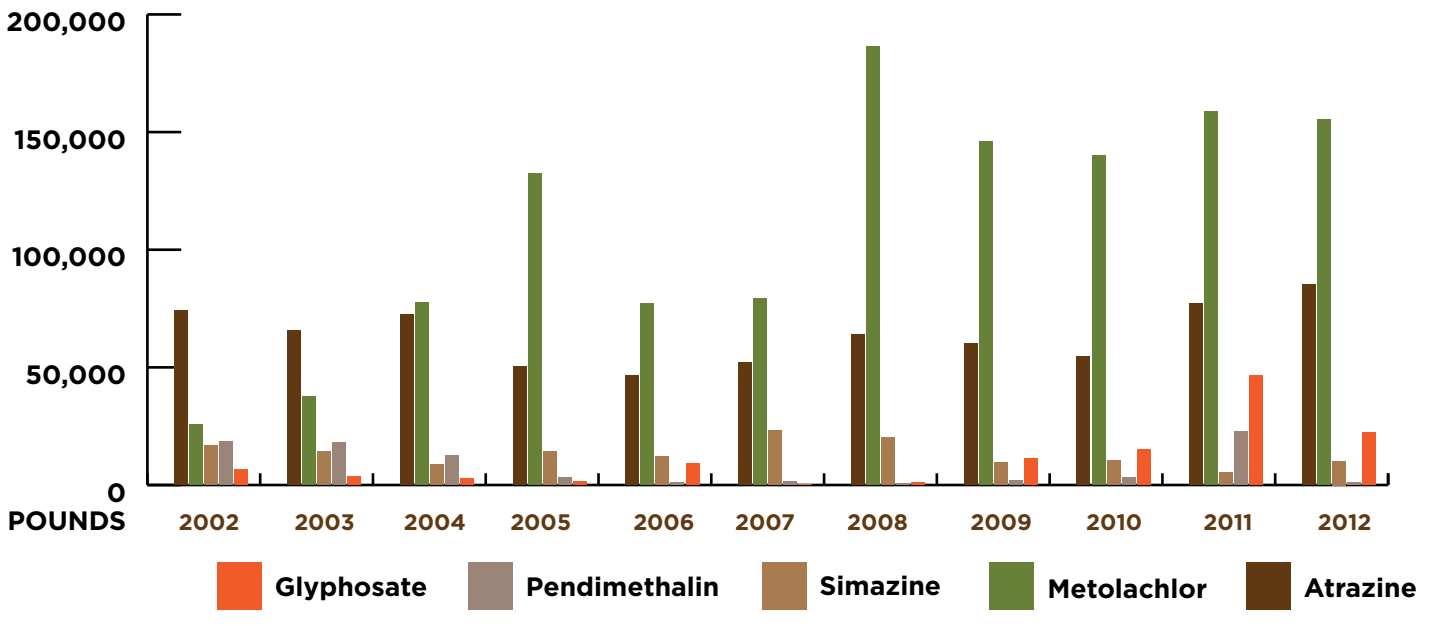
Instead of depending on glyphosate, farmers continued to depend on metolachlor and atrazine for weed control just as they had prior to adopting GMOs. Apparently, with Vermont's capricious weather, farmers and applicators determined that atrazine and metolochlor would provide more residual control of weeds than glyphosate. The pattern in Vermont has not seen glyphosate (the supposedly less toxic weed killer) replace more toxic herbicides. Instead, highly toxic herbicide use increased dramatically.

Five Highly Toxic Herbicides Used on Vermont Corn, 2002-12, in Pounds

Year	Atrazine	Metolachlor	Simazine	Pendimethalin	Glyphosate	GMO%
2002	73996	25722	16936	18543	6550	8
2003	65837	37796	14052	18118	3728	16
2004	72433	77686	8743	12383	2783	19
2005	50487	132436	14223	3011	1519	28
2006	46500	77021	12014	1195	9223	37
2007	52097	79248	23158	1384	279	46
2008	63859	186259	20291	614	952	67
2009	60225	145796	9607	1882	11147	77
2010	54672	139954	10278	3060	15022	89
2011	77232	158583	5299	22733	46730	109
2012	85083	155371	10205	1038	22261	90

Compiled from VT Agency of Agriculture Reporting Data.

Top Five Herbicides Used on Vermont Corn, 2002-2012



Compiled from VT Agency of Agriculture Reporting Data.

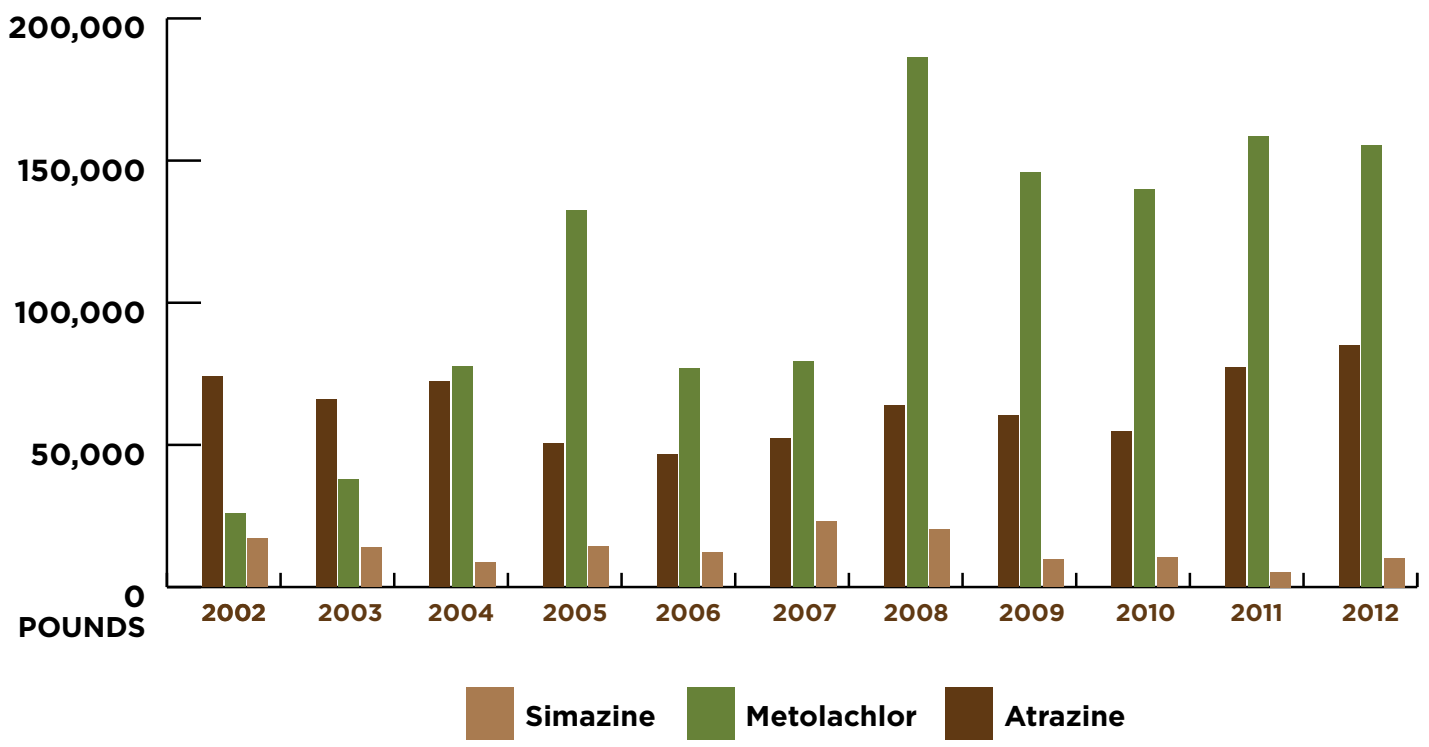
Percentage of Vermont Corn Treated with Top Herbicides, 2002-12					
YEAR	% METOLACHLOR	% ATRAZINE	% SIMAZINE	% GLYPHOSATE	% PENDIMETHALIN
2002	18.09%	52.05%	11.90%	4.61%	13.04%
2003	27.06%	47.13%	10.06%	2.67%	12.97%
2004	44.54%	41.53%	5.01%	1.60%	7.10%
2005	65.52%	24.98%	7.04%	0.75%	1.49%
2006	52.61%	31.76%	8.21%	0.63%	0.82%
2007	50.65%	33.30%	14.80%	0.18%	0.88%
2008	68.29%	23.41%	7.44%	0.35%	0.23%
2009	63.75%	26.33%	4.20%	4.87%	0.82%
2010	62.59%	24.45%	4.60%	6.72%	0.36%
2011	50.98%	24.83%	1.70%	15.02%	7.31%
2012	56.66%	31.03%	3.72%	8.12%	0.38%
Avg. '02-12	**50.97%**	**32.80%**	**7.15%**	**4.14%**	**4.12%**
Avg. '08-12	**60.45%**	**26.01%**	**4.33%**	**7.02%**	**1.82%**

