Abstract: The Legal, Ethical, and Environmental Issues of “Agent Orange Corn” and Genetically Modified Crops. This paper addresses the recent flap over the pending approval by the Federal Government of what has become known by some as “Agent Orange Corn” and the greater Genetically Modified Crop Debate by Dr. Albert Clark

The Legal, Ethical, and Environmental Issues of “Agent Orange Corn” and Genetically Modified Crops

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Introduction:

American farmers produce over $100 billion worth of major agricultural crops and $15. 1 billion in corn crops each year. According to the National Corn Growers Association, eighty percent of all corn grown in the United States is consumed by domestic and overseas livestock, poultry, and fish production. About 12 percent of the United States corn crop is consumed directly or indirectly by humans in such products as corn chips, cereal, or high fructose corn syrup. A decades old battle between

agribusiness, science, and environmentalist may soon move to another level in the fight against “Enlist”, which is a new type of genetically modified corn. Dow is seeking final approval by the United States Department of Agriculture and the Environmental Protection Agency.

The Rise of “Super Weeds”

It all started as a simple problem. How can farmers control the growth of weeds? Herbicides producing companies, once boasted on the effectiveness of their products for up to 3 months or the entire growing season. Then something happened. Over time weeds, which severely hurt crop production, and which were easily controlled by spraying, stopped dying. They became resistant and even immune to weed control. CBS This Morning reported that various varieties of these weeds were well established in 30 states. That number is growing. If America is to remain the “Bread Basket of the World”, drastic measures had to be taken.

Dow AgriSciences was one of the first companies to develop a new Herbicides which contained the compound 2,-4D. It is used in such products such as Monsanto’s Roundup and can be applied at a cost of $25 dollars an acre. Many studies have been done on 2,-4D, and when applied properly, either very early or very late in the growing season has produced excellent results The E.P.A has approved the use of 2,-4D in its present form and has rejected environmentalist petitions to ban it as being dangerous and unsafe. Advanced Farming has even given it glowing results in passing toxicology,

human exposure, environmental fate, and ecological health reports. It has also been praised in the battle against invasive species of plants that could ruin the eco-system.

The problem is that these “Super Weeds”, despite our best efforts to control them, continue to get stronger and more resistant to herbicide sprays each year. One easy solution would be to use more or stronger herbicides. Another solution might be to ask science to develop a genetically modified plant that is immune to the herbicide, and which would allow the less tolerant “Super Weeds” to simply die off doing the growing season. Both approaches have inherent problems. Critics claim there is no way to measure or predict the cumulative and synergistic effects of chemical escalations and their long term effects on both humans and the environment.

Agent Orange and 2, 4-D

Agent Orange has become almost synonymous with the Vietnam War. Indeed this is where the herbicide gained its notoriety. Containing an equal mixture of the n-butyl esters 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), the herbicide elicited a by-product from (2,4,5-T) known as 2,3,7,8-tetrachlorodibenzo-para-dioxin **(**TCDD**)**, more commonly known as dioxin. The commercial use of Agent Orange can be traced back to 1944; however its origins are the result of a National Research Council grant developed in the early years of World War II to destroy Japanese Rice crops. While the chemical was not used during World War II, President Kennedy ordered the chemical to be used for defoliation and destruction of crops. (Moore, 2000).

This tactic was undertaken in order to establish military perimeters and adversely affect the enemy's food supply. Nicknamed Operation Trail Dust (part of the larger operations named Code Ranch Hand), the US Air Force which was responsible for the dispersal of more than 95% of herbicides used. From 1961 to 1971, approximately 65% of all herbicide usage during the Vietnam conflict contained varying amounts of Agent Orange (Stellman J. M., Stellman, Christian, & Tomasallo, 2003). Exactly how much Agent Orange was dispersed are quite contentious, however more current estimates believe the number falls between 43-46 million liters sprayed (Stellman et. al, 2003; Young, 2009). As more research is undertaken and more epidemiological studies are conducted, often facilitated by concerns by the public, especially vocal groups like veterans, it becomes apparent that dioxin may pose significant health effects to humans due to its toxicity. (Stellman & Stellman, 2005).

