Behind the American Diet

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TABLE OF CONTENTS

ABSTRACT

Americans are faced with a plethora of options every single day when it comes to food and beverage choices. Whether at the grocery store, a restaurant, a friend's house, at school, on the road, or basically anywhere else, Americans make consumption choices several times a day for a multitude of different reasons. Food is not only a necessity for survival but has also become an integral part of social events, a form of entertainment, an opportunity to create multinational corporations for some, and a scientific experiment for others. With so many different calorie sources and factors that determine which foods people ultimately choose to eat, the United States Government's role in many of those decisions is much more impactful than apparent. Along with the government's influence on public health and the American diet, multinational corporations are impacting our health detrimentally without remorse. Together they maintain an alarmingly powerful grasp on what Americans are eating, with ties among top government officials and top employees of biotechnology corporations being powerful and many. America's current food system will continue to negatively affect the lives of its citizens if a reformation is not incited in the near future. With unnecessarily high childhood obesity rates, uncontrollable healthcare costs, a population consuming genetically modified foods without assured safety, and the issue of hunger persisting all the while, a different approach to feeding America must be examined. Private benefit and profit seeking cannot continue to take priority over public health or the future of America will be one of disease, malnutrition, obesity, and unhealthy victims of a distorted system.

INTRODUCTION

Upon leaving my parents' house and heading to Indiana University when I was just a teenager, I realized I was fully responsible for the most important part of my life from that point on: my health. Being on my own meant that I would choose what I ate, how often I exercised, and how I treated my body. After a few years of college, I became very health conscious and understood the importance of eating nutritious foods and maintaining a healthy lifestyle to be the optimal version of myself. However, I soon discovered how difficult eating a nutritious diet really is even with the utmost discipline: social events, office parties, school-sponsored events, lunch outings, eating at restaurants- unhealthy food options are everywhere, and they undoubtedly outnumber healthy options at this point in America. This became very frustrating since I wanted to eat nutritious foods when I could not eat at home, and I started to wonder why our food system is the way it currently is. I wanted to truly understand why fast food is so unbelievably inexpensive and why healthful, nutritious foods are both expensive and not nearly as available. After extensively researching the American food system including the roles of government agencies, agricultural biotechnology companies, and the food industry, I realized the reason behind my frustrations is that wealth and self-interest have continually dominated the American food system at the expense of public health over the course of many years. By placing a higher value on corporate wealth and interests rather than the health of the American people at-large, our resulting food system is unsustainable, unhealthy, and has a multitude of negative impacts on the country as a whole as well as several possible unknown impacts on our health.

DISCUSSION

EVOLUTION OF FARM POLICY

America's currently distorted food system is a product of many years in the making. Beginning with the pioneers in the 1800s, farmers moving westward capitalized in the midst of a boom time by acquiring as much land as they possibly could and planted excessive amounts of one crop: corn. Corn is an incredibly versatile and productive crop with high yield delivery, thus proving to be a predictable and profitable crop for farmers around the country. Due to its attractive qualities, corn became the crop to grow for American farmers and continues to be the most grown crop today.

During years of desirable weather conditions and highly successful yields, the supply of corn within the market can reach such high levels that a price crash can occur which leads farmers to often sell their crop at a loss. In the 19th century when American farmers were indeed overproducing corn and the price did collapse, a surplus of cheap calories hit the food system. This resulted in production of more compact and portable value-added commodities such as whiskey, which were easier to save and transport as opposed to keeping surpluses of corn on-hand. Whiskey was the first of a plethora of value-added commodities derived from corn to flood the American market. Today, everything from soda to cosmetics and a multitude of other products can be traced back to corn, whether through a chemical restructuring or any one of its many new-age uses. As farmers continued overplanting corn and grain throughout the 19th century, prices continued to plummet and the stage was set quite poorly for the upcoming economic downturn.

Prior to the Great Depression, government regulation of the American farming industry was nonexistent. In times of economic hardship prior to the 1930s such as the recession of the mid-1890s, government refrained from intervening in the farm business. Late Secretary of Agriculture J. Sterling Morton for example instilled a 20 percent budget cut in his department, fired unproductive bureaucrats, and cut travel budgets as opposed to subsidizing farmers at the expense of the public's tax dollars. Morton's philosophy of, "The power to tax was never vested in a Government for the purpose of building up one class at the expense of other classes," is written in the Constitution and was the foundation of government's role in the farming industry leading up to the Great Depression.

President Calvin Coolidge vetoed a piece of legislation during the 1920s, the McNary-Haugen bill, which proposed fixing prices of specified crops and passing the costs along to consumers. A proponent of limited government, Coolidge stated, "There is no reason why other industries- copper, coal, lumber, textiles, and others- in every occasional difficulty should not receive the same treatment by the Government…Such action would establish bureaucracy on such a scale as to dominate not only the economic life but the moral, social, and political future of our people." This statement exemplifies the argument against our current system of farm subsidies- why subsidize one industry over another, especially in times of economic prosperity?