Compiled from VT Agency of Agriculture Reporting Data.

Percentage of Vermont Corn Treated with Most Used Herbicides, 2002-12			
YEAR	TOP 2	TOP 3	TOP 5
2002	70.14%	82.04%	99.65%
2003	74.19%	84.25%	99.89%
2004	86.07%	91.08%	99.78%
2005	87.50%	97.54%	99.78%
2006	84.37%	92.58%	94.03%
2007	83.95%	98.75%	99.81%
2008	91.70%	99.14%	99.72%
2009	90.08%	94.28%	99.97%
2010	87.04%	91.64%	98.72%
2011	75.81%	77.51%	99.84%
2012	87.69%	90.41%	98.91%
Avg./yr	**83.50%**	**90.20%**	**99.10%**
Avg. '08-'12	**86.46%**	**90.60%**	**99.43%**

As previously noted, the top two herbicides from 2002-12 were metolachlor and atrazine, accounting for 86.46% of total use on corn. The top three herbicides were metolachlor, atrazine, and simazine, accounting for 90.60% of use. The top five herbicides were metolachlor, atrazine, simazine, glyphosate, and pendimethalin, accounting for 99.43% of use from 2002-12.

Graph of the Top Three Herbicides used on Vermont Corn, 2002-12



Compiled from VT Agency of Agriculture Reporting Data.

Apparently weeds treated with atrazine and metolachlor have not developed a level of resistance that has restricted their use, even though there are recorded instances of resistance (especially lambsquarter and red root pigweed) to both atrazine and simazine in Vermont and New York. Lumax, Syngenta's mixture of metolochlor, atrazine, and mesotrione, has been used for more than a decade as the major weed control herbicide mixture in Vermont. In 2002, the major herbicide in the Lumax mixture was atrazine at 52%. From 2008-12, however, metolachlor accounted for 60.45% of the Lumax mixture.

In addition to the pesticides that are applied on cornfields and corn seed, Vermont data shows that more than 74% of the GMO corn grown in Vermont in 2012 was modified with Bacillus thuringiensis (Bt) genes. This genetic insertion stimulates the plants to produce more genetically modified Bt than non GMO Bt insecticides which would normally be sprayed on the plants to control worms and beetles (such as the Corn Root Worm and European Corn Borer).

For example, SmartStax, Monsanto's genetically modified corn synthesizes six Bt toxin proteins, three targeting the European Corn Borer, and three for Corn Root Worm. Total Bt toxin protein production for SmartStax is estimated at 3.7 pounds/acre, which is 19 times the average conventional Bt insecticide rate of application in 2010.[14]

Recent reports have concluded that studies claiming that GMO Bt crops have decreased insecticide use "do not seem to have considered seed treatments or the Bt expressed by the genetically manipulated plants, and so may have overstated reductions in insecticide use."[15, 16] Both the Vermont AAF&M and the USDA should evaluate the additional pesticides produced by the GMO plants and the seed treatments when compiling annual pesticide use reports. This would allow a more accurate determination of the real amount of pesticides being broadcast into our rural environment. At present, no state or federal agencies are tracking and compiling this data.

Since more than 80% of Vermont corn is grown for forage, European Corn Borer (which some of the GMO Bt is designed to control) is not a major problem because most of the corn is not grown for seed, and corn borers damage the seed not the leaves or stalk. The seed-treatment pesticides designed to control corn rootworm are also not necessary, since rootworm is not a major pest in Vermont.

Whether the pesticides are needed to control pests or not, they are still being broadcast on the soil, in the air, and end up in our public water systems. The five most used herbicides are among the most dangerous chemicals used on corn in the U.S., atrazine, metolochlor, simazine, glyphosate, and pendimethalin—and they are all water polluters. The other chemicals that are part of the genetically modified and seed treatment package on Vermont corn include the bee-killing clothianidin (a neonicitinoid), excessive expressions of Bt, and biocide-like fungicides. The increase in toxic herbicide use coupled with genetically inserted and seed treatment pesticides that are not even used to control pests is irresponsible.

NITROGEN FERTILIZER

Most of the synthetic and animal fertilizer used in the state is on dairy farms, which account for the largest number of non-forested acres in Vermont (about one million). According to the Vermont AAF&M data from 2002-8, nitrogen fertilizer use averaged 14.4 million pounds (7,215 tons) per year throughout the state, while the three-year average from 2009-12 was 16.8 million pounds (8423 tons).[17]

Nitrogen fertilizer use did not drop with GMO adoption, as promised in the ads and editorials. Instead, nitrogen use increased over the 2002-8 average by 2.4 million pounds per year (17% per year) for the 2009-12 period. In 2002, when GMO corn was planted on only 8% of corn acres, nitrogen use was 8.9 million pounds (4462 tons). Average nitrogen use from 2009-12 almost doubled (increased by 1.9 times) the 2002 usage.

Vermont has 185 dairies that are designated by the USDA as Animal Feeding Operations (AFOs with 200-699 cows) and 25 Concentrated Animal Feeding Operations (CAFOs with more than 700 cows).[18] As dairies added more cows and became AFOs or CAFOs, Vermont farmers had to contain ever-increasing amounts of manure waste in lagoons, and then spread the slurry on their farmland. The dairy slurry contains pesticides, antibiotics, hormones, nitrogen, phosphorus, and potash.