Many thought that after the public scrutiny Agent Orange received, the defoliant had been relegated to the past. The commercial production of Agent Orange first began in 1944 and saw an extensive increase until 1968-1969. While the military did procure about 24 million of the 70 million kg produced by the U.S., about 36 million kg of Agent Orange, or 51% percent was used for domestic production related to "domestic herbaceous and woody plant control programs" (Young, 2009, p. 2). The issuance of an emergency suspension by the EPA effectively halted many uses of dioxin as mounting evidence from studies such as the Alsea Study, Kociba et. al, etc. indicated elevated exposure to the dioxin increased risks for cancer, birth defects, miscarriages, etc. (Gibbs, 1995). Yet if recent news is any development, then components of Agent Orange may be

mounting resurgence. According to a CBS news article 2, 4-D, one of the components of Agent Orange, has been used by Dow AgriSciences to create genetically modified corn that is resistant to weeds and can be used during the entire growing season. Farmers consider this new development a boon that could potentially save millions in an industry besieged by “super weeds” that have popped up in recent years. These weeds have been around since 1998.

“Enlist”

Dow’s new genetically modified corn is named “Enlist” and could be treated with 2, 4-D all season long. “Enlist” is currently seeking federal approval. Meanwhile early attempts by concerned groups and their petitions for its removal from the market are being dismissed in courts. A lot is at stake. Dow also maintains that it’s new version of 2, 4-D is markedly divergent from what was used in Vietnam, and that the ingredient that was most detrimental to human health was 2, 4, 5-T which produced dioxin (Attkisson, 2012). However, consumer advocates, health and safety advocates, and environmentalists aren’t entirely convinced. Some cite evidence from the International Agency for Research on Cancer that has identified 2, 4-D as a class 2-B carcinogen potentially posing significant health risks to humans, citing studies that have found a connection between the chemical and Parkinson’s disease, nerve damage, hormone disruption and potentially even birth defects (Indian Country Today Media Network, 2012).

The Greater GMO Debate

Many believe that the advent of such corn may facilitate a Pandora's Box scenario which will introduce a whole new set of issues in regards to food safety, food labeling, and even more questions about its cumulative effects and acceptable chemical thresholds. They argue that the approval of "Enlist Corn", will introduce intricate legal questions that must further be explored due to the juxtaposition of science, health, policy, and law. This example is just one illustration of the often times contentious debate that rages in regard to genetically modified foods. An abridged version of each side's argument is that genetically modified foods may alleviate the strain of feeding an increasing global population while also lessening the necessity for reliance on fertilizers, pesticides, etc. Detractors maintain that; "We are what we eat", and that genetically modified foods introduce an assortment of potential problems ranging from adversely affecting human health, engendering resistance to pesticides and antibiotics within an environment through increased usage, damaging an ecosystem's resiliency resulting in the destruction of crops, animals, and unforeseeable consequences to plants that have seen genetic modifications, precipitating a host of ethical decisions that must be factored in (Preston, 2003). The increasing usage of genetically modified foods has also introduced a complicated legal landscape that has come to increasingly rely on the courts as final arbiter.

Many believe that the history of genetically modified organisms (GMOs) like the Agent Orange corn that is currently undergoing federal government approval has been quite brief, owing its origins to the identification of the structure of DNA by Watson and

Crick in 1953 (Forman, 2009). However it is important to note that humans have been genetically modifying crops since plants were first domesticated thousands of years ago. Agricultural crops in use today all owe their origins to human involvement, which over time allowed many plants indigenous to the wild to be developed for farm use. Attributes found in modern agricultural plants such as reduced bitterness, decreased toxicity, greater productivity, and bigger seed or fruit size have effectively altered much of the agriculture in use today. Many would be unable to survive without human intervention. Human movement allowed for plants to be domesticated far outside their traditional domains i.e. the U.S. producing more corn and soybean than any other country in the world, despite the fact that the plants are native to Mexico and China. Human interference is so intertwined in modern day agricultural practices that "every crop in North America other than the blueberry, Jerusalem artichoke, sunflower, and squash are borrowed from elsewhere" (Prakash, 2001). The modern day understanding that genes are the building blocks of DNA allowed scientists to genetically engineer certain traits of organisms. Using such advancements, scientists have been able to create remarkable innovations, i.e. creating human insulin from genetically modified bacteria in 1973. Another good example of GMOs was the development of "golden rice" in 1999. It has been genetically engineered to incorporate beta-carotene into the rice which allows the body to produce vitamin A, which is a vital in regards to ensuring a healthy immune system. Traditional rice, a staple in millions of children diets around the world is lacking in this vitamin and the hope is that these marvels of genetic engineering may be able to save millions of lives (Forman, 2009).

