Seed
THE CHANGE

SEED: THE UNTOLD STORY
EDUCATIONAL DISCUSSION GUIDE




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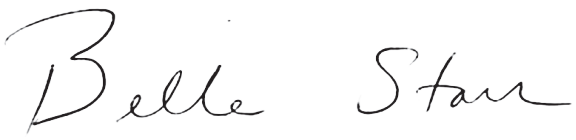
From the Authors

Welcome to the SEED: The Untold Story Educational Discussion Guide.

We created this companion guide to provide viewers with a deeper understanding of the themes and issues raised in the film. Seeds are a complex, controversial, and intriguing subject that touch on nearly every aspect of our lives—from economics and the environment to science and spirituality.

It is our hope that the information contained in the various sections of this guide will equip you with the historical, cultural, and technical knowledge to become an inspired seed advocate.

Thank you for joining us in this important movement for local seed diversity and sovereignty!



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FACILITATORS GUIDE

How to Use This Guide:

This educational discussion guide is appropriate for people of all ages and backgrounds. The sections of this guide were created for a facilitator to use after a *SEED: The Untold Story* screening event to inspire dialog, reflection, learning, and action. However, anyone can read or use this guide to delve deeper into the issues presented in the film.

The guide presents information in a question and answer format, with notes on how to guide the discussion. It was not designed to be handed out to audience members *at the beginning* of the post-screening discussion. This is because the participants' responses to the facilitator's questions may then come directly from the guide instead of their own experience, making for a less engaging discussion. However, our goal is for this guide to be used in whatever way suits YOU best, regardless of our initial intent.

When hosting a screening and discussion, it is important for facilitators to watch the film and read the sections you plan to use in advance to familiarize yourself with the material. It might be helpful to outline the parts of the guide you most want to discuss beforehand to ensure you cover the information most relevant to your group.

Be authentic. You are not expected to know all the answers. What's most important is that you have an interest in the material and are committed to increasing awareness of these topics. Share your knowledge and keep learning.

The Guide:

[Text in brackets are instructions for the facilitator.] They are designed to help guide you and anticipate what to expect.

This guide is organized into four sections based on the prominent themes in *SEED:*

1) Biodiversity Loss & Our Seeds

2) Seed Saving, Sharing & Growing

3) Corporate Consolidation of Seeds

4) Pesticide Issues & Impacts

Also included is a **"What to Know About GMOs"** sheet. At the beginning and end of each section are summaries of the material. Each section can stand alone as a focus of discussion, or be combined.

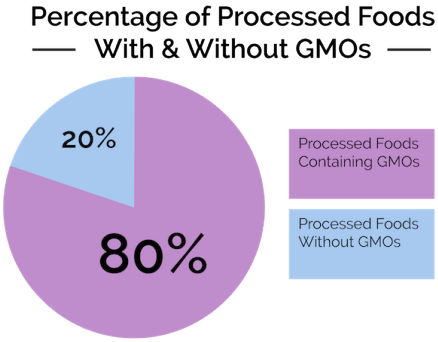
This discussion guide is publicly available at **www.seedthemovie.com/guide**

WHAT TO KNOW ABOUT GMOS

Exploring the Most Common Questions About Genetically Modified Seeds – GMOs

Few issues in our modern world are as complex—or controversial—as genetically engineered seeds. Commonly known as GMOs (genetically modified organisms), these lab-created crop varieties are at the foundation of industrial agriculture and can be found in nearly 80% of processed foods in U.S. supermarkets.[43] Proponents of GMOs claim they contribute to a healthy environment and are needed to "feed the world." GMO critics believe they carry serious risks and are part of a monopolistic and unsustainable agricultural system.

The heated debate surrounding GMOs has become a battlefield of ideas and clashing worldviews. This creates real confusion for average people trying to decide where they stand on this issue. Further complicating the matter, conflicting scientific research and misinformation abounds on both sides. **This document will attempt to address popular misconceptions around GMOs and equip you with clear, well-supported information on this topic.** Our hope is that you use this as a reference in your advocacy efforts for an ethical and regenerative food system rooted in local seeds.



What makes a seed a GMO?

Genetically engineered seeds (GMOs) are agricultural crop varieties whose DNA has been modified in a lab using gene editing technology. These seeds are protected by genetic patents, which means they must be repurchased each year and cannot be saved and replanted by farmers. There are many different types of GMOs that are designed to serve different functions. Some GMOs, such as Hawaiian "Rainbow" papaya, for example, contain a specific trait to resist a pest or disease. Others, like the recently released, non-browning Arctic Apple, are modified to provide a novel consumer convenience.

However, the majority of GMO crops currently being grown are engineered to either withstand applications of chemical pesticides or to produce their own pesticides systemically. Well-known examples are Monsanto's "Roundup Ready" line of crops (e.g., corn, soy, and cotton), which can survive being sprayed with Roundup herbicide. Bt corn, an example of the systemic pesticide type of GMO, is engineered to produce its own insecticide in the form of a protein derived from Bacillus thuringiensis, a bacterium. This protein is carried in each cell of the corn plant and kills certain insects when they eat the crop.

Though GMOs are widespread in the US food system, there are not yet that many genetically engineered crops on the market. **The most common GMOs currently being grown include corn, soybeans, cotton, canola, yellow squash, Hawaiian papaya, White Russet potatoes,**

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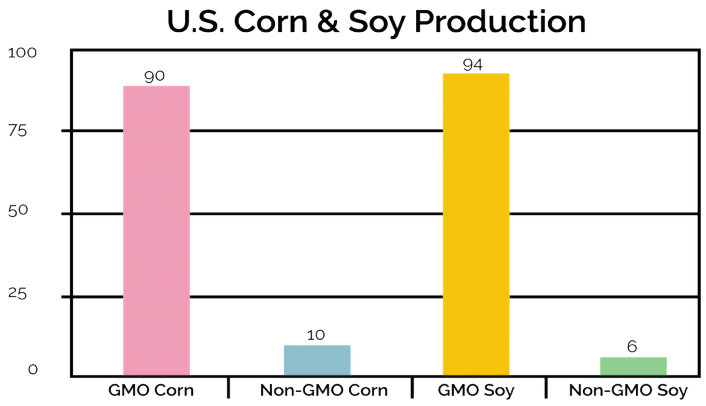
Most commercial GMOs are designed to be sprayed with pesticides.

Arctic Apples, and alfalfa (for animal feed). This list changes occasionally as new GMO crops are approved and enter the food system.[1]

The reason GMOs are so pervasive in our foods is because derivatives of corn and soy are used widely as additives in processed food products.[2] Since nearly all corn and soy grown in the US is genetically modified (over 90% of corn and 94% of soybeans),[3] you can be relatively sure that any non-organic product containing derivatives from these crops will also contain GMOs. (The exceptions here are products labeled as "non-GMO.")



How can I avoid planting GMO seeds in my garden?

At this point, the only way to purchase GMO seeds is by signing a legal contract with the seed producer. Since these seeds contain a proprietary technology, their use is carefully tracked by the seed manufacturers. These seeds are also considerably more expensive than non-GMO seeds of similar varieties. Typically, large farms are buying and planting genetically engineered seeds, as they are able to make this profitable due to their scale. In other words, if you are a gardener, you don't need to worry about accidentally purchasing GMO seeds at the nursery or from a seed company!

Haven't we been genetically modifying seeds for thousands of years through crop breeding?

Not exactly. While both of these processes can take place in laboratories, genetic engineering is distinctly different from traditional crop breeding. It involves taking genetic information from one species of organism (such as fish, pigs, or viruses) and inserting it into the DNA of a different species (such as a tomato or corn plant), which transfers certain characteristics or traits to the recipient organism.

Genetic engineering is a highly technical and relatively new process that began in the 1970s and entered supermarkets starting in 1994 with the unsuccessful Flavr Savr tomato. GMO technology is still in its infancy compared with traditional

crop breeding. **The key difference is the transfer of genes across species barriers, a technique that is impossible to achieve through conventional breeding methods.**[5] (This novel technology may carry unforeseen risks to human health, as described below.)

Are GMOs safe to eat?

Much information can be found on the potential human health risks of GMOs. While many fears are based on speculative or erroneous reports, there are some legitimate concerns that are being investigated. For example, some scientists warn of the possibility that swapping genes between species can potentially trigger genetic interactions that create new allergens.[5] There have also been scientific studies in rats that point to possible links between GMOs and cancer. However, these studies have been challenged by other scientists and pro-GMO groups.[7] Until a larger body of research exists connecting GMO foods to human health problems, the validity of these risks remains uncertain.