The combination of lagoon wastes and synthetic nitrogen used annually on Vermont corn crops is usually in excess of what is required, or recommended by University of Vermont advisories, to produce a high quality, high yield corn seed or forage crop.[19]

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NITROGEN FERTILIZER INCREASES IN VERMONT, 2002-12, IN POUNDS

YEAR	NITROGEN	PCT. GMO CORN
2002	8,924,000	8
2003	14,864,000	16
2004	14,170,000	19
2005	12,362,000	28
2006	16,188,000	37
2007	21,436,000	46
2008	12,048,000	67
2009	16,928,000	77
2010	*	89
2011	17,072,000	109
2012	16,538,000	90

Compiled from VT Agency of Agriculture Reporting Data.

The excess nitrogen and phosphorus not used by the plants ends up polluting our rivers, lakes, and the ocean and worsens global warming problems, because nitrogen manufacture and use emits nitrous oxide, which is 300 times more damaging as a greenhouse gas than CO2.

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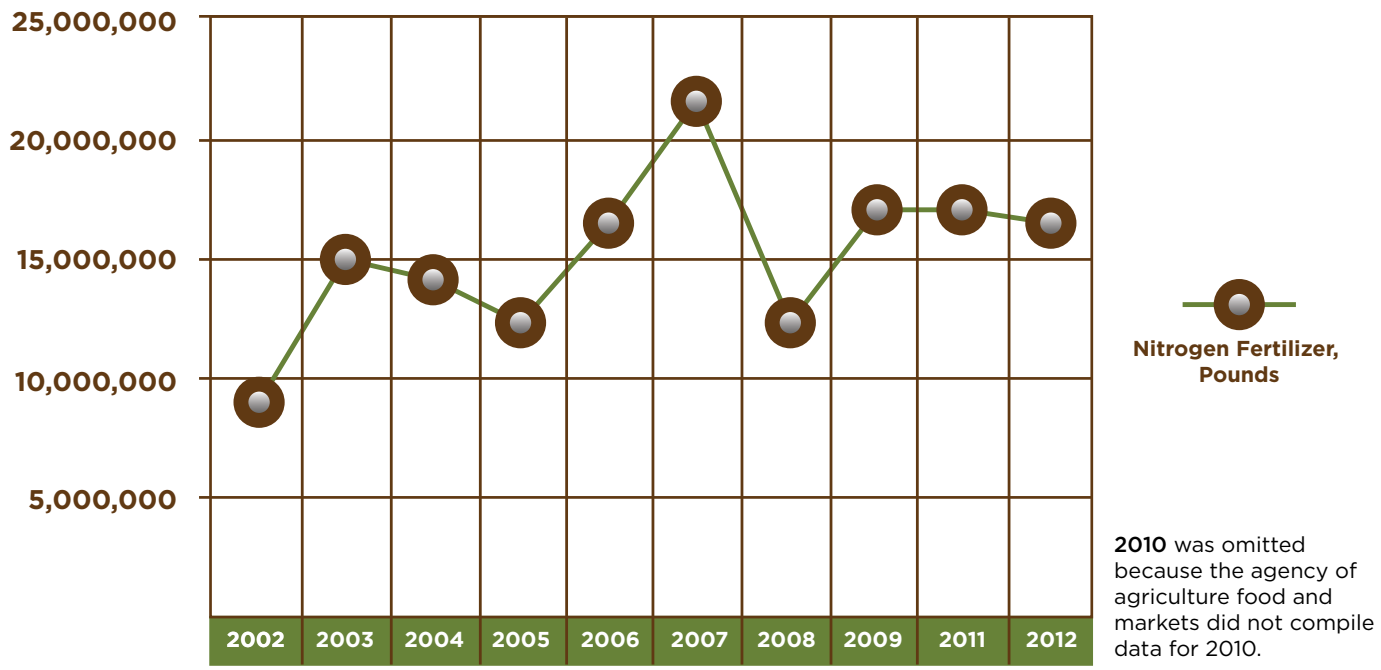
Most of the dairies in Vermont are near rivers, lakes, and streams. Since the slopes of many Vermont corn, grass, and hay lands are steep, the dairy contaminants often end up running off fields and polluting public waterways. Estimates are that Vermont dairy is responsible for 40-79% of the water polluting chemicals that are contaminating our public water systems.[20]

While phosphorous pollution has been targeted as the most damaging effluent entering Vermont's public waters, several experts have noted that synthetic nitrogen is also responsible for a significant portion of the water-contaminating effluent coming from dairies.[21] The data on nitrogen use indicates that the runoff from this source of pollution is probably increasing.

NITROGEN FERTILIZER USE IN VERMONT 2002-12



2010 was omitted because the agency of agriculture food and markets did not compile data for 2010.

Compiled from VT Agency of Agriculture Reporting Data.

Vermont AAF&M. Fertilizer Use Data not available for 2010.

Conclusions

While the availability of such state use-data is refreshingly transparent and unusual, the results are not positive for Vermont's brand. The Vermont brand has been built on a bucolic image of cows grazing on endless pastures. Cabot Cheese, Ben & Jerry's ice cream and other Vermont companies have used this idyllic imagery to sell their products. Gone are the days, however, when most of Vermont's cows were grazing in spectacularly scenic landscapes. Now, a majority of Vermont's dairy cows are locked up in what regulators call "confined animal feeding operations" – or CAFOs - with the cows grazing on concrete with a diet rich in GMO corn and pesticide residues.

The data show that the milk that these iconic Vermont brands use to create their popular award-winning products comes from dairies that pollute our public waterways. The milk used to make these products comes from cows fed corn and forage crops that are grown with increasing amounts of dangerously toxic pesticides and excessive amounts of nitrogen fertilizer. In contrast to advertising efforts of Vermont corporations like Ben & Jerry's and Cabot Creamery, their milk doesn't come from happily grazing cows.

The most striking result of herbicide use during the adoption of GMO corn in Vermont is not increased usage of glyphosate, it is the long-term, almost complete dependence on two highly toxic and water polluting herbicides, atrazine and metolachlor. These two chemicals, combined to dominate use at more than 70.14% when GMO adoption was at only 8% of acreage in 2002. And, their use has increased as GMOs came to dominate Vermont corn acreage. Together, they accounted for 86.46% of use from 2008-12.

Vermont dairies produce about 63% of the milk consumed in New England according to an AAF&M report published in February 2015.[22] The increased confinement of cows and the excessive amounts of feed the cows receive per day (132 pounds of feed to produce one hundred pounds of milk per cow, about 11.6 gallons per day), has led to an increase in milk supplies that is greater

than the New England market can consume. As a result of this glut and the decline in the price of milk from $26.00 per hundred-weight in 2014 to the current price of about $13.60, dairy farmers are dumping low-fat milk into their lagoons that they cannot sell.

The increases in pesticide, fertilizer, and water pollution detailed in this paper, and the recent dumping of milk, show that industrial agriculture solutions to dairy management in Vermont are failing. In spite of these failures, farmers have continued to spend up to double the amount on GMO seed compared to non-GMO seed and still not take advantage of or even need the GMO technology. Whether the almost total adoption of an expensive technology that is not widely used is the result of industry claimed non-GMO supply shortages or clever advertising promises is unknown.

Dairy farmers are paying the price of the failed CAFO/AFO experiment in up-and-down milk prices, and higher pesticide, seed, and fertilizer costs; and while we lament the trap they seem to be in, it is the public that is burdened with even greater costs from this failed dairy farming experiment. The confined dairy strategy in Vermont and other states has produced unsafe dairy products (from toxic pesticides and fertilizers), encouraged bad farming practices, caused significant damage to the environment, and increased pollution of our public lakes, rivers, streams, and drinking water.