The Economic Impact

The economic impact of genetically modified crops has been estimated to be quite significant, particularly in regards to farmer's income. Since the advent of commercial Genetically modified (GM) crops in 1996, it has been reported globally that "farm incomes have increased by over $19 billion or $27 billion inclusive of second-crop soybean gains in Argentina" along with estimates that report "the use of pesticides has been reduced by 172 million kg" (Brookes & Barfoot, 2004, pp. 191-193). This aligns with studies from Iowa State University and the Economic Research Service that report findings that genetically modified plants result in an increased crop yields. The findings on whether GM plants will result in decreased pesticide application, however many studies agree with the consensus that this will result in increased profits for farmers (Kruft, 2001). Yet it is important to explore the preponderance of legal and business related issues that often correspond with an increasing reliance on genetically modified foods. The science within the agriculture field has become a lot more complicated and convoluted due to advances in agriculture forcing the court to serve as final arbitrator in cases that have profound implications for legal and policy implications. Judges are often increasingly being relied on to make decisions on issues related to epidemiology, exposure, ownership, liability, etc. in regards to complicated legal questions encountered upon entering this new terrain of genetically modified organisms. (Berger, 2005; Kershen 2004), and this paper will outline arguments that highlight the advantages and disadvantages of an increasingly reliance on genetically modified crops for farmers who embrace them and farmers who have rejected them.

The U.S. Supreme Court ruled in 1980 in a narrow 5-4 majority that the patent Ananda Chakrabarty and Scott Kellogg had applied for and received from the U.S. Trademark Office in 1972 was valid. Once the technology for GMOs was created, many conglomerates such as Monsanto, Dow Chemical, Novartis, and Zeneeca ventured into the agriculture arena, seeing tremendous opportunities in the industry related to crop production, pesticides, etc. (Enriquez & Goldberg, 2000). Many such patents protect "not only the genetic material in the seeds purchased but also the next generation of seeds and any plants resulting from a hybrid of genetically engineered plants and non-GMO plants" (Preston, 2003, pp. 1155-1156). Patent owners are afforded greater protections for patented plants and these crops are widely dispersed in the U.S., yet genetic drift is not without significant problems. Infringement of patent rights may occur as a result of farmers saving patented seeds though the other culprits may be "inadvertent presence" of patented seeds attributed to (1) the dispersal of pollen to neighboring farms that may not have purchased patented seeds, (2) seeds becoming amalgamated due to handling or sharing of equipment, and (3) the presence of volunteer crops (Kershen, 2004). Cases like Monsanto Canada Inc. v. Schmeiser) illustrate that courts are sympathetic to claims of infringement, finding Monsanto was owed thousands of dollars in damages despite making no determination how the genetically patented product ended up on the farmer's property when he had no patent. The court ruled that determining the origins of the violation was not pertinent because legal precedent has established that court cases related to patent infringement need not demonstrate intent as a component of infringement. A similar ruling reached in the American case Monsanto Co v. Dawson. Many in the legal community and agriculture communities believe that this ruling puts

the Agri-business industry in precarious territory siding with an appellate court in the case found that gene patenting was embarking upon ambiguous territory. The ruling places a tremendous burden on farmers who want to avoid being sued for patent infringement with critics concerned that farmers may become beholden to a few large corporations, especially with adverse consequences for small farmers. Significant financial consequences may be incurred by farmers if they have few options for legal redress.

Some legal scholars believe that a better solution is to incorporate litigation that establishes intent to infringe as the baseline for liability in regards to genetically modified organisms. Others maintain credence must be given to incorporating elements of trespass and nuisance. In extreme cases a farmer may even end up paying for his own crop progeny if there are patents on anticipated crop modifications from GMOs by a company (Food & Agriculture Organization, 2003; Preston, 2003). Some counter that a belief that mechanisms like intent, damages, makes use clauses, and inadvertent presence exceptions are insignificant because courts are unlikely to adopt standards that are so vague and arbitrary, specifying that GMOs are not so distinct from other patentable products. Their solution is to incorporate elements such as accession and confusion of goods which allows for "conceptual separation" in order to "determine the title to and ownership of personal property when the personal property of two persons becomes intermingled or commingled" (Kershen, 2004, p. 588), though it should be noted that this standard is used primarily on concrete personal property and may pose issues when applied to GMOs. This has led some to argue that the prevailing standard in regards to legally determining patent ownership should be the law of stray animals. This law has been in place for 200