A strong case can be made when it comes to health impacts from pesticides. These chemicals are a key component in most GMO growing operations and, with the rise of herbicide-resistant "superweeds", are being applied in increasing amounts.[8] All pesticides are, by nature, toxic poisons, so it is not surprising that they might have harmful effects on human health.

While the health risks of pesticides like Roundup are still being fiercely debated, the state of California[9] and World Health Organization[10] have labeled glyphosate (the active ingredient in Monsanto's Roundup herbicide) as a "possible carcinogen." This is a controversial issue that will require additional research to confirm the actual risks.[11] But in the meantime, caution is advised.

What are some other risks of GMOs?

More evident than human health risks are the impacts that GMOs, by way of heavy pesticide use, are having on the health of our ecosystem. Pesticides have long been associated with environmental harms going back to the use of DDT, the insect-killing chemical banned by the US in 1971 for its destructive effects on wildlife. We are seeing similar ecological impacts with today's popular pesticides. Recent research on glyphosate suggests it is toxic to certain types of bacteria and fungi crucial to plant health. It also has been shown to repel earthworms and increase root-borne diseases in crops.[12] Neonicotinoids, another type of pesticide in widespread use and often added to GMO seeds, have been linked to declines in populations of bees,[13] monarch butterflies,[14] and other keystone pollinator species.

Perhaps the most important, overarching concern with GMOs (as they are predominantly used) is that the chemically-intensive, industrialized agriculture model they support is simply unsustainable. This system is failing to live up to its promises of less pesticide use,[18, 6, 8] higher yields,[28] healthier environments,[22, 46] and more prosperity for farmers.[34, 35, 45] By continuing down the increasingly futile path of industrial farming driven by GMOs and pesticides, we face very real threats to our lives and communities that can no longer be ignored.

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Below are some of the major problems that the industrial-GMO farming system is causing:

• **Biodiversity loss and food insecurity:** Industrial farming relies on uniformity through massive "monoculture" plantings of genetically identical crops. This system is contributing to a steep decline in biodiversity of our seed supplies (an issue deeply explored in *SEED: The Untold Story*.) Loss of seed diversity imperils our food security with the looming threat of crop failures and widespread famine—a very real scenario with historical precedence in the Irish potato famine of the 1840s.[15] (The increasing consolidation of the seed system by multinational corporations is another contributing factor in our declining seed diversity, as far fewer varieties are being made commercially available.)

• **Pesticide resistance:** Just as our seeds become better adapted over time through seed saving, the pests invading farmers' fields (weeds and insects) are developing adaptations to survive the pesticides we spray. A scourge of glyphosate-resistant "superweeds" is spreading across US farmlands, forcing GMO farmers to spray increasingly more pesticides on their fields.[8] The agrichemical industry's solution to this problem? Develop new GMO crops to tolerate ever-more toxic pesticides.[17] This is a losing battle against nature that will only lead to stronger pests and heavier chemical use.

• **"Genetic trespassing":** Altering the DNA of a plant organism can be problematic for an obvious reason: plants naturally reproduce. The modified genes in a GMO can easily escape as pollen from a farmer's crop and "trespass" into another field, transmitting their patented traits. Corn pollen has been known to travel for miles carried by the wind. This is a serious problem for organic farmers whose crops must remain GMO-free. There is no federal law in place protecting non-GMO farmers' crops from GMO contamination. The danger also exists that modified genes (like systemic pesticides) can slip out into wild plant relatives causing damage to natural ecosystems.[19]

• **Climate change:** GMO proponents claim that genetic engineering can offer solutions to climate change—for example, by developing more drought-resistant crops.[20] While this is entirely possible, there are a couple of issues that must be taken into account:

• **Genetic engineering isn't the only—or necessarily the best—way to develop drought-tolerant crops.** A 2014 article in the journal *Nature* reports that conventional crop breeding is outpacing genetic modification in creating superior drought-resistant corn.[21]

Photo of indigenous corn in Oaxaca, Mexico. Native American varieties of corn hold traits such as drought tolerance, which we need to preserve in order to survive climate change.

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GMO technology is also far more expensive than traditional breeding and uses funds that could be directed to other climate resilience measures.

• **The industrial agriculture model supported by GMOs is a primary contributor to climate change.** Soil erosion and depletion, deforestation, and the heavy use of fossil fuels in farm machinery, pesticides, and fertilizers are just a few ways GMO-based industrial farming is driving global warming.[22, 47] Changing this underlying system—rather than tweaking the GMOs it uses—is the real answer to addressing climate change.

• **Economic and social injustice:** The combined impact of GMOs and their pesticides is causing serious harm to farmers and agricultural workers around the world. In the US, millions of migrant farm workers are exposed to high concentrations of pesticides while earning low wages without health benefits. The unaccounted costs borne by these workers and their home countries (e.g., health risks, poor working conditions, and low pay) keep the industrial-GMO farming system running at the expense of human lives and dignity.[23]

Farmers, too, are victims of this unsustainable paradigm. Hundreds of GMO farmers in the US, India, and other countries have gone bankrupt due to crippling debt to agrochemical companies, crop failures, and climbing prices of biotech seeds.[24] Government subsidies for commodity crops like corn and soy keep the industrial agriculture system afloat in the US, essentially funneling billions of dollars into the pockets of the GMO and pesticide companies.[25]

Abundance on display at the National Heirloom Expo.

Do we really need GMOs to "feed the world"?

We are often told that we need pesticides and GMOs to "feed the world." By now, you may be questioning this belief. You are not alone in these doubts. Many researchers (and everyday people) are coming to the conclusion that the chemical-dependent, industrial model of agriculture is unsustainable and unnecessary.

A key promise made by GMO companies is that these seeds would lead to higher crop yields for farmers, thus producing more food for the global population. But recent research shows that this promise is failing to deliver.

In a 2016 feature by the *New York Times* titled "Doubts About the Bounty of Genetically Modified Crops", data from the United Nations

was analyzed comparing GMO- and pesticide-dependent farms in the US and Canada with farms in Western Europe, where cultivation of these GMO crops is banned. The Times' analysis showed "no discernible advantage in yields" for the GMO farmers.[28] Several other studies have reached similar conclusions in recent years, indicating that a central premise of GMOs—higher yields—appears to be more wishful thinking than scientific fact.[29, 30]

Food and pollution experts at the United Nations also fired a shot directly at this claim. In a March 2017 report, they denounce the idea that pesticides (and by extension, GMOs) are needed to feed a growing global population as a baseless myth.[26] They state: "Reliance on hazardous pesticides is a short-term solution that undermines the rights to adequate food and health for present and future generations."[27]

Another persistent piece of this myth is the notion that, without GMO crops, much of the developing world will starve.[31] This claim is highly objectionable. According to the Food and Agricultural Organization of the United Nations, about 90% of the world's 570 million farms are owned and operated by families.[32] These people grow food for a significant proportion of the world's population. The ETC Group reports that this "peasant food web" produces 70% of the world's food with just 30% of its total agricultural resources.[33] So from the very start, the idea that we "need" GMOs and industrial agriculture to survive should be questioned.

While food shortages and famine are very real and tragic occurrences in some parts of the world, there are many complex reasons for this. Poverty, civil unrest, and lack of access to basic farming needs like water, fertilizers, and infrastructure are all underlying factors to global hunger that GMOs cannot address.[34] Furthermore, in many hunger-stricken regions such as rural Africa, farmers follow traditional seed saving and environmentally friendly growing practices that are essential to long-term resilience. Introducing "one-size-fits-all" GMO seeds and pesticides into these communities will likely erode this vital diversity and traditional knowledge, adding to their challenges the same mounting problems US farmers are facing.[35]

Finally, let's look at exactly what kind of "food" most GMO crops are producing. The biggest agricultural crop in the US by far is corn, with around 15 billion bushels grown in 2016. Soybeans come in second with a 2016 harvest of over 4 billion bushels. The vast majority of this is GMO (over 90% of corn and 94% of soy).[3]

Corn is the United States' biggest agricultural crop, however, nearly 40% is turned into ethanol and used as fuel for automobiles.

