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# The United States Love Affair with Maize: A National Security Issue?

## Abstract

Maize is the most widely grown crop in the United States. The crop has a variety of applications being used for food, fuel, and in some industries. Maize is heavily integrated into the fabric of billions of lives across the world. The United States has encouraged the growth of a massive maize monoculture through the usage of government subsidies. However, this presents issues for the United States since it has created a large monoculture that is threatened by natural disasters, pest infestation, and bioterrorism attacks. Additionally, the cheap nature of the monoculture has additional externalities. Examples include decimated maize production in Mexico, Central America, and developing countries, which has led to dependence on the United States crop and decreasing international food security.

## Keywords

Corn, Mexico, NAFTA, Monoculture, Maize, International food security

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**Keywords**: Maize, United States, International Food Security

## Background

Maize has had a long-storied history arising from teosinte and becoming one of the world's most dominant crops. Maize is estimated to have originated in Mexico, in the current state of Oaxaca. Word of this wonder crop soon proliferated across other regions of the Americas and its usage eventually found its way to the Columbian Exchange. Maize is a staple crop that supported the civilizations of the Toltec, Olmec, Mixtec, Zapotec, Aztec, Maya, and other groups. In North America maize was a prominent part of three sisters' agriculture that included maize, beans, and squash. The abundance of maize and its storage capabilities led civilizations to make significant strides in astronomy, math, medicine, and engineering to build the remarkable cities of Tlatelolco and Tenochtitlan. In Central America maize was revered; this reverence is reflected in the Mayan sacred text, the Popol Vuh, which states that the gods mixed maize flour (Masa) and their own blood to create people (Smithsonian 2019). Maize is still prominent in the Americas and in the United States the reliance on maize has become a national security issue.

## Introduction

Historically the United States has had numerous cash crops such as cotton, indigo, tobacco, and sugar, but today corn is king. In the United States maize is the most widely grown crop, has the highest market value, and the most acreage beating soy, which is the second most expansive crop, by a large margin (Pimentel and Patzek 2005). The United States maize crop is so large that the country produces

more than the next four largest producing countries combined: China, Brazil, Ukraine, and Argentina (Allen and Valdes 2016). Maize is a fundamental ingredient in many goods including: foodstuffs, toothpaste, packing peanuts, makeup, shampoo, diapers, food coloring, adhesives, perfume, Aspirin, matches, batteries, plastic, pharmaceutical drugs, and fuel, among other products (Paasche 2012). The love affair with maize is reflected in the diversity of maize's applications and the financial support put forth by the government to maintain and encourage the maize industry. The globalized trade of maize from the United States has broad and dangerous implications both domestically and internationally.

**A History of Monocultures in the United States**

A monoculture is the agricultural practice of growing a singular crop species in which all plants are identical or genetically similar over vast swaths of land. The usage of a monoculture has some benefits as it typically results in low input prices and high yields. However, growing a singular species on large tracts of land creates large scale pest problems and prompts the pest treadmill cycle. The pest treadmill cycle occurs when pests build resistance to pesticides, thus requiring a greater amount of pesticides or new types of pesticides to get rid of them. When this process begins, the use of pesticides becomes an integral part of the agricultural cycle. In the United States, commodity monocultures are encouraged due to the Farm Bill which incentivizes the overproduction of cotton, wheat, maize, and soybeans through the use of government subsidies. The Farm Bill originated during the Great Depression and maintained a goal to preserve

the diverse American farm landscape. In this period of history crop surpluses ran high, but demand remained low. President Franklin Roosevelt passed the Agricultural Adjustment Act which paid farmers not to cultivate certain percentages of their land, allowing commodity prices to increase, and ultimately prevent farmers from going out of business. This kept the market afloat, however in the process it became a permanent piece of legislation following 1938 (Masterson 2011).