Currently, Vermont is attempting to comply with clean water mandates from the EPA to stop the pollution of Vermont's public waters by dairies, milk processing facilities, sewage treatment plants, and municipalities. Until recently, legislators and regulators have not considered the data analyzed in this paper in crafting legislation aimed at curbing the pollution of our public waters because no one had evaluated the state's own important collection of pesticide, fertilizer, and GMO data from the dairies.

Many Vermonters have begun to realize that it will be impossible to address Vermont's dirty water problems without changing the dominant confined animal dairy strategies, which encourage the use of large volumes of extremely toxic pesticides and fertilizers that end up in public water systems.

It is important to stress again that the toxic runoff and effluent from Vermont dairies, according to several scientific studies, is responsible for at least half of the pollution of Vermont's public waters (as we have noted, some researchers have estimated as much as 79%).

The results are clear: Vermont's dairies are much more toxic than any of the critics imagined. If dairy, as the state's dirtiest water polluter, is not regulated with respect to pesticides and nitrogen fertilizer, then it will be impossible to clean up Vermont's water. If Vermont's dairies are allowed a continuation of their decades long regulatory free-pass on water pollution and toxic pesticide and fertilizer use, Vermont's bucolic brand could be terminally tarnished.

It doesn't have to be this way. About 200 of the 970 Vermont dairy farms have adopted sophisticated organic rotational grazing systems, which enhance the quality of the forage, and sequester large amounts of carbon that can help reverse climate change. More than 20% of Vermont's dairies are organic (the highest percentage in the U.S.) These farm leaders have realized the urgency in rejecting the failed confined dairy farming system that depends on toxic fertilizers and pesticides, pollutes our lakes and waterways, and contributes to global warming. Ironically, while there is a glut of CAFO and AFO milk that is being dumped, there is a projected long-term shortage of organic milk.

Vermont is blessed with abundant water, lush pastures, and an environment where pastured cows can thrive. All of Vermont's dairies could adopt a more sustainable form of dairy management, and the government and private businesses could help farmers make the transition and curb the pollution. We have the technical knowledge to make these management changes, but we urgently need to accelerate the transition to cleaner, safer, and more environmentally friendly dairy farming systems.

Appendix A:
Methods of Analysis

The Vermont Agency of Agriculture, Food, and Markets (AAF&M) publishes annual reports of pesticide use, GMO use, and fertilizer use. The AAF&M requires farmers and licensed applicators to file actual use reports, which are designed to provide an accurate picture of pesticide and fertilizer use and GMO adoption rates for forage and seed corn. This data set was analyzed to evaluate whether industry predictions and lobbyists' claims were valid.

Unfortunately, the Vermont data set, which was analyzed and shared with several legislators, the Secretary of Agriculture, and staff from Ben & Jerry's was found to have been corrupted by faulty data entry and a poorly designed computer program. According to officials at the AAF&M, the data entry staff miscalculated the quantity of chemicals, and the computer programmers were only counting the amount of the primary pesticide in mixed products that have multiple pesticides as active ingredients since 2008. Since a great majority of the pesticides used in Vermont are mixtures of two or more chemicals, this oversight was very significant. The data entry errors overestimated the recent use of some pesticides, but more importantly, the computer programming errors significantly underestimated the total tonnage of pesticides applied on Vermont corn.

In a commendable effort to correct these errors, a second set of data was provided by the AAF&M and analyzed for this report. All of the pesticide data analyzed in this paper is derived from the second set of data.

The pesticide, fertilizer, and GMO data were analyzed and copied onto spreadsheets so that the data from each category and each year could be compared and evaluated.

Data for pesticide use began being compiled in 1986 by the AAF&M, and annual reports of pesticide use by commercial pesticide applicators and farmers with applicator permits have been available on-line since 1999.

Fertilizer and GMO data were only available from the AAF&M since 2002. Data for GMO use is compiled by the AAF&M, which publishes annual reports of seed usage, acreage involved, as well as varieties and amounts of genetically altered crops in Vermont.[23] Data for fertilizer use in Vermont has been compiled for several years, however, in 2002, the AAF&M revised their format for collecting and annually reporting on fertilizer use. Data using that format were the only available data on fertilizers from the AAF&M. Nitrogen fertilizer use was analyzed from 2002-12, which covers most of the period when GMO corn was adopted by Vermont dairy farmers.[24]

Our comparative analysis of pesticides, nitrogen fertilizer, and GMO data begins in 2002, the first year when GMO data was compiled.[25] Pesticides include insecticides, herbicides, fungicides, fumigants, miticides, slimicides, and aquacides. However, the pesticides analyzed in this paper are predominantly herbicides, because more than 99% of the pesticides applied on Vermont corn acreage and reported to the AAF&M are used to control weeds.

Data on pesticides were analyzed in relation to the percentage of GMO corn acreage. When GMO corn acreage was below 60%, pesticide use was analyzed and averaged for those six years, 2002-7. When pesticide use increased significantly after GMO corn was grown on 67% to more than 90% of the acreage from 2008-2012, use was analyzed and averaged for those six years. Pesticide use averages from 2002-7 were compared to average usage from 2008-12.

While the corn pesticides analyzed in this paper only include herbicides applied in Vermont, most corn seed arrives at the seed dealer treated extensively with herbicides, insecticides, and fungicides, which are applied by the seed corporations, before being shipped to Vermont seed dealers. For example, Monsanto's Acceleron corn seed treatments include ipconazole, metalaxl, and trifloxystrobin as fungicides, clothianidin, a neonicitinoid, as an insecticide, and Poncho VOTiVO—a Bacillus firmus for nematodes.[26] These seed treatment pesticides are not currently tallied by any regulatory agencies.