The Great Depression of the 1930s brought about the United States Government's initial role in crafting the American food system and diet. With times of widespread poverty and hunger plaguing the nation, the U.S. Government decided to intervene with what was supposed to be a temporary stimulus measure for farmers in an attempt to help

rebuild the economy. Holding opinions different from those of Coolidge, Presidents Hoover and Roosevelt proceeded to end the era of limited government regulation of the American farm industry. Hoover's Farm Board program was the first to disrupt the American farm system. His program fixed price floors for wheat and cotton: if market prices went below $0.80 per bushel of wheat and $0.20 per pound of cotton, the U.S. Government would buy the crop, store it, and sell it at a later time for a higher price. This enticed many farmers to switch to growing these crops since they were guaranteed a secure income by the price floors- thus beginning the overproduction of wheat and cotton. After two years of buying up the surpluses and expending all of the allotted program funds, the federal government either gave away the excess crops or sold them on the international market at a loss.

After Hoover's failed Farm Board came Roosevelt's Agricultural Adjustment Act (AAA) in 1933. This New Deal program established the Agricultural Adjustment Administration under Secretary of Agriculture Henry Wallace, which implemented a system of subsidizing producers of certain commodity crops to reduce their production quantities, called paid-land diversion. The Act intended to restore prices of crops to a level of purchasing power equal to that of 1909-1919, a period of relative stability and success for the farming industry. The government under this Act set a minimum price which farmers would expect to earn from the land forgone, called a minimum price support, which was then paid to farmers to control the supply of crops in the market. The government also bought up and stored any grain surpluses from farmers, controlling its release on the market to prop up prices when they deemed appropriate.

After World War II, growing surpluses continued with the rise of new mechanical and chemical technology as well as overall rising productivity within the economy. The farm policy debate leading up to the 1960s centered around the idea of either continuing to administer high price supports and supply controls or to end government's role in regulating the agricultural sector of the economy. The Food and Agricultural Act of 1965 established under president Johnson provided a solution by continuing to pursue supply control through government intervention while reducing price supports and providing new income support payments to protect farmers' incomes.

The 1996 Federal Agriculture Improvement and Reform (FAIR) Act, also known as the Freedom to Farm Act, was the next piece of legislation to provide notably impactful policies relating to regulation of the farm industry. The FAIR Act was intended to reduce government intervention by eliminating its supply control powers; however, the opposite occurred. Main features of the legislation included the suspension of price supports and deficiency payments and the introduction of a new form of income for farmers: direct compensatory payments. Direct payments were distributed in the form of cash subsidies paid to producers of specific commodity crops based on farmers' historic records of what could be produced on their land. With the FAIR Act came the elimination of paid-land diversion, which meant farmers were permitted to plant their entire acreage with any crop other than fruits or vegetables without any loss of their direct payment. Farmers eligible for direct payments were solely required to follow prescribed conservation compliance obligations, keep their land devoted to agriculture, and abide by the restrictions on planting fruits and vegetables. The total annual direct payment to a farmer could not exceed $80,000; this allowed a $40,000 subsidy for one farm with an

allowance of up to $20,000 for each additional entity per person, with a maximum of two additional entities.

During the 15-year period 1995-2010, the federal government paid out $161 billion in direct subsidy payments to farmers. 90 percent of the $161 billion was paid to only one fifth of all farmers across the U.S., meaning two thirds of American farmers received nothing. Corn, soy, wheat, rice, and cotton accounted for 84 percent of all direct subsidy payments; dairy, livestock and related products account for 14 percent; and less than one percent was paid out for fruit and vegetable production.

By subsidizing commodity crops for so many years, the landscape of American agriculture has become one of almost solely those crops due to the related incentives for farmers driven by U.S. policy. This has resulted in a food system with minimal acreage devoted to healthy, nutritionally dense foods such as fruits and vegetables. Only three percent of the total acreage in America used for agricultural production is dedicated to specialty crops: fruits, vegetables, tree nuts, dried fruit, horticulture, and nursery crops. Considering the legislation passed throughout the past century and the fact that 2008 was the first year specialty crops received their own title in a Farm Bill, the three percent distribution of acreage dedicated to specialty crops is not surprising.

Even after increasing the funds allotted to specialty crops in the 2014 Farm Bill, the aggregate amount still accounts for less than one percent of total outlays. Of the $489 billion appropriated amongst Farm Bill programs, specialty crops received just $1.1 billion total, while commodity crops were allotted $4.7 billion in mandatory spending alone. Other note-worthy provisions of the 2014 Farm Bill include a reduction in payment acres for any farmer who produces specialty crops alongside commodity crops

at the same farm; farmers' total subsidy payments are reduced if a certain percentage of their acreage is dedicated to specialty crops. Along with punishing farmers for growing healthful crops, the 2014 Farm Bill repealed a previously instated grant program from the 2008 Farm Bill designed to increase access to specialty crops. The matching grant program funded several public and private entities to improve transporting nutritious foods to markets lacking access, but was repealed by the House and Senate in 2014. By appropriating such a minimal amount of funds to specialty crop programs, punishing farmers for growing specialty crops, and repealing programs designed to increase access to healthful foods, the U.S. government has crafted a system promoting malnutrition.