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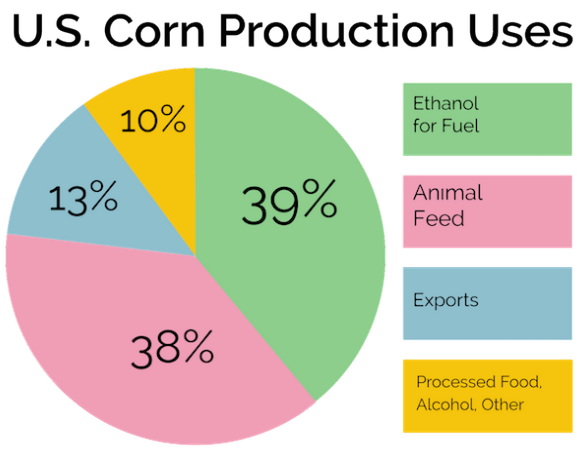
Of all this incredible abundance of GMO crop production, very little—almost none—is actual, nutritious food. Nearly 40% of corn grown in the U.S. is turned into ethanol for fuel, and 38% is fed to livestock; exports account for 13% of corn production (based on averages from 2010-2016). The rest is used in food additives like high fructose corn syrup, alcohol, plastics, and more.[4, 44] An infinitesimal amount winds up as the sweet "corn-on-the-cob" you can actually eat.[37] Up to 98% of the US soy crop is used to feed animals, with the remaining 2% converted to oil for processed food and industrial use. (The soy in the edamame beans, milk products, and tofu we eat is imported.)[38]

The obvious question here is: How, exactly, are these GMO crops feeding the world? When the overwhelming majority of GMOs grown on the planet are used to fuel cars, fatten up livestock, and fill out junk food, this narrative—propagated by the GMO seed and chemical companies[39]—falls apart. (Of course, the case could be made that we can "eat" GMOs by consuming the animals that feed on them. We don't have room here to go into the numerous ecological and human health problems caused by our equally unsustainable animal agriculture system. Suffice it to say, this is hardly the best way to "feed the world.")

So, how do we feed a hungry and growing global population, then? For starters, we can more equitably distribute food resources and reduce food waste. The United States alone throws away nearly half of all its produce—a whopping 60 million tons every year.[40] More than enough food



is already being grown for everyone on Earth, but economic inequality prevents it from reaching hungry people. These are deep problems rooted in capitalism that further industrialization of food production will only make worse.[41]

Indigenous populations, such as these farmers in Oaxaca, Mexico, have long been keepers of our seeds.

Luckily, we don't have to recreate the wheel. By looking to the peasant food web that brings us 70% of the world's food with a fraction of the resources, we can find our answers.[42] The traditional seed saving practices highlighted in *SEED: The Untold Story* will be essential to replenish our bioregional crop diversity and bolster our resilience to the effects of climate change. Permaculture, agroecology, Biodynamic farming, and indigenous growing methods from around the world will all play an important role in making the shift to a regenerative and abundant food system.

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SEED: THE UNTOLD STORY DISCUSSION GUIDE

Where Have All the Purple Tomatoes Gone?

Section 1: Biodiversity Loss & Our Seeds

Background for Facilitators:

This theme section explores concepts that are foundational to all of the other themes in this discussion guide. Biodiversity and its relationship to our seeds is a central issue in *SEED: The Untold Story.* If this were not a serious concern, the film wouldn't have been made!

To unpack this dense and fascinating topic, let's start with a few premises around biodiversity and seeds that will be helpful to keep in mind as you present this section. You may want to share an overview of these premises with participants so that everyone will be on the same page.

The strength of any ecosystem is its biodiversity.

Diversity creates resilience in living systems. When a broad range of genetic diversity is present in a population of living beings, such as plants or animals, these populations are better able to withstand the pressures of climatic change, pests, diseases, or other challenges.

The web of life is diverse, interdependent, and always adapting.

All living things are connected in countless ways. From the depths of the ocean to the highest mountains, a remarkable diversity of plants, animals, and bacteria live symbiotically. Just as the evolutionary process of natural selection depends on biological diversity to develop new species, biodiversity in our seeds is vital to create genetic adaptations that keep our food system healthy and strong.

We eat to live and live to eat.

Food is not just one of life's great pleasures—it's also a basic need for survival. This goes not just for humans but for all living things. We are all a part of the "food chain" and depend upon one another for our existence. **To better understand how biodiversity relates to the food chain (and where we fit in), we must go below the surface to examine seeds at their foundation. Being good stewards of seeds as the source of our food system ensures the health and wellbeing of the interconnected web of life that supports us.**

Emigdio Ballon teaches children to separate seeds from chaff.

Unpacking a Crisis

After seeing *SEED: The Untold Story* for the first time, many people are shocked to learn about the biodiversity crisis facing our seeds. They often say, "I had no idea this was a problem!"

[Text in brackets are notes for the facilitator.]

Q1: Did you have this same reaction? What were the most surprising things you learned from the film?

A1: Many people don't realize the remarkable diversity of food and seed varieties that were available not that long ago, just at the turn of the last century. These crops were different from region to region and community to community. Seeds have a lineage, just like our families have genealogies. The "genealogy" of many seeds stretches back to indigenous cultures and peoples, and sometimes for thousands of years. Imagine how this diversity of food choices, passed down from generation to generation, was valued by people 100 years ago.

Farm workers in India winnow grain.

Q2: Now consider your own local community. What makes the food you eat unique? Are there any distinctive dishes, crops, or recipes that define where you live and make it special?

A2: *[Participants will call out answers. Make the connection between specific foods and the seeds that they come from. For example, if someone calls out "taco", ask them: "What is it that makes this local food unique? Is it a local corn variety that is grown to make the tortilla, or a special sauce?" If someone calls out a type of cheese, ask them: "What gives this cheese its unique, place-based flavor? Is it the local grass that the cows eat?"]*

As you can see, we can connect our local foods to the seeds that they arise from in one way or another. These specialty foods have a sense of place that speaks to a community or region's rich cultural heritage and identity. The French word *terroir* (pronounced "ter-wahr"), used to describe how local environments create unique wines, is now being applied to local foods. When we plant a seed in a particular place, the resulting crop picks up the nuances of the soil, air, and water where it is grown to create a unique and special food.

Q3: Can you think of some popular foods that are intimately linked to a certain region or country of origin?

A3: *[Let participants respond first. Then, give an example from below or your own.]* Examples may include the following:

- Parmesan cheese from Parma, Italy
- Shepherd's Pie from Great Britain
- Maple syrup from Canada
- Bratwurst from Germany

Human Connections to Seed Diversity

The Ojibwe tribe in Minnesota are known for their beautiful wild rice, a crop that they hold as sacred. In *SEED: The Untold Story,* the Ojibwe seed activist Winona LaDuke discussed the proud connection her people have to this rice, which they have been growing for thousands of years; it is not found anywhere else in the world.[1]

Winona LaDuke holding Ojibwe wild rice.

Q4: Can you think of other crops featured in the movie that are connected to the traditions and identities of indigenous communities?

A4: In addition to the Ojibwe, rice also plays a big part in the culture of the people of India. Corn is a very important and sacred crop to the Hopi Tribe and many other indigenous peoples of the Americas. For many indigenous peoples, corn is not only food, it's an integral part of life, from ceremonial use and other cultural practices, to playing a part in their origin stories.

Q5: We've been talking about the ways that seed diversity is connected to our cultures and communities. Another way to think of this is that our seeds have "a name, a place, and a story." What are some other reasons that having rich biodiversity in our crop seeds is important?

A5: *[As audience calls out answers, repeat them aloud. Answers may include: disease and pest resistance, flavor, drought tolerance, climate change, cultural/community identity ("a name, a place, and a story"), resilience, and food security]*

We can sum up a lot of these in one word: **Resilience. Biodiversity in our food crops is our best protection against pests, diseases, and the pressures of climate change.** And this biodiversity starts, of course, with the unique, genetically diverse seeds at the foundation of our food system. If we don't have this seed diversity, our food system becomes incredibly vulnerable and fragile (not to mention rather bland).

Seed Diversity and Food Security

Q6: Who remembers learning about the Irish potato famine of the 19th century?[2] What happened there? Does it seem like we're in danger of repeating this mistake today?

A6: Overdependence on one variety of potato led to a great famine when potato blight devastated the crop.

A major theme in the movie deals with the loss of biodiversity in our seeds over the past century. You may remember the striking quote in the film from Dr. Gary Nabhan[3] that today, "the diversity in our seed stock is as endangered as a panda or a polar bear."[4]

Seed companies celebrated diversity in the early 1900s.