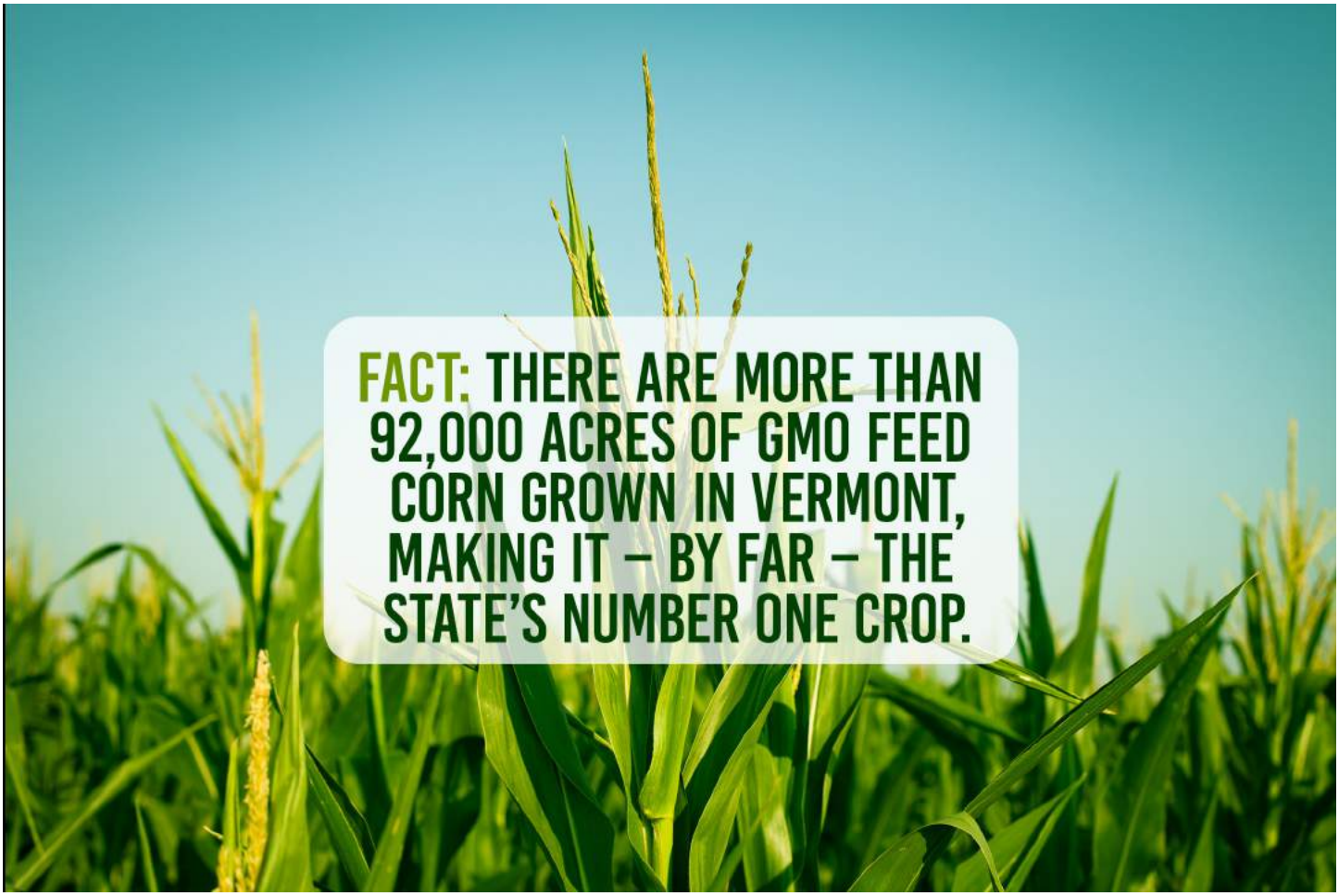
Data on nitrogen fertilizer was also analyzed in relation to the percentage of GMO corn acreage, but also in terms of the increase in use from 2002, when use was low in comparison to all the years that followed when average nitrogen use from 2003-12 was dramatically higher. Nitrogen fertilizer average use from 2002-8 was compared to average use from 2009-12, when GMO corn ranged from 77% to more than 90% of acreage. Fertilizer data from 2010 is missing from the AAF&M reports.

After use of pesticides and fertilizers from 2002-12 was analyzed, a review of the toxicity and impact of the most used pesticides was conducted. A review of the University of Vermont advisories for use of and the impacts from nitrogen fertilizer was also conducted.

To determine the toxicological profiles of the most used corn herbicides, the following regulatory authorities' and academic lists were consulted and cited where appropriate: U.S. EPA; International Agency for Cancer Research (IARC); California EPA, Department of Pesticide Regulation (Cal EPA/DPR) Proposition 65 list, and the Birth Defects Prevention Act Priority Risk Lists of Chemicals; E.U. List of Toxic Chemicals, Pesticide Action Network List of Toxic Pesticides; Our Stolen Future website—the Colborn List; the Lawrence Keith List; the Benbrook List; the U.S. EPA Toxic release Inventory List; and the Illinois EPA List. Other articles on pesticide toxicology were also consulted and are referred to in the text or in footnotes 12-19.

Vermont AAF&M has made a concerted effort to collect and publish pesticide, fertilizer, and GMO data for several years. When the staff at the AAF&M realized that they had published erroneous pesticide data they provided reconfigured data for the most recent years. We need data like Vermont's in every state. We need agency leaders and staff that make the data available and make every effort to correct errors. The analysis of state use-data can provide a clearer picture of use-trends, problem areas, and how to craft regulatory solutions.

Only a few states track actual farm pesticide use, including California, New York, New Jersey, and New Hampshire. Some of these states also track purchased fertilizer. Almost all the other states rely on survey data of pesticide, fertilizer and GMO use that the United States Department of Agriculture (USDA) conducts. The USDA data is valuable, but not usually as accurate as the state data and is not compiled for all states.



Endnotes

1 Quoted in "The Benefits of Biotechnology," Joint FAO/WHO Expert Consultation on Biotechnology and Food Safety. Rome, Italy, 30 September to 4 October 1996. Dr. H. de Haen, p.2.

2 Dr. Abigail Salyers, , Professor of Microbiology at Univ. of Illinois, Urbana. Genetically Engineered Plants are Safe and Necessary. Christian Science Monitor, Jan. 28, 1997. http://www.csmonitor.com/1997/0128/012897.opin.opin.1.html

3 Quoted in "Agriculture Genomics May Bring Benefits Faster Than Human Genomics: Tips from Top Plant, Animal Experts at Purdue," Dr. Ray Bressan, professor of horticulture. October 27, 2003.

4 International Food Information Council Foundation, 2013. http://www.monsanto.com/newsviews/pages/what-experts-say-about-gm-crops.aspx

5 Atrazine resources: According to the EPA Toxic Release Inventory, atrazine is carcinogenic. http://www2.epa.gov/toxics-release-inventory-tri-program/cancer-data-tri-listed-chemicals

Atrazine causes neuroendocrine, reproductive, and reproductive developmental effects in experimental animals. Animal studies have shown that atrazine disrupts estrus cyclicity (i.e., irregular ovarian cycling and changes in the number and/or percentage of days in estrus and diestrus) and alters plasma hormone levels in rats and pigs. P. 37 www.atsdr.cdc.gov/interactionprofiles/IP-10/ip10-a.pdf

Albanito, Lidia, Rosamaria Lappano, Antonio Madeo, Adele Chimento, Eric R. Prossnitz, Anna Rita Cappello, Vincenza Dolce, Sergio Abonante, Vincenzo Pezzi, and Marcello Maggiolini. May, 2015. Effects of Atrazine on Estrogen Receptor α– and G Protein–Coupled Receptor 30–Mediated Signaling and Proliferation in Cancer Cells and Cancer-Associated Fibroblasts. Results suggest a novel mechanism through which atrazine may exert relevant biological effects on cancer cells. Environmental Health Perspectives; DOI:10.1289/ehp.1408586. V. 123, Issue 5.

Bethsass, Jennifer, Aaron Colangelo. July, 2006. European Union Bans Atrazine, While the United States Negotiates Continued Use. International Journal of Occupational and Environmental Health. Volume 12, Issue 3, pp. 260-267. The U.S. EPA approved the continued use of atrazine in October, 2003, the same month the EU announced that in 2004 atrazine use would no longer be permitted because of ubiquitous and unpreventable water contamination. http://www.maneyonline.com/toc/oeh/12/3?mobileUi=0.

Donna, A. et al. 1989. Triazine herbicides and ovarian epithelial neoplasms. Scand. J. Work Environ. Health 15:47-53. www.sjweh.fi/do

Pesticide Action Network has labeled atrazine as a bad actor chemical. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

The Illinois EPA, the Keith List, the Benbrook List, the Colborn list and the EU list all determined that atrazine is an endocrine disruptor.