INTRODUCTION OF GENETICALLY ENGINEERED SEEDS

When the U.S. government began directly subsidizing farmers for growing commodity crops in 1996, today's largest producer of genetically engineered (GE) seeds on the planet also introduced its products to the American farming industry. Monsanto, a multinational agricultural biotechnology corporation based in the U.S., began its integration into the American food system after transitioning from being a chemical company to a biotechnology-based one. Shortly after its founding in 1901 by John F. Queeny, Monsanto launched its first product: saccharin, a zero-calorie sweetener 300 times sweeter than regular table sugar, which it later sold to Coca-Cola as an artificial sweetener. Progressing through the 20th century, Monsanto developed and marketed various chemical products such as: 2,4-D, an herbicide that kills plants by changing the way certain cells grow; DDT, a pesticide used for insect control which was outlawed by the EPA in 1972 but can still be legally manufactured in the U.S. and exported to other

countries for use; recombinant bovine growth hormone, or rbGH, a genetically engineered artificial hormone injected into dairy cows to increase their milk production by 10-15 percent; and many more. In 1975, Monsanto established its Agricultural Division focusing on herbicides, one called RoundUp in particular, also known as glyphosate. Shortly after the commercialization of RoundUp herbicide in the U.S., Monsanto began acquiring seed companies such as the Jacob Hartz Seed Company in 1982, known for its soybean seed. Upon this acquisition, Monsanto began genetically modifying soybean seeds to become resistant to their widely-used herbicide, RoundUp. Coined "Roundup Ready Soybeans," Monsanto introduced the GE soybean seeds to American farmers in 1996 providing them with in-seed herbicide tolerance to RoundUp and other glyphosate-based herbicides. One year later in 1997, Monsanto introduced RoundUp Ready Canola and RoundUp Ready Cotton followed by RoundUp Ready Corn in 1998. Today, Monsanto makes eight GE seeds: soybeans, cotton, corn, alfalfa, sorghum, wheat, canola, and sugarbeets. Monsanto claims to use genetic modification to bring beneficial traits to plants such as the ability to tolerate drought better, resist herbicide applications, and ward off pests.

By creating GE seeds for all commodity crops subsidized by the U.S. Government, Monsanto and similar proprietary seed companies capitalized on farmers' inelastic demand for commodity crop seeds. Of the total global seed market, Monsanto maintains the largest share at 26 percent of the total market with competitors DuPont, Syngenta, and Groupe Limagrain upholding shares of 21 percent, eight percent, and five percent.

U.S. GOVERNMENT & BIOTECHNOLOGY INDUSTRY INTEGRATION

The three federal agencies responsible for our food system include the Food and Drug Administration (FDA), U.S. Department of Agriculture (USDA), and the Environmental Protection Agency (EPA). The FDA is responsible for protecting public health by assuring foods are safe, wholesome, sanitary, and properly labeled; the USDA is responsible for a multitude of different aspects including food and nutrition programs, food safety and inspection, international food trade, conservation, farming programs, and more; and the EPA is responsible for regulating pesticides used on crops. Throughout the years, agricultural biotechnology companies like Monsanto have pursued heightened involvement with these agencies to maintain their hold on the American farming industry.

Monsanto's connections with the U.S. Government are alarmingly numerous and powerful. The need to comply with federal rules and regulations coupled with the search for government funding for research has led the company to pursue increased levels of involvement in federal agencies. One impactful figure to examine is Michael Taylor, current Deputy Commissioner of Foods at the FDA since he was appointed to the newly-crafted position by President Obama in 2010. According to the FDA, Michael Taylor has served in numerous high-level positions at both the FDA and the USDA including deputy commissioner for policy, staff attorney, and administrator of the USDA's Food Safety and Inspection Service, as well as the vice president for public policy of Monsanto Company. Shortly after serving as Vice President of Monsanto for a decade, Taylor returned to the FDA as deputy commissioner for policy where he took part in the legal approval of both GE crops and bovine growth hormone for cows without labeling

requirements for either GE crops and bovine growth hormone use were both technologies benefitting Monsanto; essentially Mr. Taylor crafted U.S. policy to benefit his private employer by reducing regulatory burden and in turn increasing its profitability.

Another member of the revolving door between federal agency employees and Monsanto is Dr. Margaret Miller, who according to the General Accounting Office was a chemical laboratory researcher at Monsanto from 1985-1989 before joining the FDA in 1989. She was responsible for validating tests measuring levels of bST in cow blood, tissue and urine and insulin-like growth factor-I in cow liver and muscle while at Monsanto; shortly after joining the FDA as a reviewer in 1991, she assisted in drafting the FDA's response to a citizen's petition seeking to halt all sales of milk from cows treated with rbST (a genetically engineered hormone injected to increase milk production). Based on Dr. Miller's findings regarding the safety of bST, the FDA approved the use of Monsanto's bovine growth hormone and did not require labeling on milk products produced through use of the hormone.