years and concerns the legal rights appropriated to the owner of land that sees stray animals trespass upon it. The statute acknowledges that while the owner maintains rights, so does the owner of the animal. Being that these rules have been employed for an extensive period with consistency, many note that upholding this standard would allow all parties involved to understand where they stand legally. This standard could help financially protect farmers who may be victims of inadvertent presence while simultaneously protecting patent rights of the companies who hold them because “the law of stray animals has the qualities of stability, predictability, common sense, and accommodation” (Kershen, 2004, p. 600). This theory would essentially hold that while the company who owns the patent maintains certain rights in regards to it, so does the farmer when the seeds become cross-pollinated allowing both sides significant legal leeway because “the farmer who owns cross-pollinated seed has the license to harvest for a single commercial crop but is prohibited from saving seed for planting or for supplying seed to anyone for planting; the patent holder retains ownership of the genes and cells as the intangible intellectual property protected by the patent” (Kershen, 2004, pp. 604-605). However there are other prominent legal scholars argue that cases such as this should be looked at on an individual basis rather than applying uniform rules in determining liability due to other social and economic considerations that must be factored in as evidenced by non-GMO farmers who are also being impacted.

The European Union and Japan have heavily regulated genetically modified foods since their onset, proceeding with caution due to apprehension about any possible adverse consequences that may arise from using GMOs. This runs counter to the American

approach that views GMOs through a lens that emphasizes advantages while controlling for dangers, facilitating an approach that promotes GMOs (Applegate, 2001). This means that farmers that choose to grow non-GMO crops have often found such markets extremely lucrative. Yet many farmers often run the risk of seeing their businesses jeopardized as they struggle to maintain their plants identity by keeping their non-GMO plants from being cross-pollinated. This issue is due in large part to the fact that GMOs cannot be completely contained no matter the intention and genes may end up in unexpected places. These concerns are also prevalent as the crops as the crops go from the farm to the fridge since a supposedly non-GM plant that has been compromised can pose significant health risks due to allergies with foods containing ingredients such as nuts ending up in unexpected places. The farmer may thus end up in the precarious position of being unable to sell contaminated GMO crops to the non-GMO market on the one hand, and being unable to sell the crops as is without being sued for patent infringement on the other hand which can result in significant financial and economic hardships for non-GMO farmers. Many scholars note that courts have had a precedent of not holding farmers liable for pollen drift in courts onto adjacent properties there are court cases that have found courts liable in regards to negligence related to pesticide use suggesting that this may be a route that may be utilized in future court cases (Heald & Smith, 2006; Kruft 2001).

Possible solutions suggested are often weary of imposing overarching statutes created by state and federal legislatures because traditional one size fits all laws because they often don't consider how multi-faceted liability can be. At stake is a "multi-billion

dollar agricultural industry producing organic and other non-GMO crops for markets in Japan, Europe, and the United States" (Heald & Smith, 2006, p. 150) and assigning liability must factor in the social costs by imposing nuisance laws that consider factors related to economic and market factors when seeking to impose liability. Others argue that a congressional standard may be the only solution since it could potentially "establish an acceptable standard of behavior for farmers growing genetically modified crops and identify the duty owed to neighbors growing non-GMO crops" (McEowen, 2004, p. 622) with arguments even being considered for the establishment of some sort of mechanism that would ensure that farmers who see their crops contaminated are adequately compensated. Equally important is the suggestion of the precautionary principle, which has gained a lot more traction in Europe than the U.S., which adherents believe takes on such unintended consequences that are the result of an overreliance on GMOs in a preemptive fashion. This principle extols "foresight" and "seeks to anticipate the risks of new and existing technologies so as to avoid or minimize them" (Applegate, 2001, p. 248). Reliance on four main components that include trigger, timing, response, and iteration, the precautionary principle sets the stage for a regulatory framework that anticipates and alleviates potential problems, the solution is suggested as a way to bridge the gap between the U.S.'s product oriented approach and Europe's process oriented approach however critics contend it is a merely a mechanism for an overreaching regulatory approach that delays the advent of vital technology that could prove beneficial while others say it doesn't go far enough in mitigating risks so that they are removed (Applegate 2001).