Agriculture went through a radical shift following the Great Depression, innovations overhauled farming and led to the massive monocultures seen today in the United States. In the 1960s, the Green Revolution led to the introduction of high-yield hybrid crop varieties, synthetic fertilizers, farm equipment mechanization, and pesticides (Mills n.d.). The average size of farms kept growing in this period and today the average number of acres per farm has increased over 100% since the 1980s (DePillis 2013). In this period, farms have consolidated with 20% of farmers producing 80% of agricultural commodity outputs (Mills n.d.). A major factor that changed the farming landscape in the United States was the Marketing Loan Program incorporated into the Farm Bill in which agricultural commodities revolve around a fixed price set by Congress. One result of the Marketing Loan Program is that farmers would be reimbursed if prices fell beyond a certain point. This government reimbursement program encouraged increases in agricultural production whether it was needed or not. The more farmers grow, the more money they will gain even if it lowers the overall commodity price (Riedl 2007). The

radical changes in the American farming landscape starting in the 1960s, and new Farm Bill programs such as the Marketing Loan Program changed the way farmers managed risk and established the foundations for the monocultures seen today in the United States (Haspel 2014).

**Lack of Crop Biodiversity**

The current method of US maize production results in a massive monoculture. Currently it is estimated that Monsanto, DuPont, and Syngenta control 47% of the global seed market and 65% of the proprietary maize seed market (Associated Press 2009). Control of the seed crop by oligopolies constrains the varieties of seed available to farmers. Many of the seeds sold are of hybridized varieties which are typically sterile, the other major form of seed is that of genetically modified seed. Since genetically modified seeds contain patented information, they cannot be replanted without prior consent by the patent holder according to the Supreme Court holding in *Bowman v. Monsanto Co.* Most commercial farmers are reliant on the major seed companies to supply them each season, from these companies they have only a narrow menu of varieties available to them. Little biodiversity exists in the domestic maize crop. The vast majority of maize grown in the United States is a variety known as yellow dent corn or a closely related variety derived from it. The lack of genetic diversity renders the maize crop susceptible to largescale failures.

**Externalities from a Reliance on Monoculture**

In the past the reliance on large monocultures have led to catastrophic consequences when they have failed to produce a viable crop. Examples of large monocultures failing are seen throughout history. In the 1940s a significant portion of the oat crop was lost due to a fungal pathogen known as Victoria blight, while in the 1850s-1870s the Great French Wine Blight caused by aphids laid waste to the wine industry in France. The Gros Michel was the primary export banana consumed around the world until the 1950s, when the variety declined due to significant losses resulting from Panama Disease. One of the most notable monoculture failures was the Irish Potato Famine occurring between 1845 and 1852 in which the potato crop failed, and the population of Ireland was reduced by about 20 – 25 percent due to starvation and mass exodus. Monocultures are larger than they have ever been, and the reliance on them is far greater than it ever was in the past. This is problematic as they are extremely susceptible to infestations, natural disasters, and in our current era, bioterrorism attacks.

**Anthropogenic Impacts**

A bioterrorist attack would involve the intentional dissemination of biological or herbicidal agents such as viruses, fungi, bacteria, toxins, or chemical substances to destroy plants or disrupt agricultural food production. Since 1978, the United Nations Environmental Modification Convention has outlawed “any technique for changing the composition or structure of the

Earth's biota" (ENMOD 1978: Article II). However, if an entity were inclined to disrupt the American maize crop, extensive damage could occur by comparatively low-tech means. A bioterrorism attack would require relatively little specialized expertise and technology to be carried out. The impacts from such an attack would pose a serious threat to both US agriculture and the domestic economy (Wheelis, Casagrande, and Madden 2002). It is an extremely vulnerable area where there are little to no protections in place. The maize monoculture is vulnerable to both biocrimes and bioterrorism which are difficult to protect against. It is difficult to pinpoint where an attack will come from as agricultural bioterrorists have a variety of motives.