Supreme Court Justice Clarence Thomas, nominated by President Bush in 1991, holds previous affiliation with Monsanto as well: he was an attorney for the biotechnology company from 1977-1979. Along with the Supreme Court, the EPA fosters multiple Monsanto affiliates. Linda Fisher (currently an employee at DuPont) has been back and forth through government and corporate positions three times. Her employment history includes: Deputy Administrator of the EPA; EPA Assistant Administrator for Office of Prevention, Pesticides and Toxic Substances; EPA Assistant Administrator for Office of Policy, Planning and Evaluation and Chief of Staff to the EPA Administrator for a combined total of more than 17 years, as well as serving as Vice

President of Government Affairs for Monsanto from 1995-2000. William Ruckelshaus, Administrator of the EPA from both 1970-1975 and 1983-1985, also has history as a member of Monsanto's Board of Directors. Lidia Watrud, Manager of New Technologies and former microbial biotechnology researcher at Monsanto, also serves as a researcher for the EPA in the Environmental Effects Laboratory, Western Ecology Division.

According to Food and Water Watch, agricultural biotechnology companies have employed over 300 former White House staff and congressional members as lobbyists and spent a total of $547.5 million lobbying Congress in the 10-year period 1999-2009. Given the revolving door of federal agency and biotechnology employees, our federal agencies responsible for America's food system have prioritized the profitability and economic standing of agricultural biotechnology companies over public health. At the expense of powerful industry figures and lobbying dollars, the health and well-being of Americans has been discounted. Considering the revolving door along with the evolution of U.S. farm legislation and the incentives linked to growing commodity crops, America's food system has become distorted in the worst ways. Although farmers may simply be responding to market demands and desirable financial incentives, a multitude of impacts related to the current food system are upon us as a nation. This unsustainable and ineffective system is detrimental to human and animal health, the environment, the economy, and the nation as a whole.

IMPACTS

INEFFECTIVE AT FEEDING PEOPLE

Our current food system is first and foremost ineffective at feeding people. Of all the corn produced in the U.S., roughly 76 percent is used for purposes other than feeding Americans: feeding livestock accounts for about 36 percent of all production and producing ethanol amounts to about 40 percent. Much of the remaining 24 percent is exported, which leaves quite a small fraction for the purpose of actually feeding Americans.

Using the majority of corn for purposes other than feeding the population has resulted in a feeding system more inefficient than that of countries such as Bangladesh, Egypt, and Vietnam. The average cornfield in Iowa is capable of yielding at least 15 million calories per acre every year; however, with the amounts currently allocated to animal feed and ethanol production, the total potential calories per acre per year is a mere 3 million for feeding Americans. This amounts to sustaining only three people per acre annually (if all of the corn were being consumed by people) as opposed to 14 people per acre if corn was not used mainly for means other than food.

DETRIMENTAL TO HUMAN & ANIMAL HEALTH

Along with being inefficient at feeding the American people, our current food system has a multitude of negative impacts on both human and animal health. Using grain as animal feed results in multiple negative effects on both the animals consuming it as well as the people consuming those animals. Cows are biologically adapted to convert

grass into both meat and milk. At the onset of the corn surplus in the 19th century, farmers started feeding cattle their excess supply. As they began this process, they soon learned that the grain-fed cows gained weight at rates notably faster than those eating grass. With the help of antibiotics, growth hormones, and protein supplements, grain-fed cows today can reach slaughter-ready weights in about 13-15 months. Seventy-five years ago, grass-fed cows reached slaughter-ready weights in about four to five years. By switching the diet of their livestock from grass to grain, farmers could produce far more slaughter-ready animals quicker and cheaper, making it a sensible option to increase profitability.

Grass-fed cows maintain a stomach acidity level considered Ph neutral, while a grain-fed diet produces dangerously high levels of stomach acidity which can then lead to acidosis. If acidosis develops, antibiotics and medications are given to the cow which create an environment for E.coli to flourish. E.coli are a large, diverse group of bacteria which can cause diarrhea, urinary tract infections, respiratory illness, pneumonia, and other illnesses in humans. Since animals at feed lots stand in their own manure all day due to poor sanitary conditions and lack of adequate space for such a large amount of animals, if one animal gets E.coli, the whole feed lot will likely contract it as well, meaning Americans would then consume contaminated beef.

Along with the exponentially escalated risk of E.coli in grain-fed cows, they also produce fundamentally different meat than that of grass-fed cattle. Seeing as cows are not biologically suited to process grain in their bodies, their meat ultimately contains 15-50 percent less Omega-3 fatty acids than that of grass-fed cattle. The Omega-6 to Omega-3 ratio of grass-fed cattle is by contrast perfectly healthy for both the animal and the humans who ultimately eat the animal.