A primary reason for this biodiversity loss has to do with the industrialization of our food system. The incredible diversity of crop varieties that were being grown and enjoyed 100 years ago have been abandoned for seeds that work well in industrial farming systems. As a result, there are far fewer options available in our seed catalogs and on the supermarket shelves.

In fact, if you Google the phrase "best vegetable seed varieties", you will end up with a list of common crop names like "green peppers", "cucumbers", and "lettuce" rather than specific variety names such as "Baltimore Fish pepper" or "Armenian cucumber". The specialized, regionally appropriate seed diversity associated with a particular place or culture has given way to a "one-size-fits-all" seed marketplace that serves all regions with the same product.

This might make sense from an economic perspective for large corporations, but it puts us in a precarious situation when it comes to food security. And of course, we also lose the stories, the flavors, and the ecological benefits that seed diversity brings.

We seem to be repeating the Irish potato famine's mistakes in our agriculture system. There have been several modern examples of crops failing due to overreliance on one variety. In the early 1970s, southern corn leaf blight devastated the corn crop, reducing it by 20 to 25 percent nationwide.[5]

More recently, Florida's citrus industry has been struggling to recover from "citrus greening", a disease caused by a bacterium that affects the tree's vascular system. Two-thirds of citrus crops were affected in 2005.[6] In Hawaii, the papaya industry was nearly wiped out by a ringspot virus that has been destroying crops since the 1940s.[7] Farmers are currently growing a genetically engineered papaya variety that is resistant to the virus—but this solution has other problems as organic papaya farmers are now finding GMO contamination in their crops.

As you can see, the biodiversity loss in our seed supplies is already opening us up to real threats to our food security.

Photo of "citrus greening." Disease can decimate an industry when all crops are the same susceptible variety.

Seed Diversity Loss: Causes and Solutions

Let's delve deeper into some of the concepts we've been discussing.

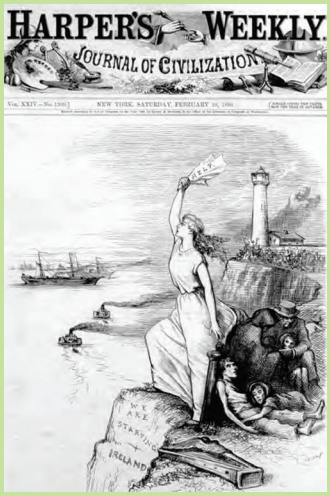
Q7: In the movie, it was stated that we have lost over 90% of our seed diversity over the last century.[8] Based on what we have discussed, where did this biodiversity go?

A7: This statistic comes from a 1983 study by Rural Advancement Foundation International (RAFI).

They compared the number of fruit and vegetable varieties commercially available in 1903 to the number of related varieties found in the National Seed Storage Lab (NSSL) in 1983. Some of these varieties may have completely disappeared or gone extinct. But it is also possible that some of them still exist in basements, attics, growing in personal gardens, and stored in the collections of crop conservation groups or agricultural agencies. However, this diversity is no longer readily available in our seed catalogs or on the shelves of our grocery stores.

Q8: How did this biodiversity loss in our food system happen? What are the forces behind it?

A8: Biodiversity in our seed supplies was primarily forfeited for a relatively small number of industrial varieties that do well in large-scale farming systems. These "one-size-fits-all" varieties are typically selected for their uniform appearance, long shelf-life, hardiness in transportation, and so on. This is a result of market forces seeking to maximize profits. But what makes the most sense economically in a capitalist system, such as



The Irish Potato Famine

FAMINE OR RESILIENCE—HOW CROP DIVERSITY PREVENTS CATASTROPHE

When the fungus *Phyophthora infestans* swept over the Irish potato fields, the entire crop was destroyed by rot. This is because there was no genetic variability present in the lumpers that might have provided resistance to the fungus. Had the Irish farmers planted a wide variety of potatoes, it is likely that some would have survived due to a genetic trait that protects it from the disease.

Nature is inherently diverse for this reason. Maintaining genetic diversity in our seed supplies is a natural hedge against crop diseases, pests, climate change, and other environmental pressures. This is one of the most crucial concerns we face in an industrial farming model based on genetically identical crops. **Without the built-in resiliency of crop diversity, famine from crop failure is a very real risk for our food system.**

in the U.S., doesn't always support ecological health, local resilience, or cultural needs.

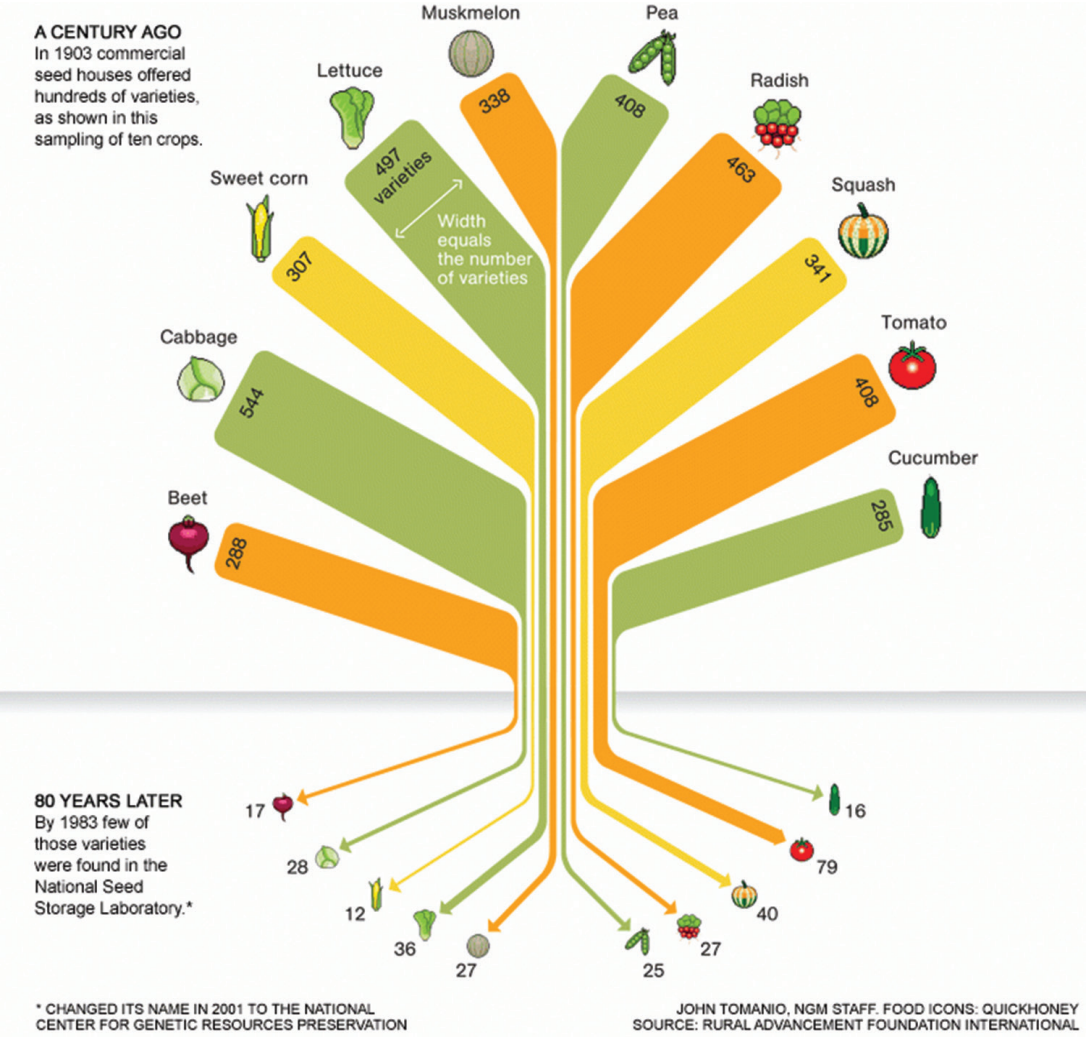
As a result, thousands of unique, interesting, and abundant varieties of regionally adapted seeds, perhaps with great flavors or advantageous, but very specific, strengths couldn't compete in the marketplace and were dropped from production. This has also impacted backyard gardeners who no longer have access to the heirloom varieties grown and stewarded by their great-grandparents.