Keith List: Keith, Lawrence H. 1997. Environmental Endocrine Disruptors: A Handbook of Property Data, Wiley Interscience. New York. http://searchworks.stanford.edu/view/3743203

The Colborn List/Our Stolen Future List: Widespread pollutants with reproductive and endocrine-disrupting effects. June 13, 2005. http://www.ourstolenfuture.org/basics/chemlist.htm

Benbrook List: Benbrook, Charles M. September 1996. Growing Doubt: A Primer on Pesticides Identified as Endocrine Disruptors and/or Reproductive Toxicants, National Campaign for Pesticide Policy Reform. Washington, DC.

Illinois EPA List: These data were taken from the Report on Endocrine Disrupting Chemicals, Illinois EPA (February, 1997). http://www.idaillinois.org/cdm/compoundobject/collection/edi/id/174979/rec/3

EU List: Data on which the list is based were taken from the report Towards the Establishment of a Priority List of Substances for Further Evaluation of Their Role in Endocrine Disruption, Appendix 1, BKH Consulting Engineers and TNO Nutrition and Food Research. June 21, 2000. ec.europa.eu/environment/archives/docum/pdf/bkh_main.pdf

Atrazine is a possible cause of several types of cancer, and, according to many researchers, a proven endocrine disruptor. The Economics of Atrazine. Frank Ackerman, PhD. International Journal of Occupational and Environmental Health. 2007;13:441–449 www.ase.tufts.edu/gdae/Pubs/rp/EconAtrazine.pdf

Atrazine is the most commonly detected contaminant in US drinking water, and is the most serious water contaminant throughout the corn growing areas of the US. In 2010, sixteen cities sued Syngenta after finding atrazine levels exceeding the standards under the federal Safe Drinking Waterfile://localhost/message/%253C20151105-10364615-1060-0@SNE-IT-0J4V.sne1.net%253E Act. In 2012, Syngenta settled two class-action law suits brought by towns with atrazine contaminated drinking water. One of the lawsuits was reported by the Wall Street Journal: Berry, Ian. May 25, 2012. Syngenta Settles Weed Killer Lawsuit, Wall Street Journal. www.wsj.com/.../SB10001424052702304840904 90.

The Environmental Working Group Drinking Water Data Base reports that 28 states and 490 water systems serving 17.39 million people had water with atrazine contamination above health guidelines and that 6 states and 37 water systems serving more than 861 thousand people had atrazine concentrations above the legal limits set by the EPA. The EWG also expresses the following health concerns for atrazine: endocrine disruption, allergies/immunotoxicity, developmental/reproductive toxicity, cancer, organ system toxicity (non-reproductive), persistence and bioaccumulation, occupational hazards, irritation (skin, eyes, lungs), and ecotoxicity. http://www.ewg.org/tap-water/chemical-contaminants.

6 Metolachlor resources: Weight-of-Evidence Characterization of metolachlor by the U.S. EPA as classification C; possible human carcinogen. http://www.epa.gov/iris/subst/0074.htm

Metolachlor is listed as an endocrine disruptor in the Keith list. Lawrence H. Keith's, Environmental Endocrine Disruptors: A Handbook of Property Data, Wiley Interscience (New York, 1997). http://searchworks.stanford.edu/view/3743203

Mathias, Francielle Tatiane, Renata Marino Romano, Hanan Kaled Sleiman, Claudio Alvarenga de Oliveira, and Marco Aurelio Romano. Accepted 28 February 2012. Herbicide Metolachlor Causes Changes in Reproductive Endocrinology of Male Wistar Rats, ISRN Toxicology Volume, Article ID 130846, 7 pages. Academic Editors: S. M. Waliszewski and K. Yamasaki. http://dx.doi.org/10.5402/2012/130846

Appears on the California Priority Risk List, triggered by the Birth Defects Prevention Act of 1984 (SB 950) as being oncogenic (causes tumors), and causing chronic toxicity. http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Listed as a bad actor chemical by PAN, as a known groundwater contaminant by PAN and a potential groundwater contaminant by the California EPA. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

Environmental Working Group's National Drinking Water Database recognizes Metolachlor as a public water contaminant and the data indicate the following health concerns: cancer (possible human carcinogen), organ system toxicity (non reproductive), and irritation (skin, eyes, lungs). http://www.ewg.org/tap-water/chemical-contaminants

7 Simazine resources: Simazine has been classified by the California EPA/DPR on their priority risk lists derived from studies mandated by the California Birth Defect Prevention Act of 1984, as a medium priority pesticide, which showed oncogenic (causes tumors) and chronic toxicity in their combined study. http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Listed on the U.S. EPA Toxic Release Inventory as a developmental toxin.http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals

Simazine is on the Keith List and the EU List for endocrine disruptors.

Simazine is on PAN's list of Bad Actor chemicals and is listed as a known water polluter. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

The Environmental Working Group Drinking Water Data Base for Simazine found that it was a persistent water polluter, and because of that the EPA established a maximum legal limit for tapwater. The EWG also expressed the following health concerns: endocrine disruption, cancer, organ system toxicity (non-reproductive), irritation (skin, eyes, or lungs), ecotoxicity, and multiple, additive exposure sources. http://www.ewg.org/tap-water/chemical-contaminants.

8 Pendimethalin resources: Regulators and researchers have determined that pendimethalin is birth defect progenitor, and is a suspected carcinogen. Categorized by the California EPA/DPR Priority risk listing as a birth defect chemical of low priority rating, because of oncogenic (causes tumors) test results as required by the Birth Defect Prevention Act of 1984 (SB 950). http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Hurley, PM, RN Hill, and RJ Whiting. 1998. Mode of Carcinogenic Action of Pesticides Inducing Thyroid Follicular Cell Tumors in Rodents. Environmental Health Perspectives 106:437-445 It is also a suspected endocrine disruptor. Appears on the Colborn List/ Our Stolen Future List. Widespread pollutants with reproductive and endocrine-disrupting effects, June 13, 2005. http://www.ourstolenfuture.org/basics/chemlist.htm Colborn, T. F.S. Vom Saal and A.M. Soto, "Developmental effects of endocrine-disrupting chemicals in wildlife and humans,"Environmental Health Perspectives,1993, v. 101, pp. 378-384. Although pendimethalin is a suspected public water and drinking water pollutant, the EPA has not established a maximum legal limit for tapwater. The Environmental Working Group Drinking Water Database lists the following health concerns for pendimethalin: endocrine disruption, allergies/immunotoxicity, persistence and bioaccumulation, cancer, organ system toxicity (non-reproductive), ecotoxicity, and multiple, additive exposure sources. http://www.ewg.org/tap-water/chemical-contaminants

9 Glyphosate resources: In March, 2015, the International Agency for Research of Cancer determined that Glyphosate was a probable human carcinogen (Group 2A). Detailed evaluations are to be published in IARC Monographs Volume 112: Evaluation of Five Organophosphate Insecticides and Herbicides http://www.iarc.fr/en/media-centre/iarcnews/pdf/MonographVolume112.pdf A summary of the final evaluations together with a short rationale have now been published online: Guyton, Kathryn Z., Dana Loomis,Yann Grosse. Fatiha El Ghissassi, Lamia Benbrahim-Tallaa, Neela Guha, Chiara Scoccianti, Heidi Mattock, Kurt Straif. 20 March, 2015. Carcinogenicity of tetrachlorvinphos, parathion, malathion, diazinon, and glyphosate. Published Online on behalf of the International Agency for Research on Cancer Monograph Working Group, IARC, Lyon, France. The Lancet Oncology. http://www.thelancet.com/journals/lanonc/article/PIIS1470-2045%2815%2970134-8/abstract

Glyphosate has been identified as a birth defect progenitor.