Along with the appropriate Omega-6 to Omega-3 fatty acid ratio, grass-fed cattle produce meat containing high levels of conjugated linoleic acid, or CLA. CLA was discovered in 1987 by scientist Michael Pariza as a more effective inhibitor of carcinogenesis (the initiation of cancer formation) than almost all other anti-carcinogens and all fatty acids. CLA is a healthy form of a trans fat which also possesses anti-inflammatory, heart health, and body-fat reduction properties. A 2007 issue of *American Society for Nutrition* concluded CLA to even increase fatty acid utilization in humans during sleep. Grass-fed beef contains three to five times as much CLA as its grain-fed counterpart, making it a much more nutritional option for humans.

As corn drastically replaced grass for animal feed at the start of the 20th century, the levels of Omega-6s and Omega-3s as well as the amount of CLA in beef was reduced equally as drastically. Rates of weight gain, cancer, heart disease, and diabetes rose to epidemic levels in correspondence at the start of the 20th century. To compare the leading causes of death in the year 1900 to 2005, cancer increased from 4.1 percent of all deaths to 23 percent; an 18.9 percent increase over the century. Heart disease fatalities increased ultimately by 17.4 percent, accounting for 26.3 percent of all deaths in the U.S. in 2005. Diabetes did not account for a significant percentage of leading causes of death in the U.S. in 1900; however, in 2005 it accounted for 3.1 percent of all deaths in the country.

Feeding America's livestock with the corn that the government subsidizes has detrimental effects on both the health of Americans and the innocent animals consuming it. By feeding livestock the surpluses of corn in feedlots as opposed to their biologically suitable diet of grass in pastures, Americans are destined to continue facing the threats of

E.Coli as well as increased risk of cancer, heart disease, excessive weight gain, and diabetes.

With still such an excessive supply of corn even after considering its dominant uses as animal feed and ethanol, many other products and food products have been developed using the grain to make use of the ongoing surplus. Adhesives, toothpaste, cosmetics, hand soap, and aspirin all contain corn derivatives among many others; however, the most dangerous of all is the commonly known high fructose corn syrup. High fructose corn syrup is a highly refined derivative of corn starch, which is a chain of simple sugar (glucose) molecules joined together and separated from the rest of the corn kernels. Natural enzymes are then added to the corn starch to convert some glucose molecules into fructose, which is the sugar found in natural sources such as fruits. The liquid then passes through activated carbon and is filtered to end the process. High fructose corn syrup is the end product, typically consisting of 42 percent or 55 percent fructose. The industry refers to these forms as HCFS 42 and HCFS 55; HCFS 42 is used in processed foods, baked goods, cereals, and some sugary beverages while HCFS 55 is used mainly in soft drinks.

According to the FDA, stomach acid and gut enzymes rapidly break down the chemical bond found in sucrose (table sugar), while this chemical bond does not exist in high fructose corn syrup. However, they also claim to be unaware of any evidence that a difference in safety exists between consuming foods with HFCS 42 or HFCS 55 and other foods with similar amounts of sweeteners such as honey and sucrose.

Along with high fructose corn syrup, sugar hides behind a multitude of other names: maltose, dextrose, sucrose, fructose, glucose, and many more. 80 percent of foods

in America now contain added sugar in one form or another. These added sugars differ from natural sugars, such as those found in berries and honey, in the way the body absorbs the food. When a person consumes 100 calories of blueberries, the fiber content prevents the food from being absorbed immediately- resulting in a much lower and longer blood sugar rise in the body. 100 calories of a soft drink contains zero fiber, thus unleashing a bigger, immediate sugar rush in the liver which consequently turns the sugar into fat for storage instantly. Along with sugar being processed as fat by the human body, all starch-containing foods are digested as glucose: starches are metabolically the same as sugar to the human body.

Metabolic diseases such as diabetes, heart disease, cancer, lipid problems, and strokes are all driven by sugar. Fructose, the sweet part of sugar, can only be processed by the liver. When the liver is pushed beyond the maximum level it can process without the necessary fiber, the pancreas assists by producing excessive amounts of insulin, an energy storage hormone, which then turns the sugar into fat. When the pancreas has to produce excess insulin, signals of fullness to the brain are blocked by that insulin. Consequently, the brain thinks the body is still starving- leaving the person feeling hungry, tired, and lethargic. This biochemistry describes the onset of obesity.

According to the Centers for Disease Control and Prevention, over a third of U.S. adults and about 17 percent of adolescents aged 2-19 are obese. The U.S. government essentially funded this obesity epidemic by subsidizing commodity crops, which are manipulated into high fructose corn syrup, processed foods, and cheap value-added commodities. The food industry, whose goal is to maximize profits as opposed to protect the public's health, has capitalized on the excessive and inexpensive supply of

commodity crops over the years and created a plethora of unhealthy food products and beverages. Since commodity crops are the cheapest calorie sources, the American food system has been skewed to processed, convenient, sugar-laden foods as opposed to healthy ones.