There are a number of adaptive strategies the United States can use to mitigate against a bioterrorist attack. First and foremost, the government could seek to address the issue of what creates monocultures such as reforming or eliminating the Marketing Loan Program. If the government chooses to maintain the Farm Bill and subsidies, they can use these rewards to incentivize farmers to grow different varieties of crops. Farmland where the crops maintain a diverse genetic composition are less susceptible to a bioterrorism attack, especially if that attack targets a specific crop or plant variety. As technology progresses ports of entry can be equipped to perform more comprehensive testing of foodstuffs, and crops being brought in to prevent pests or pathogens from being introduced intentionally or unintentionally.

**Foreign Energy Dependence**

A change in the US maize supply would affect fuel prices and increase the United States dependence on foreign oil. The 2007 Energy Independence and Security Act (EISA) promoted the growth of the maize-ethanol industry. Today approximately 40% of the maize crop is converted into ethanol for fuel use annually. As time passes, more mandates are directing maize specifically into ethanol production (Foley 2013). This occurred following the spike in the price of crude oil in the late 2000s' and, as a result, EISA was touted as a means for the United States to achieve energy independence. The United States viewed maize ethanol as a viable alternative fuel following the success of Brazil's biofuel program. In 2006, Brazil announced they had become dependent from foreign fossil fuels as their flex vehicles were primarily running off ethanol from sugarcane (Reel 2006).

In 2007, 4.7 billion US gallons of ethanol were produced, and EISA mandates suggest the figure should increase to 36 billion US gallons in 2022 (EPA 2017). Currently, the conversion of maize kernels into ethanol is very inefficient as maize is starchy and requires enzymes to be broken down into sugars. In the future, the production of cellulosic ethanol from maize stalks may make maize an efficient option, but as it currently stands the operation remains inefficient. On the other hand, sugar cane from Brazil is 20% sugar and can be fermented almost immediately (Cox 2007). Ethanol is less efficient than traditional fossil fuels as it achieves 30% fewer miles to the gallon than gasoline (Ethanol Fuel Basics 2019).

If the US maize supply were reduced, ethanol production

would also decrease, leading to a greater demand for gas and oil. The United States has increased its domestic production of gas and oil following the shale revolution; however, the country remains a net energy importer. The United States would face a greater demand for international energy primarily from fossil fuels. Reliance on the maize monoculture is subject to vagaries as it can be impacted by a natural disasters, such as droughts, or an attack. If the monoculture is impacted, the United States will face a greater dependence on foreign fossil fuels and the potential for the country to become caught up in political entanglements with volatile energy producing countries. As one of the world's largest oil consumers, uncertainties concerning the maize monoculture and the lack of energy security means the United States is subject to the whims, powers, and price fluctuations of OPEC. The United States' decision to use maize as a means to reduce foreign oil dependence is not efficient and creates a national security concern as it increases the domestic reliance on an uncertain commodity.

**Food Costs**

The negative impacts to the United States maize monoculture would have reverberations felt by people across the world. In the United States, a decrease in the yield of maize results in an increase in food prices. Meat and dairy production in the United States relies on maize with 36% of the domestic crop being used for livestock feed (Foley 2013). Additionally, maize is used in a variety of food preservation processes including the production of ICEIN™, a maize based processing aid sprayed on produce to prevent oxidation

for fresh foods. A shock to maize supply would impact the prices for processed foods, meats, eggs, dairy, vegetables, and fruits. Price increases disproportionately affect the poor, and can expand the demographic of individuals experiencing food insecurity.

A supply shock in the US maize monoculture will have international impacts, most notably in countries reliant on US maize. When this occurs, the global poor are the demographic most adversely affected. Many of these individuals are food insecure, with few other options. A food shortage can force migrations into other areas which may not have the capabilities to respond to incoming refugees. Additionally, maize is typically used in USAID food aid, and is an arm of US diplomacy. Maize is only used if American farmers have a surplus crop which is then exported as humanitarian aid (USAID 2019). If the monoculture is impacted, the United States then loses a significant part of its food aid and an element of its soft power.