Industrial agriculture also has serious impacts on other forms of biodiversity. When large swaths of land are cleared for farming, natural habitat areas are reduced for wildlife and insects like pollinators. The heavy application of pesticides on industrial farms can harm beneficial insects like bees and affect the microbiome of the soil, repelling or killing off bacteria and fungi crucial to healthy plant life.[9]

Q9: So, what can we do to address these problems and restore seed diversity? Think back to the film—any ideas?

A9: The simple answer here is: Local seeds. Finding and growing crops known to perform well in your region—and then saving the seeds from those crops—is the key to rebuilding seed diversity and resilience in our food systems. When seeds are saved from crops grown in the same place, season after season, they have amazing resilience due to regional climate and soil adaptation.

Diversity also makes your garden or farm less susceptible to pests or disease because different seed varieties will be impacted differently. Saving seeds allows you to select for the flavors, colors, and traits that work best for you. Soon you will have a new heirloom treasure to share with your community. If gardening isn't a possibility, you can support seed diversity by purchasing locally-grown food and raising awareness about the issue in your community.



National Geographic. Our Dwindling Food Variety. (n.d.). Retrieved from http://ngm.nationalgeographic.com/2011/07/food-ark/food-variety-graphic

GROUP ACTIVITY: SEED SEARCH

[Have participants break into groups of 2-4 people. Ask participants the questions below and have them discuss their responses with their group for about 10 minutes, writing their responses if helpful. After 10 minutes, bring everyone back together, and ask for volunteers to share what they discussed with the room.]

Let's say you are looking for interesting seeds that will grow well where you live. What kind of places would you look for them? What are some characteristics you might want to select for when you grow the crops and save the seeds?

[Offer some of the following answers as additional sources if they are not mentioned by participants.] For the "where to find local seeds" question, some possible answers include: historical societies; indigenous communities; Master Gardeners or gardening groups; attics, basements, and closets of seed savers; local botanical gardens or arboretums; seed catalogs specializing in your region; community seed libraries or exchanges; or seed conservation groups such as Seed Savers Exchange[10], Native Seeds/SEARCH[11], and the Sand Hill Preservation Center.[12]

For the characteristics question, answers may include the following: flavor; resistance to extreme temperature or drought; "lived through a cricket infestation"; "came up in the least likely place to grow"; or "survived when nothing else did!"

Q10: How can we help rebuild seed diversity through our choices as eaters and food buyers?

A10: You have a lot of power as a consumer to "vote with your dollar." Shop locally whenever possible and support your farmers' markets. When shopping at the grocery store, buy the most diverse items available. For example, look out for unusual colors and varieties of veggies, like yellow carrots and purple broccoli. Every time you purchase something that is outside the norm, the scanner picks it up and verifies that consumers want more diversity in their food.

These choices do make a difference. A book called *Rain Forest in Your Kitchen: The Hidden Connection Between Extinction and Your Supermarket*[13] written in 1992 suggested that consumers buy brown eggs instead of white eggs to prompt more diversity of chickens in the egg industry. People heeded this advice and the market responded. Today, a trip to the egg aisle is a much more colorful experience than it was 25 years ago!

Q11: How does seed diversity contribute to healthier environments?

A11: One important way that seed diversity contributes to environmental health is by reducing the need for "inputs." These include things like fertilizers, pesticides, and water. The more varieties of a crop you grow, the greater your chances of success. Those of us who are careful not to "baby" certain plants instead look out for those that are doing well with fewer inputs. When you find those special crops that thrive with little to no water—or survive the surprise frost or beetle infestation—save the seeds from those plants! Now you are adding resilience to your garden while using less resources to grow delicious food.

Did you know?

Supporting organic seed growers is always a good idea, but it is also crucial to support diversity in our seeds. Be aware that only a very small percentage of the seed varieties available are certified organic. **If you find an interesting and unique non-GMO variety that is not yet organic, grow it organically and save the seeds! Now you have the diversity as well—the best of both worlds!**

Conclusion

Diversity is nature's way of making sure life on earth continues to thrive and adapt into the future. When we turn against this natural order by reducing biodiversity, we create real threats to our long-term survival. The biodiversity crisis facing our seeds is a serious threat that cannot be ignored. Thankfully, we all have the power to rebuild this seed diversity in our own backyards. Plant a unique seed, save some from your harvest, and replant them the following season.

If you're able, consider supporting local food and diverse varieties by "voting with your dollar." Share what you've learned with your friends and family. If each of us do something, we will be well on the way to recreating the amazing abundance of our past—and we'll have more delicious food to share and enjoy in the present!

TAKE ACTION

Feeling inspired? Here are some things you can do today to get started.

• If you are a gardener, expand your horizons! Try out unusual, interesting varieties in your garden. Start small and "trial" a few different vegetables or grains. Keep an eye out for those varieties and specimens that work well, and save seeds from the plants that have the qualities you are looking for.

• If you aren't a gardener but like to eat, experiment with new foods, vegetables, grains, and dishes at restaurants and in your kitchen. Think about all of the differences these unique foods "bring to the table" and celebrate them by spreading the word, hosting dinner parties, and sharing recipes.

• Ask the growers at your local farmers' market where their seeds come from. Encourage farmers to expand their seed diversity by trying new varieties and saving their own seeds.

Seed Biodiversity Resources

For more information on seeds and biodiversity, check out the following books and organizations: *Shattering: Food, Politics, and the Loss of Genetic Diversity* by Cary Fowler and Pat Mooney; *The Diversity of Life* by Edward O. Wilson; and the Environmental Working Group.

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Red tomatoes: © Friedrich Haag / Wikimedia Commons / CC BY-SA 4.0

Parmesan cheese: Parmigiano reggiano cheese, image by Dominik Hundhammer, 2004 {{GFDL}}

Colorful tomatoes: By Dwight Sipler from Stow, MA, USA (Cherry Tomato Mix Uploaded by Jacopo Werther) [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons

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SEED: THE UNTOLD STORY DISCUSSION GUIDE

S.O.S: Save Our Seeds!

Section 2: Seed Saving, Sharing, and Growing

Background for Facilitators:

Seed saving was a necessity throughout most of human history, going back nearly 12,000 years to the dawn of agriculture. Our ancestors created an incredible diversity of crop varieties through the careful technique of growing, selecting, and replanting seeds from the best plants each season. But in our modern lives, this timeless tradition has fallen out of common practice, and much of the abundant seed diversity we once stewarded has all but disappeared.

What roles have seeds played in shaping our cultures and communities? How do indigenous connections to seeds differ from our modern use of these vital resources? In this section, we will explore these questions and examine the practice of seed saving across a variety of perspectives, from its indigenous roots to today's revival of traditions.

Introducing the Discussion:

If possible, bring in corn seed for attendees. You can use popcorn from the grocery store or a packet of seeds from a garden center. A packet with around 100 seeds is a great option. Start with everyone holding the seed in their hand and reflecting on how important this seed is.

A chef from Itanoni Restuarant in Oaxaca, Mexico holds native corn

How many thousands of meals, families, and cultural experiences has corn supported over the millennia? In the film, we learned that corn is a deeply sacred plant for indigenous cultures. We will explore the spiritual and cultural importance of corn for Native peoples later in this section.

As we saw in the film, there are many reasons that people save seeds. For example, some Native communities (like the Hopi Tribe we saw in the film) save seeds as part of subsistence farming and in accordance with their ancient traditions. They depend on saving seeds for food and to uphold their way of life.

[Text in brackets are notes for the facilitator.]

Q1: What is a seed?

A1: *[Give participants some time to reflect, and then ask for volunteers to answer. You will be astounded at the diversity and beauty of the responses.]*

Q2: What are some reasons you or your neighbors might want to save seeds?

A2: *[Answers may include: flavor, resilience, adaptation, disease resistance, or drought tolerance. There are no right or wrong answers.]*

Beans come in all shapes, sizes and flavors!

Genetic Diversity and Seeds

Q3: In the film, the seed saver Will Bonsall (the man with long, white beard) says that genetic diversity is the hedge between us and global famine.[1] Why would this be true?

A3: The answer has to do with resilience. When you have many different varieties of a crop, a single disease or pest is not likely to wipe them all out. Some will have genetic resistance built in and be unaffected. In a monoculture food system where all plants are genetically alike, famine is a very real threat. This is why diversity is so important for food security—or as we like to say, *diversity is the strength of any ecosystem.*

You can help create this diversity in your own backyard. Simply look for the healthiest plants in your garden and save seed from them. Now you are practicing crop selection; you have become a citizen scientist (without a PhD!) and are helping build more resiliency into our food system.