According to the USDA's Economic Research Service, the relative prices of fruits and vegetables have risen about 40 percent since 1980. As prices of fruits and vegetables have continually risen and those of commodity crops and processed foods have been consistently low, Americans are faced with the decision of whether to spend their incomes on healthful foods at much higher prices or to save their money for other necessities and purchase the cheapest options, which also happen to be the least healthful ones. According to the USDA, about 14 percent of U.S. families were food insecure in 2014, meaning they were either uncertain of having, or unable to acquire, enough food to meet their families' needs. If food insecurity is still an issue in America and the relative prices of fruits and vegetables are continually increasing, a considerable amount of Americans are likely forced to eat the cheapest and most unhealthy foods because they simply cannot afford nutritious ones.

PREVALENCE OF GE FOODS & FOOD PRODUCTS

Once a biotechnology company like Monsanto genetically modifies a crop, the crop is patented- meaning that company owns the modified seed. Upon purchase of patented GE seeds, farmers, researchers, and all other buyers are required to sign an agreement ensuring they will honor the company's patent rights and environmental regulations, meaning they are prohibited to grow the GE crops for certain research-

related purposes. Consequently, scientists, universities, and all researchers are legally prohibited from conducting research on the human health impacts of GE crops without permission from the seed companies. Seed companies have been known to deny permission to researchers, review any findings before publication, and launder data before submission to the EPA.

Due to these research restrictions on the patented GE seeds, Americans are consuming GE foods without assured long-term safety. Without substantial federal testing on GE foods and food products, the American public is at risk of the unknown long-term health impacts associated with eating GE foods. Due to biotechnology companies' involvement within federal agencies, federally conducted testing of the safety of these products is not required by law. Unfortunately, the American people will continue to be experimented on until legislation requires the necessary testing on GE foods.

SMALL FAMILY FARMS DIMINISHING

The farming industry has evolved drastically over the years as a result of subsidizing specified commodity crops. In 1900, the average farm produced about five different commodities; fast forward to 2000, the average farm produced only one commodity. By subsidizing only commodity crops, American farmers are enticed to either switch their operations to growing commodity crops or to begin mass-producing them in order to stay competitive. Just like most Americans, farmers have children to support, bills to pay, and need a guaranteed source of income. Due to the income security of direct subsidy payments for producing commodity crops, farmers consequently decide

to grow commodity crops like corn as opposed to fruits or vegetables which have less predictable yields and are not subsidized. This is reflected in the proportion of agricultural sales in the U.S. for commodity crops. According to the 2012 Census of Agriculture, corn and soybean sales in 2012 totaled $106 billion; while fruit, tree nut, berry, vegetable, melon, and potato sales combined totaled only $42.8 billion.

The evolution of American farming to a system of monocultures and mass production will likely shut out small- and medium-sized farms in only a matter of time. Mass production requires excessive use of pesticides, herbicides, and other fertilizers coupled with expensive, high technology machinery to deliver profitable yields. Small farmers who lack access to the kind of capital that large farmers do cannot compete in a market where mass production is at the forefront of the system: in a market where demand for commodity crops remains very high, small farmers with diverse acreages cannot be profitable in comparison to their massive counterparts who capitalize on the production and marketing efficiencies of concentrating on fewer commodities. Although most farms in America are considered small, the aggregate value of agricultural production is concentrated on only a few large farms. Since 1900, the total number of farms nationwide has fallen by 63 percent while the size of the average farm has increased by 67 percent. As farms have become larger and fewer in number, the aggregate value of U.S. agricultural production has become heavily concentrated on these few large farms. In 2012, 75 percent of all farms in the U.S. had sales amounting to less than $50,000. Alarmingly, that 75 percent of all U.S. farmers produced only a mere 3 percent of the total value of agricultural products sold in America. On the other side of the size spectrum, less than 0.5 percent of farms had sales totaling more than $5 million

in 2012; however, this small fraction accounted for 32 percent of the total value of all agricultural products sold. Farms with sales of $1 million or more, accounting for 4 percent of U.S. farms, produced 66 percent of the total value of agricultural products in 2012.

By subsidizing a system that promotes monocultures and mass agricultural production instead of diversified farming, U.S. policy has in turn made it extremely difficult for small farmers to thrive amongst industry leaders. If upcoming legislation fails to more thoroughly address specialty crop production and incentivize farmers to diversify their acreages, small farms across the country will soon cease to exist.