**Subsidies and Cheap Cereal**

US maize is produced very cheaply from taxpayer subsidies, which has an adverse impact on the developing world. Maize subsidies in the United States have totaled $113.90 billion USD from the years 1995-2019 (EWG 2019). This has resulted in a process that produces maize at a very cheap rate. Maize is exported to other countries so cheaply that it has become cost ineffective for countries to grow their own maize or other cereals. International markets, predominantly in the Global South, are flooded with cheap maize, creating a non-competitive landscape for international farmers. Many of these

farmers go out of business, while countries lose farmland, skilled farmers, and self-sufficiency, thus becoming dependent on US maize exports. When a country is dependent on US maize exports, they are subjected to the artificial highs and lows of cereal commodity prices. These countries are then at the mercy of conditions that affect US farmlands. An example of this was seen in the 2012 North American drought, where the supply of maize exported was reduced because of the drought and a larger percentage of the crop was being devoted toward ethanol production. Countries which relied on US maize could not secure maize, which was an issue for areas suffering from natural disasters, crop destruction, and food shortages (Schwartz 2012). In this event, the people who suffered the most were the poor in the Global South who had become reliant on US maize exports but did not have access to the product.

**Maize and Mexico**

The negative effects of cheap US maize are seen firsthand in the country of Mexico. Following the signing of the North American Free Trade Agreement (NAFTA), cheap US maize flooded Mexico's markets leading Mexico to become the biggest importer of US maize. Mexico's maize production and the cultural importance of growing maize has declined significantly (Carlsen 2013). Today the US state of Iowa produces more maize than the entirety of Mexico (Living History Farms 2019). The decimation of Mexico's maize industry has led to large numbers of skilled farmers losing their jobs and unskilled laborers from Mexico moving into United States. In the United States,

many remain undocumented workers earning wages typically lower than what federal minimum wage laws dictate. Laborers have the ability to drive wages down and many of the laborers do not speak out against this since they are subjected to abuses from employers and are threatened due to their legal status.

Despite the prevalence of cheap US maize in Mexico, significant portions of the population are still hungry with an estimated 20 million Mexicans living in food poverty (Carlsen 2013). Ultimately cheap maize could destroy international markets, leading to migration throughout the Global South, and dramatically reducing the level of food security for reliant countries.

**Conclusion**

The United States is in too deep with its love affair for maize as it currently devotes most of its agricultural subsidies to the maize monoculture (EWG 2019). Agricultural monocultures have failed in the past on a much smaller scale leading to severe consequences such as industry collapse and mass migration movements. These have occurred from natural phenomena; however, the United States also needs to take into account the additional threat that bioterrorism poses against its most valuable crop. If the US maize crop is impacted in a negative manner, consequences will occur on a global scale. A decrease in the maize crop will lead to a greater dependence on foreign oil, higher food prices, and the rise of hunger in the Global South.

The United States heavily promotes the maize industry as it plays a major role in the food, industrial, and energy sector. The United

States can address these areas independently by promoting investments in domestic energy production not reliant on ethanol and promoting other crops for feed and industrial usage. Encouraging alternate forms of agriculture and different crops would reduce the overreliance on a single crop and reduce future national security risks. Additionally, maize maintains many important uses which were highlighted throughout this paper, however the lack of genetic diversity in the maize crop renders it vulnerable to natural phenomena and attacks. Attempts to increase the varieties and diversity of maize will be a significant first step in challenging American agricultural monocultures, and improving national security. Addressing monocultures in the United States has global implications, as it will allow international small-scale farmers to gain a better foothold in their countries and work towards domestic food security. The government programs that have encouraged large monocultures should look to the initial intentions of the Agricultural Adjustment Act to preserve the rich diversity of American farmland that once existed.

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