Paganelli, A. et al. 2010: "Glyphosate-based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling". Chem Res Toxicol 23, no. 10, Aug. 9, 2010: 1586-95. www.glyphosate.eu/literature-database-developmental-and-reproductive-

Dallegrave, E.; Mantese, F.D.; Coelho, R.S.; Pereira, J.D.; Dalsenter, P.R. and Langeloh, A. 2003: The teratogenic potential of the herbicide glyphosate (Roundup) in Wistar rats. Toxicol. Lett., 142 (1-2), 45-52. www.ncbi.nlm.nih.gov/

Glyphosate has been identified as an endocrine disruptor.

Romano, Marco Aurelio, Renata Marino Romano, Luciana Dalazen Santos,
Patricia Wisniewski, Daniele Antonelo Campos, Paula Bargi de Souza,
Priscila Viau, , Maria Martha Bernardi, Maria Tereza Nunes, Claudio Alvarenga de Oliveira. 2012 Glyphosate impairs male offspring reproductive development by disrupting gonadotropin expression. Reproductive Toxicology. Arch Toxicol. April, 663-73. www.ncbi.nlm.nih.gov/...

Glyphosate is the most used herbicide in the U.S. and is a suspected water polluter.

The Environmental Working Drinking Water Database is concerned about the water pollution potential of glyphosate (which has not been evaluated by U.S. or international regulators) and expressed the following health concerns: developmental/reproductive toxicity, organ system toxicity (non-reproductive), cancer, neurotoxicity, irritation (skin, eyes, lungs), ecotoxicity, and persistence and accumulation in agricultural and household settings. http://www.ewg.org/tap-water/chemical-contaminants

10 Acetochlor resources: Listed by California's Proposition 65 as a known carcinogen. Case Number 34256-82-1 January 1, 1989. http://oehha.ca.gov/prop65/prop65_list/files/P65single051115.pdf

Listed by Colborn's list and the EU list as an endocrine disruptor. http://www.ourstolenfuture.org/basics/chemlist.htm

Listed by PAN as a Bad Actor Chemical. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759 Several river and groundwater studies have illustrated that acetochlor, the third most used pesticide in US corn production, and its metabolites, migrate into groundwater, rivers, lakes and ultimately the ocean. The Environmental Working Group National Drinking Water Database – Chemical Contminants. 2010, advises additionally that acetochlor triggers the following health concerns: endocrine disruption, cancer, organ system toxicity (non-reproductive), allergies/immunotoxicity, occupational hazards, irritation (skin, eyes, lungs), and ecotoxicity. http://www.ewg.org/tap-water/chemical-contaminants

11 Dicamba resources: Categorized by the California EPA/DPR as a high priority risk pesticide that showed neurotoxic, oncogenic (causes tumors), and chronic toxicity results in studies triggered by the Birth Defects Prevention Act of 1984 (SB 950). http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf

Listed on the U.S. EPA Toxic Release Inventory as a developmental toxin. http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals Listed as a bad actor chemical by PAN, a developmental toxin, and a ground water contaminant. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

The Environmental Working Group Drinking Water Data Base lists the following health concerns for dicamba: endocrine disruption, cancer, occupational hazards, organ system toxicity (non-reproductive), developmental/reproductive toxicity, irritation (skin, eyes, lungs), ecotoxicity, and multiple exposure sources (both agricultural and household). http://www.ewg.org/tap-water/chemical-contaminants

12 Alachlor resources: Alachlor has been classified B2 by the US EPA Category B: Probable human carcinogen. Known to cause cancer in animals but not yet definitively shown to cause cancer in humans. EPA found sufficient evidence of carcinogenicity from animal studies. An updated list was published in 2002. Office of Pesticide Programs List of Chemicals Evaluated for Carcinogenic Potential, March 15, 2002, not on-line. U.S. Environmental Protection Agency. Also appears on the Toxic Release Inventory List of carcinogenic chemicals. Classified as a known carcinogen by California's Proposition 65. http://oehha.ca.gov/prop65/prop65_list/files/P65single051115.pdf Listed as a low priority chemical by California EPA/DPR as oncogenic (causes tumors), causing chronic toxicity, and having toxic impacts at low dosages (low NOEL). http://www.cdpr.ca.gov/docs/dept/prec/2011/prec_letter_report_52_20110916.pdf Classified as an endocrine disruptor by the Illinois EPA list, http://www.idaillinois.org/cdm/compoundobject/collection/edi/id/174979/rec/3 the Keith List http://searchworks.stanford.edu/view/3743203, the Colborn List http://www.ourstolenfuture.org/basics/chemlist.htm, and the EU List ec.europa.eu/environment/archives/docum/pdf/bkh_main.pdf. Appears on the EPA Toxic Release Inventory List of developmental toxins. http://www2.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals PAN lists it as a Bad Actor Chemical, and a known water pollutant. www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34759

13 European Union Bans Atrazine, While the United States Negotiates Continued Use. 2006 Jul-Sep;12(3):260-7. International Journal of Occupational and Environmental Health. http://www.ncbi.nlm.nih.gov/pubmed/16967834 "Atrazine is a common agricultural herbicide with endocrine disruptor activity. There is evidence that it interferes with reproduction and development, and may cause cancer. Although the U.S. Environmental Protection Agency (EPA) approved its continued use in October 2003, that same month the European Union (EU) announced a ban of atrazine because of ubiquitous and unpreventable water contamination." Simazine lost its registration in the EU in 2004. Jan Gerritse, Bas van der Grift and Alette Langenhoff. 2009. Contaminant Behaviour of Micro-Organics in Groundwater pp.112-144, Simazine pp.134-5. http://media.johnwiley.com.au/product_data/excerpt/91/04707780/0470778091.pdf EU refuses to reregister alachlor, Regulation/Directive (Regulatory Decision excluding substance from Annex I of Directive 91/414). April 4, 2006 http://www.pan-europe.info/Archive/About%20pesticides/Banned%20and%20authorised.htm EU phase-out for acetochlor. The European Commission has decided not to re-register the herbicide, acetochlor. It has instructed EU member states to withdraw approvals by 23 June 2012. AgroNews http://news.agropages.com/News/NewsDetail---6107.htm

14 Benbrook, Charles. 2012, Impacts of Genetically Engineered Crops on Pesticide Use in the US—The First Sixteen Years. Environmental Sciences Europe, 24:24.