It is important to consider that imports of non-GM crops to the EU from the United States have dropped with other countries like Brazil, who has banned genetically modified crops assuming valuable market space that the United States once occupied (Kruft 2001), while demand for organic crops has increased significantly. 2006 estimates place sales of organic products at more than $15 billion dollars with industry sales comprising almost four percent of the market. This growth is largely the result of "organic sales have increased between 17% and 21% each year since 1997 compared with total U.S. food sales which have been growing at an average rate of 2% to 4% a year" (Bellows, Onyango, Diamond, & Hallman, 2008, p. 2). A 2003 survey indicates that even in America where legislation embracing GM foods has been near the forefront, approximately 49% of Americans approve of plant based GM foods (a decrease from 2001 which saw approximately 58% approval). Many American surveyed express serious concerns about health risks of consuming these types of foods with only 45 percent considering such food safe, and with knowledge of genetically modified foods so low that American public's opinions display an enormous amount of skepticism and susceptibility in regards to GMOs (Hallman, Hebden, Aquino, Cuite, & Lang, 2003). Many believe that GM crops may only ever serve niche market due to research that indicates that preferences about for organic plants don't translate into purchases by consumers, with only a quarter of advocates adhering to such purchases (Bellows et. al 2008), and others arguing that it is unrealistic to maintain a zero tolerance standard in regards to genetically modified foods noting that such a standard can be daunting. The practicality of maintaining a 1% threshold, as is the case with the European Commission, may indeed prove undetectable to the scope of modern technology (Barboza 2001;

Whitman 2000). Nevertheless there are fears that the pervasiveness of GM crops will continue to present quite a dilemma for farmers who fail to utilize them.

GM plants may indeed be the latest application of science and their increasing usage shows that they are indeed quite profitable. Yet the benefits of such products must be balanced with the risks from an economic standpoint for all sides. Farmers who accept GM may find themselves navigating a convoluted legal landscape when it comes to ownership and liability; however the same can be said for farmers who reject using such products. Ambiguous legal statutes are of little benefit to farmers who either support or reject the usage of genetically modified crops because there is not one prevailing standard that has been embraced. The call for uniform statutes and federal regulation is often met with reluctance by some scholars, however so are doctrines that advocate usage of infringement, negligence, trespass, nuisance laws, the precautionary principle, the law of stray animals and even calls to look at each case on an individual basis when it comes to determining ownership and liability related to increased usage of GM crops. Indeed until the court delves more definitively into determining which legal statutes are to prevail, the GM crop debate will only continue to heat up as more stories reporting on advances in genetic engineering such as the one on Agent Orange corn continue to hit the presses, amplifying the stakes for both sides. Law, the greater GMO debate, and Conclusion

Conclusion

Three million Americans served in the military doing the Vietnam War. What happened to many of them may serve as a guideline as to why the pending decision

regarding the approval of Agent Orange or “Elite Corn” and the growing debate over genetically modified crops is so important. Not only did many of the soldiers returning from a politically unpopular war have to deal with a culture that deemed them less than “heroes”, but they were also forced into the realization that their own government was in deep denial regarding the ill effects of such a dangerous chemical agent like Agent Orange. Many are still ill today and feel that the government is at fault for its approval of the dangerous chemical which posses such long term permanent effects. After years of court battles, Dow Chemical and Monsanto reached a class action settlement for $180 million. That money was dispersed to those veterans exposed until the year 1996. After that, plaintiffs would have to sue the manufacturer directly. Chance of success in those lawsuits would be slight. In 2009, the Supreme Court basically put and ends to veteran’s chance at monetary relief regarding Agent Orange lawsuits. It declined to hear any appeals in denying relief the Issacson and Stephenson test cases. In what has become known as the Military Contractors Doctrine, independent contractors have been given a type of immunity, so that government work can be done. (Lamb 2009)

Agent Orange Corn or “Elite Corn” along with the genetically modified crop debate regarding D, 2-4D may indeed gain its final Federal approval soon. If it does, we can only hope that it is the right decision financially, and that does not cause a roller coaster effect to the detriment of public health and the environment. Legal challenges will be hard pressed to reverse any harmful effects once these types of new crops become the norm for modern day agriculture and farming practices.

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