Q4: Recall from the film that we have lost over 90% of our crop diversity since the turn of the last century. If we once had so many different crops to eat, what happened to them and why?[2]

A4: The answer has to do with uniformity. As our food system began to be industrialized, crop varieties were developed with traits that make large scale production and harvesting easier—for example, crops with uniform growing habits, predictable ripening patterns, tough skin for shipping, and long shelf lives in grocery stores. In doing this, farmers across the country abandoned the unique crops they once grew in their regions for these uniform varieties.

Q5: It's easy for many people to name the common vegetable varieties in the supermarket, such as Iceberg lettuce, Russet potatoes, and Better Boy tomatoes. But can you name some heirloom, heritage varieties that you know of or might find at a farmer's market?

A5: *[Allow audience to call out heirloom varieties. Some answers may include: Mortgage Lifter tomatoes, Einkorn wheat, Red Russian kale, and Paddy Pan squash.]* Often times, the more obscure or "weird" looking a crop is, the more unique and interesting are its characteristics. Genetic diversity gives us more flavors and food that may grow better in our local environments.

Colorful cauliflower varieties.

Q6: We've all probably heard about "heirloom" seeds and crops. Who can explain what an heirloom crop is?

A6: Simply stated, an heirloom is a *treasure.* An antique is another good way to think about this. Some people think this means it has to be really old, but we think any crop that is unique and created by a seed saver can be called an heirloom.

All heirlooms are "open pollinated." This means that the pollination process that created the seeds was not controlled in any way and was "open" to nature. For seed saving, this also means that the plant will reproduce offspring similar to the parent plant. The big benefit with open-pollinated seeds is you can save the seeds easily.

Seed Saving History and Traditions

Q7: You may remember in the movie that Leigh, the elder from the Hopi Tribe, saved seeds from all of his blue corn—even those ears that were damaged by crows. Now that you know a little about this idea of "selection," how would you describe the way Leigh practices seed selection?

A7: Since Leigh collects seed from all the corn, even the damaged ears, we might say he practices "non-selection"! There may be multiple layers of wisdom here. On a spiritual level, Leigh says "These are all my children, and we bring them all in." So, since all corn seed is sacred, none gets left behind. Also from a scientific perspective, you need hundreds of corn plants to maintain a healthy, genetically diverse population. Both of these ideas are supported by Leigh's "non-selection" method. Corn is one of the more challenging crops to save because it is pollinated by the wind, which carries pollen from plant to plant, and also by insects, such as bees or monarch butterflies. This means that cross-contamination between corn varieties is common and can take place over long distances—even miles away! Contamination of native corn varieties with genetically modified corn is a big concern among indigenous farmers. We will discuss this more later on.

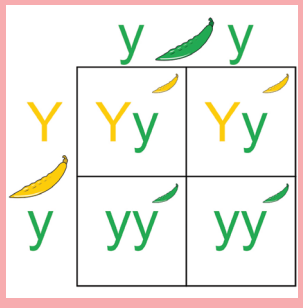
At the end of this section you will find a list of resources to help you in your seed saving explorations. Saving seed is an ancient practice dating back over 12,000 years. This back-and-forth dance with the plants has transformed the human race and is a fundamental part of our story as a species.

Leigh Kuwanwisiwma of the Hopi tribe saves all the corn from his field.

Q8: In the film, one crop was cited as an example of a very malleable, adaptive, and essential crop that fueled three civilizations. What was the crop and can you name the civilizations? *[Maybe offer a hint: we were just discussing this crop.]*

A8: Corn! Aztec, Mayan, and Inca. In our modern times, we can add the "United States of Corn" to that list.

OPEN POLLINATED VS. HYBRID SEEDS



You may have noticed these terms used to describe seeds. But what exactly is an "open-pollinated" or "hybrid seed"? These descriptors have to do with how the seed was bred. They also provide information about the type of crop you can expect to grow from the seeds.

Seeds are produced through a fertilization process in plants called pollination. In open-pollinated plants, the pollination process happens naturally, typically aided by insects, birds, or the wind. These plants tend to have a lot of genetic diversity because pollen can "cross" between different specimens, mixing up their genetic traits.

The hybrid seeds you find in catalogs, on the other hand, are made by humans. (Another term to look out for on seed packets is "F1", which means the seed has been hybridized.) They are the result of specifically crossing two distinct parent plants from the same species that have been uniformly bred to produce a superior and predictable offspring. Hybrid seeds are prized by farmers and gardeners because of the "hybrid vigor" of their crops, which often grow faster, taller, or hardier than open-pollinated plants.

The downside of hybrids is that they are genetically identical, which reduces biodiversity in our seed supply and makes the crops vulnerable to pests and diseases. Also, it is difficult to save seeds from hybrid crops as they will produce an offspring with unexpected and undesirable characteristics. For seed saving purposes—and to replenish our seed diversity—it is best to grow open-pollinated seeds.

GROUP ACTIVITY:
VAVILOV'S CENTERS OF ORIGIN

[Print this page and hand out to participants. Have participants break into groups of 2-4 people. Ask participants the question below and have them discuss their responses with their group for about 10 minutes, writing their responses if helpful. After 10 minutes, bring everyone back together and ask for volunteers to share their guesses. Then, read out the correct answers from page 9.]

The plants we eat originated in many different parts of the world. Nikolai Vavilov, a Russian scientist, led expeditions prior to 1935 to find out the origins of many common crops. Can you guess where the following crops originated?

- Potato
- Corn
- Orange
- Garlic
- Strawberry
- Mustard Seed
- Rye
- Pineapple
- Coffee
- Coconut

Answers on page 9

Q9: In many indigenous communities, growing food and saving seed ties them into the seasonal cycles. Saving seeds also corresponds with their celebrations and rituals, and anchors their connection to the earth. Planting and harvesting crops and processing seed are essential to the livelihoods, beliefs, and cultural identities of these communities. For the Pueblo people, corn holds a special place in their lore and origin stories. In an interview that was not in the final version of the film, Tesuque Pueblo's Louie Hena describes one such belief:

Louie Hena from the Tesuque Pueblo in the Pueblo corn field.

"For the Pueblo people, Blue Corn Woman and White Corn Maiden are the original mothers whom each child acquires his soul at birth. The ears of corn are placed on either side of the infants cradleboard. Afterwards, they are carefully wrapped and planted the following spring. In our communities we are brought up, that we are connected to everything around us. Anywhere we go on Earthmom, it's a special place for us. And as indigenous communities, the importance of our seeds is that this is our pantry and our medicine chest and that's how we look at it."

For information on another Corn-related ritual, the Cherokee Green Corn Ceremony, visit: http://nativeamericannetroots.net/diary/951

Seed saving was also an integral part of the early history of non-Native communities in the United States. For example, as you learned in the film, in the late 1800s the U.S. government gave away millions of packets of seed to farmers around the country.[4] Why would they do this?

Animation from Seed: The Untold Story. In the late 1900s, the U.S. government gave away millions of seed packets.

A9: As a young country, the U.S. was committed to helping create robust and self-sufficient agricultural regions by providing good seed stock. The idea was to encourage seed saving in each area of the country with farmers growing crops that worked for them.

This activity was viewed as fundamental to the health and security of the country. It cut across all boundaries—political, religious, economic, and social—as an activity for all citizens to engage in. This is still true today, of course; seed saving is something that can be done by anyone!

In the third section of this guide ("Corporate Consolidation of Seeds"), we will look at the changing stance of the U.S. government on seed saving and ownership. We will also revisit how, over time, our right to save our own seed has been co-opted and seed has become a commodity that companies can own and patent. Until recently, this was an issue mostly with industrial crops. Not anymore.

Let's get back to the magic and power of seed saving. Imagine that each seed saved can literally produce hundreds, thousands, or even millions more seeds! There are eight crops that are especially easy to save seed from.[5] They are "self-pollinating" crops, which means you typically don't have to worry about things getting mixed up from cross-pollination with other varieties. We always emphasize that "never say never" is the rule when it comes to biology, but generally these seeds will produce plants like the ones you started with.

Q10: As it turns out, our favorite veggies are generally the "self-pollinators" that are easiest to save seed from. Can you guess what they are?

A10: Tomatoes, lettuce, peas, beans, peppers, oats, wheat, and barley.

Q11: If you are saving the seeds from these favorites, how do you know when they are ready to harvest?