TAXPAYER BURDEN

According to the Government Accountability Office, between 2007-2011 the U.S. government paid about $3 million in direct payment subsidies to 2,300 farms where no crops of any sort were grown. Perhaps this is due to the USDA's definition of a farm: any place that produced and sold, or normally would have sold, $1,000 or more of agricultural products during the census year. Coupled with this upsetting statistic, between 2008-2012 another $10.6 million was paid to farmers who had been deceased for over a year. Along with direct payments from the government, as dramatic increases in technology and productivity have reduced the need for household help on farms, farmers have begun seeking alternative forms of employment while still maintaining their farms. In 1930, only 33 percent of farm operators worked off the farm for at least 100 days. In 1970, more than half of all farms brought in off-farm income; by 2000, 93 percent of farms brought in off-farm income. Considering this information, farmers have not only

been receiving direct subsidy payments but have also been partaking in other employment opportunities for supplemental income. In 2002, average farm household income exceeded the national average by nearly $8,000. American taxpayers have thus been supporting people with multiple jobs, many of whom have multiple sources of income and a total income higher than the national average. The farmers harvesting corn alone rake in the most subsidies, totaling $90 billion over the period 1995-2010.
By subsidizing farmers through government policy, American taxpayers are essentially supporting many people who are not in need of extra income.

HARMFUL FOR THE ENVIRONMENT

Growing such excessive quantities of commodity crops results in a highly vulnerable system. If a natural disaster, pest outbreak, or economic downturn occurred in the U.S., a major disturbance in the food system would likely occur due to the minimal biodiversity across the nation. Over the years, the industrialization of American agriculture has resulted in a loss of over 90 percent of agricultural diversity.
Monoculture, the production of only one crop in a field year after year, is an unsustainable approach to agriculture and ultimately results in increased use of pesticides. By simplifying an agricultural system down to only one or two commodity crops, pests adapt more easily and thus accumulate in higher amounts, meaning more pesticides must be used to fend them off. By contrast, maintaining diversity in an agricultural system through crop rotation is a sustainable and effective strategy. By growing different crops each season, the food supplies of pests are disrupted, soil nutrients are replenished, and the need for chemical fertilizers and insecticides is therefore greatly reduced. The mass

chemical use required for monocultures and industrialized agriculture is detrimental to the environment: runoff results in contaminated groundwater which many Americans ultimately drink, the chemicals can become air pollutants which are linked to ozone depletion, and soil becomes full of chemical remnants. Although Monsanto claims the proliferation of its GE crops leads to reduced pesticide use, since their introduction in 1996 the aggregate amount of glyphosate applied to all crops grown in the U.S. has increased from 27 million pounds to almost 300 million pounds in 2013.

Our current food system results in other detrimental effects on the environment such as excessive water usage, polluted bodies of water, and damaged ecosystems. Corn production alone in the U.S. uses an estimated annual 5.6 cubic miles of irrigation water extracted from freshwater rivers and aquifers. With 97 million acres of American soil dedicated to corn production, the amount of freshwater resources required to sustain such a large acreage is concurrently excessive.

Along with unsustainable freshwater resource depletion, the continual expansion of land dedicated to harvesting corn and other commodity crops has caused habitat reduction and a loss of other natural resources. A study published in *Proceedings of the National Academy of Sciences* found that an estimated 1.3 million acres of grassland and prairie were turned over to the western Corn Belt (an eco-region including parts of Iowa, Minnesota, Nebraska, Kansas, Missouri, Wisconsin, and South Dakota) between 2006 and 2011. This loss of land threatens nearby waterways, wetlands, and species previously occupying the grasslands and prairie. Expanding outside the Corn Belt throughout the entire U.S., land devoted to corn production alone increased by more than 13 million acres from 2006 to 2011. Continual expansion of land designated to industrialized

agriculture will continue to harm natural habitats, ecosystems, waterways, and all relative environmental resources.

RECOMMENDATIONS

PROMOTE ORGANIC AGRICULTURE

As opposed to subsidizing commodity crop production and neglecting to promote specialty crop production, the U.S. government should incentivize sustainable agriculture: organic farming. Organic agriculture is sustainable, healthy for both humans and animals, great for the environment, and marketable. In a 30-year study conducted by the Rodale Institute beginning in 1981, organic crops were grown alongside conventional crops to test a variety of comparable features. GE seeds were added to the conventional plot upon their introduction to the market. The study provided multiple scientifically verified facts regarding organic agriculture and its potential to sustain the global food system.

The study concluded that organic yields match those of conventional; in years of drought or flooding, organic yields even out-perform their conventional counterparts. Since organic soil is full of vital microorganisms and nutrients, the crops can still yield profitable amounts when the weather cannot provide the nutrients the crops need. Conventional soil is chemical-laden, and thus cannot supply crops with necessary nutrients when the weather cannot either. With remarkably better soil health than conventional, organic soil provides higher groundwater recharge. Organic soil also produces a much more tasty crop, since the nutrients necessary for proper growth are found in the soil as opposed to chemicals.

Organic farming completely eliminates pesticide use, which has detrimental effects on the environment. By using absolutely no chemicals, a system of organic agriculture would result in a much more sustainable world. The elimination of chemicals in our agricultural system would end the associated groundwater contamination, decrease air pollution, and eliminate the potential adverse effects on human health of consuming pesticide remnants. The Rodale Institute's study found that organic yields produce 40 percent less Greenhouse gas emissions per pound than conventional. The benefits of organic farming for the environment are quite significant, and would provide for a much more sustainable framework worldwide.