15 A Meta-Analysis of the Impacts of Genetically Modified Crops Klümper, Wilhelm, Matin Qaim. Nov. 3, 2014. "On average, GM technology adoption has reduced chemical pesticide use by 37%. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111629

16 Douglas, Margaret R. and John F. Tooker, March 20, 2015 Claims of Reduced Pesticide Use with GM crops are Baseless, Environ. Sci. Technol. http://pubs.acs.org/doi/abs/10.1021/es506141g Krupke, Christian, Brian Wallheimer Greg Hunt, Jan. 2012 Researchers: Honeybee deaths linked to seed insecticide exposure. Purdue Newsroom. http://www.purdue.edu/newsroom/research/2012/120111KrupkeBees.html Seeds of most annual crops are coated in neonicotinoid insecticides for protection after planting. All corn seed and about half of all soybean seed is treated in the US. Kuivila, Kathy, Alex Demas. 7/24/2014 Insecticides Similar to Nicotine Widespread in Midwest. U.S. Department of the Interior, U.S. Geological Survey. http://www.usgs.gov/newsroom/article.asp?id=3941&from=rss_home#.VV6WsBDF9xt Gurian-Sherman, Doug. January 10 2012. Genetically Engineered Crops in the Real World, Bt Corn, Insecticide Use, and Honey Bees. Union of Concerned Scientists.
http://blog.ucsusa.org/genetically-engineered-crops-in-the-real-world-bt-corn-insecticide-use-and-honeybees-2

17 AAF&M and UVM researchers estimate that about 90% of synthetic nitrogen is applied to forage and seed corn in Vermont, but in those cases where the phosphorous index is very high on grass fields, farmers are prevented from using slurry—which contains high amounts of phosphorous—and farmers apply synthetic nitrogen to get sufficient grass yields.

18 This ANR/DEC publication (no date) lists 19 dairies in Vermont as CAFOs and 155 AFOs. http://www.vtwaterquality.org/erp/htm/agriculture.htm However, Marli Rupe, the Vermont ANR/DEC dairy specialist, informed me that there were 25 CAFOs and 185 AFOs as of May 13, 2015.

19 The UVM recommendations are for farms trying to yield 150 Bushels of corn grain or 25 Tons of silage per acre. Recommended rates are 130-150 lbs of nitrogen per acre, but, according to UVM agronomists, farmers often apply more

in an effort to achieve higher yields and in response to recommendations from fertilizer suppliers. For example, for a typical corn starter fertilizer, including nitrogen, phosphorous, and potassium, UVM recommends 100 pounds, but farmers are commonly using 200 to 300 pounds per acre. UVM recommends that the remainder of nitrogen (not included in the starter fertilizer) be applied as a side dressing after the plant is 10-12 inches tall and after determining through soil sampling how much soil nitrogen is present. http://pss.uvm.edu/vtcrops/articles/VT_Nutrient_Rec_Field_Crops_1390.pdf, pp.3-6.

20 Troy, A. Updating the Lake Champlain basin land use data to improve prediction of phosphorus loading. Cited in Technical Report No.34; Wang, D., Ed.; Lake Champlain Basin Program: Grand Isle,VT, USA, 2007. 65%–79% of the total annual P load is attributed to agricultural runoff. http://plan.lcbp.org/ofa-database/chapters/reducing-phosphorus-pollution
Stone Project, Final Report. ID 092156-G. December 15, 2011. Identification of Critical Source Areas of Phosphorous Within the Vermont Sector of the Missisquoi Bay Basin. This study concluded that dairy farming was responsible for 64% of the bay's pollutants. www.lcbp.org/wp-content/uploads/2013/04/63

21 Gobler, C.J.; Davis, T.W.; Coyne, K.J.; Boyer, G.L. 2007. Interactive influences of nutrient loading, zooplankton grazing, and microcystin synthetase gene expression on cyanobacterial bloom dynamics in a eutrophic New York lake. Harmful Algae, 6, 119–133. Gobler and colleagues suggest that N could play an equally important role to P in algae bloom promotion. http://www.somas.stonybrook.edu/~gobler/publications.htm

22 Milk Matters: The Role of Dairy in Vermont. A report compiled by the Vermont Dairy Promotion Council, The Vermont Agency of Commerce and Community Development, the Vermont AAF&M, and Castelton Polling. www.vermontdairy.com/download/VTDairy_MilkMattersReport.pdf

23 Reported Genetically Engineered Seed Sales in Vermont, 2002-12, Vermont AAF&M.

24 Annual Vermont Fertilizer Tonnage Reports, Farm Use, 2002-12. Mar. 25, 2014, Vermont AAF&M.

25 Annual Commercial Applicator Pesticide Usage Host Group Summary: Pounds of Active Ingredient Statewide, Corn. 2002-12. Vermont AAF&M.

26 From: Seed Treatment Options for Corn and Soybean, Monsanto Corporation Advisory. www.aganytime.com/Pages/Article.aspx?fields=article&article=309


Feeding the industrial cow has come at a heavy price. It's responsible for nearly 50% of Vermont's water woes, including the extensive pollution to Lake Champlain, one of 13 lakes in the state that the EPA considers "impaired".

Regeneration Vermont: An Agricultural Solution

Our goal is to redirect Vermont agriculture toward regenerative methods that provide economic justice to farmers and farm workers, protect and enhance the natural environment, produce healthy food products, promote animal welfare, and implement climate change remediation through an understanding of -- and commitment to – healthy, living soils. The regeneration movement is especially concerned with educating citizens about the high greenhouse gas emissions from the current, industrial style of agriculture, but more importantly, showing how changes in farming, ranching, and forestry are the most significant vehicles for sequestering carbon and reversing climate change.

To accomplish our goals, Regeneration Vermont is proposing an extensive public education effort followed by (if necessary) creative, grassroots campaigns that take direct aim at corporations profiting from toxic, climate-threatening agriculture. We will tell the tragic story of degenerative agriculture, identify its corporate enablers, and then put them in the spotlight of marketplace activism. In Vermont, that means the dairy corporations. And that means Ben & Jerry's and Cabot Creamery.

But it's about more than targeting and putting a stop to toxic, climate-threatening agriculture. The regenerative agriculture that will replace it will not only put a halt to GMOs, toxic pesticides and factory animal production, but also employ practices that enhance soil quality and, as a result, sequester more and more carbon from the atmosphere. We are seeking to hasten the necessary transition that puts agriculture in its rightful place as a solution to many of our ecological woes, rather than the cause.

Regeneration Vermont's founding team has extensive experience in the theory and practice of agriculture, forestry and ecology, living on the cutting-edge of regenerative change for decades. More than running successful organic farms, maple sugaring operations and practicing restorative forestry, we have also built and led grassroots movements, published books, magazines and articles, and designed and implemented educational and activist campaigns that have changed both the culture and agriculture. We live and speak regeneration, bringing both a reverence and understanding for what's necessary and possible for our planet's survival.

REGENERATION VERMONT

The Regeneration Pledge

Regeneration Vermont is initiating dialogues with the dominant national and international food corporations within Vermont that control the region's agriculture, most notably Ben & Jerry's and Cabot Creamery. We are asking them to work with us in helping their farmers transition toward regenerative forms of agriculture, including the adoption of these seven principles:

- Transition away from GMO crops;
- Transition away from toxic pesticides/fertilizers and toward regenerative organic agricultural methods;
- Fair wages for farmers, including premiums based on regeneration benchmarks and assistance in the transition toward regenerative methods;
- Economic justice for farm workers, fair and livable wages, decent housing and social and cultural dignity;
- Adoption of climate remediation techniques, beginning with an emphasis on healthy soils and cover-cropping for carbon sequestration and erosion control;
- Humane treatment of farm animals, a phase-out of confinement dairies and a transition back to grassland grazing and grass-based feed for ruminants;
- Cleaning up and protecting our watersheds, streams, rivers, ponds, lakes, and groundwater.