A11: Peas and beans will be brown and the pods will be brittle. Leave them on the vine until this happens. Then simply take the round seeds out of the pods. Lettuce plants shoot out a stem with yellow flowers that will turn fuzzy like a dandelion (which is in the same family as lettuce). When the flowers become dry, pull the stems off and shake them in a bag to release the seed.

Tomatoes are slightly more work. Cut them along the equator and squish out the seed in a small, wide-mouth mason jar. Any flesh or other pieces that drop into the jar are fine. Mix this up with the juice of the tomato. Leave the jar in a dark place (maybe on your countertop) for a few days until a white mold forms. This is like an antibiotic and will kill any diseases that might be on the seeds.

At this stage, stir up the mixture again. The dead seeds will float to the top, and the good seeds will settle to the bottom. Pour off the liquid making sure you don't dump out your seeds. Use a sieve or household strainer for the final pour-through. Plop the seeds on a paper plate, newspaper sheet, or paper towel and be sure to label it. Leave it to dry for a few days and you will have a tomato seed "cookie." Break it up and you will find hundreds of seeds.

Children at Four Bridges Permaculture Institute in New Mexico beat on wheat stalks to separate the seeds.

Beating and *flailing* are words used to describe the process of releasing the seed from the plant when processing grains. Sometimes seed heads can be rubbed together making sure there is a container under your hands to catch the seeds. Be careful with certain varieties, as the seedheads can be sharp.

Seed saving offers some amazing perks. You can often save seeds and still eat the veggie—like with the tomatoes. Also, if you make a "mistake"—if for example, you aren't sure if a crop you are saving seed from was cross-pollinated with something else—you can eat these, too! In fact, unintended "mistakes" in gardens and small farms are how many of our most beloved varieties came to be, including modern sweet corn, butternut squash, and pumpzinni.

Once you start saving seeds successfully, the biggest problems you are likely to have are good ones. You will have more seeds than you know what to do with and you'll need to store them and share them with others!

Q12: We saw examples of seed banks in the film, including Svalbard in Norway, Tesuque Pueblo Seed Bank in New Mexico, and Native Seeds/SEARCH in Arizona. What are the benefits and pitfalls of storing seeds in a seed bank?

A12: Seed banks were built to be safe havens for seeds. Larger regional and international banks take on the responsibility to care for the seeds. Eventually this means growing them out to keep them alive. Svalbard on the other hand, was built to be a safety backup for the world's seed banks, a safety deposit box if you will. Countries or conservation organizations that "bank" their seeds in Svalbard, retain all the rights to their own seeds. No one else has access unless give permission by the original depositor.

Diane Ott Whealy, founder of Seed Savers Exchange, searches for seeds stored in the Seed Savers Vault.

Storing seed properly is crucial when attempting to keep them fresh and viable. The mantra we use is, "Keep your seeds cool, dark and dry." According to Dr. Bruce Bugbee of Utah State University, seeds start dying off more quickly when they are exposed to temperatures above 80°F.

Q13: What are some ways we can share and spread seed diversity? Go for the obvious here!

A13: You can always give them away to anyone who wants them. Seed exchanges or swaps are a great way to share seed diversity in a community. Some examples of local and regional seed sharing models are the Santa Barbara Community Seed Swap, Southern Exposure Seed Exchange, and Seed Savers Exchange. You can host events where people come together to swap seeds and stories, such as Seedy Saturdays[8] in Canada.

Another popular way to share seeds is by setting up a seed library. Seed libraries work like book libraries. The idea here is that a person "borrows" seed (for free!), plants it in their garden, and saves some seed from the resulting crop to return to the library. This creates local adaptations in the seeds over time, making the library a unique repository of heirlooms from the community!

Community members swap seed at the Heirloom Expo conference.

SEED BANKS—FOOLPROOF OR FALSE SECURITY?

In the film, we learned of the Svalbard Global Seed Vault in Norway, an impressive structure encased in arctic ice where copies of much of the world's seed diversity are stored. This facility is meant to preserve our seeds in case of planetary disaster. But as Rocky Mountain Seed Alliance Director Bill McDorman cautions in the film, the problem with Svalbard is that it "gives us a false sense of security."[6]

He may be right about this. In May of 2017, news headlines announced that the Svalbard seed bank had been flooded by water from melting permafrost as a result of climate change.[7] Ironically, the most evident global catastrophe we know of has already compromised this "Noah's Ark of seeds." Can we truly depend on seed banks to keep our seed diversity safe from disaster?

The answer is that seed banks play an important role as a line of defense for crop diversity—but we shouldn't put all our seeds "in one basket." In addition to seed banks, we should be actively growing, saving, and sharing seeds in our communities. In this way, seed diversity is being preserved "in place" in our fields and gardens. Local and regional seed banks are another great idea. Storing backup copies of our seed resources in many places ensures that a disaster in one area doesn't wipe out a variety entirely.

In other words, to preserve our seed diversity, we should *diversify* our approaches to keeping it safe!

SEED LIBRARIES

Seed libraries are an innovative way to preserve and expand regional seed diversity. By growing, saving, and sharing seeds in our communities, we are creating local reserves of seeds that are adapted to where we live. This way we are creating our own heirlooms and building up resiliency in our local food and seed systems.

Currently, there are over 400 seed libraries in the United States alone. Many of these were launched using the resources at SeedLibraries.net to get started. Richmond Grows Seed Lending Library in Richmond, California is considered the grandmother of the seed library movement and provides step-by-step instructions for setting one up.

Another great resource for starting your own seed library (along with lots of historical info and tips for success) is the book *Seed Libraries: And Other Means of Keeping Seeds in the Hands of the People* by Cindy Conner. For a detailed history of the seed library movement, check out the article "Sowing Revolution" from the January 2012 issue of Acres magazine.[9]

For those who really want to dive into seeds, you can start a regional seed company. Like any business, it takes a lot of planning, commitment, and knowledge of the field to be successful. One important thing to realize about seed companies is many don't grow all of the seeds they sell. Even though they may want to, this is often challenging. Seed grower co-operatives, where many growers collaborate under the banner of a single company or organization, is a smart solution to this problem.[10, 11, 12]

Farmworkers harvesting grain in India.

Conclusion

Seed saving is an ancient practice stretching back over 12,000 years. By learning these traditional methods and saving your own seeds—even from one plant—you are taking part in one of humanity's oldest experiences. You are rejoining a ritual that makes us who we are. And in doing so, you are helping to create a more sustainable, beautiful, and abundant world for present and future generations.

TAKE ACTION

Feeling inspired? Here are some things you can do today to get started.

- Host a seed swap or exchange in your community. Make it a potluck!
- Start a seed library
- Grow something (anything!) and save the seeds, even if it's just a lettuce plant in a pot
- Join the Rocky Mountain Seed Alliance and the Million Seed Saver Campaign (rockymountainseeds.org)
- Join Seed Savers Exchange (seedsavers.org)
- Spread the word and let others know about *SEED: The Untold Story*

Seed Saving Resources

For more in-depth seed saving resources, check out the following books: *Seed to Seed*: *Seed Saving and Growing Techniques for Vegetable Gardeners* by Suzanne Ashworth; *Basic Seed Saving* by Bill McDorman; and *Breed Your Own Vegetable Varieties* by Carol Deppe.

Also, look into these seed saving courses:

- Seed School *(Rocky Mountain Seed Alliance)*
- Seed School Online *(Rocky Mountain Seed Alliance)*
- Seed Academy *(Seven Seeds Farm)*
- Seed Seva *(Sierra Seeds)*

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Colorful tomatoes: By Dwight Sipler from Stow, MA, USA (Cherry Tomato Mix Uploaded by Jacopo Werther) [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons

*Visit **SEEDTHEMOVIE.COM/GUIDE** for useful online resources and links that appear in this guide.*

Answer Key for Vavilov's Center of Origin Group Activity (pg. 4):

- Potato - 8
- Corn- 7
- Orange - 1
- Garlic - 3
- Strawberry - 8a
- Mustard Seed - 5
- Rye - 4
- Pineapple - 8b
- Coffee - 6
- Coconut - 2

SEED: THE UNTOLD STORY DISCUSSION GUIDE

Is Bigger Always Better?

Section 3: Corporate Consolidation of Seeds

Background for Facilitators:

Seed saving was once a foundational part of life in the United States and Europe, as it still is in indigenous communities around the world. But over the last century, traditional seed saving practices gave way to corporate control over seed production. Rapid consolidation facilitated by a capitalist economic system was the centerpiece for this change. Our intimate and fundamental relationship to the seeds that sustain us was radically altered.