Along with the preceding benefits of organic farming, according to the Organic Trade Association, organic farmers have an operating profit of $45,697 compared to $25,448 for conventional farmers. Since organic farming requires no chemical usage or high-technology equipment, the marginally lower input costs make organic systems very competitive even without a price premium.

Current U.S. funding allocated to organic agriculture is minimal to say the least. Of the $489 billion in total outlays allotted for the 2014 Farm Bill, organic agriculture was allotted a mere $45 million in discretionary spending. Of the $45 million, $20 million was allotted for enforcement and penalties for violations of labeling and to update the organic database. Only $25 million of the $489 billion for farming programs was provided for the development of organic production and processing. By increasing funding for organic agriculture, the U.S. government could actually take a big step in the right direction for our food system both globally and domestically. Investing in the

development of organic production and processing would help promote transitioning to a system of organic agriculture as quickly, efficiently, and as cost-effective as possible.

INCREASE TRANSPARENCY

A second critical recommendation to improve our food system is to increase the transparency of our federal agencies. Federally requiring GE foods and food products to be labeled and requiring federally-conducted testing of GE foods are the first steps to providing Americans with the freedom to choose what they want to put in their bodies.

Although the FDA claims to be responsible for protecting public health by assuring foods are properly labeled, currently no legislation has been passed requiring any GE foods or food products to be labeled as such. Consumers unknowingly consume these foods due to the lack of labeling requirements; currently over 80 percent of foods and food products in the U.S. contain GE ingredients. Without requiring companies to label their products as containing these ingredients, consumers are denied their right to know what they are actually consuming. Currently, more than 60 countries worldwide require labeling of any foods containing GE ingredients. Being such a powerful and industrialized nation, the U.S. is clearly behind the rest of these countries for the disheartening reasons of both lobbying dollars and corporate interest. According to a recent Consumer Reports survey, over 92 percent of Americans want GE foods and food products labeled.

Agricultural biotechnology companies patent their GE seeds upon creation and apply certain research restrictions by contract to all purchasers of their seeds. The FDA permits these companies to conduct their own research on all of their products, meaning

federal scientists do not conduct any research on the GE seeds and their impacts. These industry-funded studies typically last no longer than 90 days; by studying the impacts on human health for a mere 90 days, the long-term effects are far from clarified. Without a federal procedure for testing the long-term effects on human health, Americans are unknowingly being experimented on until the FDA overpowers its lobbyists and biotechnology industry employees with true political will and mandates federally conducted studies.

By increasing the transparency of our federal agencies, Americans will be able to make more informed and knowledgeable decisions about what foods they choose to eat. Without requiring the labeling and federally conducted testing of GE foods and food products, Americans will unknowingly continue to consume under-researched foods and potentially suffer the unknown consequences in the near future.

INDIVIDUAL-LEVEL DECISIONS & CHANGES

A final recommendation to improve both America's food system and the health of all Americans is to make individual-level changes and consumer decisions that will have lasting impacts for all. Transitioning from a food system composed of GE foods and food products; processed, sugar-laden, and chemical-laden foods; and minimal nutritious foods to one of truly healthful and nutritious ones will not be easy nor sudden, but the process will undoubtedly be expedited through improved consumer choices and awareness.

Americans decide where they grocery shop and eat every day. By shopping at local farmers' markets and community co-ops, consumers can support small and family farms by buying fresh produce instead of going to a commercialized grocery store and

supporting industrialized agriculture. Another option for consumers is to purchase USDA certified organic produce and other organic food products. Choosing organic over conventional for any product shows an increase in demand for organic production, which will in turn assist with the prices of organic foods decreasing. Although organic foods are currently significantly more expensive than conventional, making choices such as purchasing just one or two organic products every time a consumer goes to the grocery store can make the smallest but also a significant difference. Choosing to buy organic over conventional in any situation shows true consumer preference and can in turn help transition our food system to one of more organic products than conventional.

A last individual-level recommendation is for Americans to educate their selves, families, and friends as much as possible about our current food system and its impacts on human health and the environment. By spreading awareness about the prevalence of GE foods and food products and all of the known and unknown impacts associated, Americans can make more informed purchasing decisions and even become advocates of organic agriculture.

CONCLUSION

America's current food system is a long-standing product of corrupt policy, lobbying dollars, corporate interest, and government involvement with agricultural biotechnology company employees. These forces have slighted the public health of Americans at the expense of wealth and self-interest, leaving citizens with a system that promotes malnutrition, requires an unsustainable amount of inputs, affects our

environment detrimentally, and results in the cheapest calories being the most unhealthy ones. By instigating changes such as subsidizing organic agriculture, increasing federal agency transparency, and promoting individual-level changes to further progression to a system-wide change, Americans could be on their way to a much more sustainable and healthful food system for all.

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