Many cultural, political, and legislative factors came into play during the period that led to the corporatization of our seed supplies. Understanding this history is critical to effectively address the challenges we face in the seed and food movements today. This discussion guide section will ask important questions about the ethics, economics, and cultural implications behind the corporate consolidation of our seeds. We will explore the dynamics of the modern seed industry and pose thought-provoking questions that should create lively discussions and may help frame your community's efforts toward increased awareness and seed stewardship.

Here are some premises to help set the tone for this section:

Suman Khulko saves seeds in India.

Seeds have become corporatized.

For thousands of years, seeds were grown, saved, and shared by local farmers and gardeners within a bioregion. In contrast, today a majority of the world's seeds are produced by a small number of corporations that increasingly own and control seeds through patents. This consolidation has accelerated rapidly over the past 20 years, altering the profound and intimate relationship humanity has had with seeds for millennia.[1]

Animation from SEED: The Untold Story

Capitalism transformed seeds from the "commons" to commodities.

With the rise of market capitalism, a dramatic change took place in how we view seeds. Suddenly these precious gifts of nature that had always been considered part of the public trust in the United States were now objects for businesses to profit from. They were taken from the commons to become incredibly valuable commodities within our food system, controlled by multinational corporations backed up by government agencies.[2]

Plant patenting and genetic engineering increased corporate consolidation of seeds.

Advances in crop breeding technology and legislative decisions on plant patenting that favored corporate interests further ramped up control of our seed supplies. With the advent of genetic engineering, corporations began to claim legal ownership over seeds, prohibiting farmers from practicing seed saving. This represents a monumental shift in our story of seeds and our relationship to the natural world.

Today, seed knowledge is largely regarded as the purview of scientists in lab coats, disconnecting seeds from their indigenous roots and the lives of everyday people, farmers, and gardeners.

This couldn't be further from the way humans and indigenous communities have related to seeds throughout most of human history. Seeds are sacred in many indigenous communities and have been bred by farmers and gardeners for thousands of years. Yet along with the corporate consolidation push, traditions and the spiritual aspects surrounding seeds have largely been discarded by the modern seed industry.

In this segment, we'll talk about how the seed paradigm in the early days of American history, a system that the Founding Fathers upheld for the United States' health and safety, has dramatically shifted. We will focus on the seed industry's developments in the United States, which have since spread out through globalization to impact and influence the rest of the world.

We will mainly be discussing the events and milestones of the emerging seed industry as they pertain to non-Native communities. Because of their rich heritage and traditions linked to seeds, indigenous peoples have a unique and crucial perspective on these issues. As the seed movement evolves, the role of Native Americans and indigenous communities around the world will be a vital force in shaping its future. Their involvement will be especially important if large companies continue their attempts to patent or genetically modify seeds that were originally developed by indigenous peoples. In the film, we were introduced to Winona LaDuke, a seed activist from the Ojibwe White Earth Reservation in Minnesota.[3] She offers a strong example Native communities protecting their heritage seeds with the

SEED STEWARDSHIP IN INDIGENOUS COMMUNITIES—PAST AND PRESENT

Indigenous communities are the original stewards of the lands of North America, long before Europeans arrived. Generally, these First Nations peoples sustained themselves by hunting, gathering, and growing crops. Corn, also known as maize, spread from Mexico across North and South America around 9,000 years ago to become a staple food for many indigenous tribes. In addition to cultivated crops like corn, beans, and squash, Native peoples were adept at supplementing their diet with a wide variety of foods such as nuts, berries, fruits, and wild plants. This nutritional diversity kept their communities healthy and thriving.

protracted (and successful!) battle her people fought against patenting of their wild rice. [4, 18]

[Text in brackets are notes for the facilitator.]

Seed Distribution and Crop Breeding History

As we learned in the film, free seed distribution was once a foundational part of agricultural life in the United States.

Q3: Were you surprised to learn that the U.S. Patent and Trade Office gave away more than a billion packets of seed by the turn of the last century?

A3: Prior to corporate consolidation, seeds were viewed as part of the "commons." No one could own them, and they contributed to the strength and resilience of our communities.

Q4: Around this same period in the nineteenth century, land-grant universities began to emerge in the United States. (The Morrill Act, signed by Lincoln, began the land-grant colleges in 1862.) The purpose of these publicly funded institutions was to support specific regions with technical and agricultural assistance. Because each area had its own unique environmental challenges for farming, *extension agents* were sent out from the land-grant universities to help communities navigate climatic, soil, and crop disease issues. (The cooperative extension system was authorized by the Smith-Lever Act in 1914.)[11]

Today, the picture has changed. Most land-grant universities are now in partnership with large agribusinesses to help fund their research and plant breeding programs for industrial agriculture. Patenting new varieties before being released to the public is often required now by universities. This is a sharp break from the founding principles of bioregionalism and community-focused initiatives originally used to define the land-grant system. How do you feel about this change?

Hybrid Seeds and the Green Revolution–1930s-1980s

Before the 1930s the USDA gave away seeds for free to farmers.

Q5: Let's go a bit deeper into the history of what happened with our seeds and where we are today. By the early 1880s, a new business group was formed—the American Seed Trade Association, or ASTA. These eager businessmen were convinced of the idea that seeds should not be given away freely. They saw a huge new market in selling seeds. After intense lobbying for 40 years, in 1924 their efforts paid off and Congress eliminated the free government seed distribution programs.

Take a moment to consider this event and how it transformed the economy, culture, and communities of the U.S. With the commodification of seeds, a veritable gold rush began—only the "gold" this time wasn't a precious metal but the seeds of our common heritage.

At the same time as the seed market is born, another dramatic development in the seed story takes place: hybrid seeds. Does anyone know what exactly a hybrid seed is?

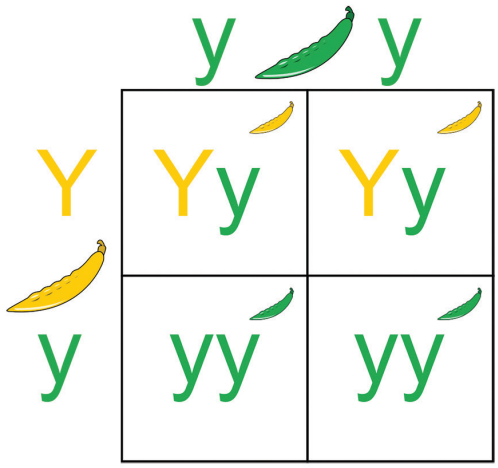
A5: Simply put, a hybrid seed is the combination of two parent plants from the same species that have been uniformly bred to produce a superior and predictable offspring.[5] (See section 2 of this guide, "Seed Saving, Sharing, and Growing," for more explanation.) Hybrid seeds are developed using traditional breeding methods—so they are different from genetically modified organisms. Examples of common hybrid crops are Better Boy and Early Girl tomatoes. **An important thing to note about hybrid seeds is that *only the first generation offspring* is superior and predictable. Attempting to save seed from a hybrid to replant can result in undesirable and unexpected characteristics.**

Saving seed from hybrids results in offspring that don't grow "true" to the parent variety.

In the film, Bill McDorman, Executive Director of the Rocky Mountain Seed Alliance, discussed the unpredictability of replanting saved seeds from hybrid crops. He compared this to "Mr. Toad's wild ride." However, it's important to note that saving the seeds of hybrids is not impossible. It simply takes a bit of finesse and persistence. Diligent farmers and gardeners can coax a workable offspring out of a hybrid by saving seeds for three or four generations. The uniformity necessary for industrial farms would take longer, maybe seven or eight generations. This represents a great opportunity to capture the traits that make hybrids desirable in new, open-pollinated crops!

Q6: What kinds of characteristics would we want to select for and improve in hybrid crops?

A6: Hybrids are developed to improve things like yield, uniformity, flavor, color, and most often, disease resistance. This is accomplished using techniques that some of us may be familiar with from biology class. For example, using the Punnett square system we can actually begin to predict the outcomes of genetic inheritance and create hybrid seeds with certain desirable characteristics.[3]



A Punnett Square is a diagram used to predict an outcome of a breeding experiment.

"Hybrid vigor," is a phrase often used to promote hybrid seeds. Hybrid seeds result in bigger, faster-growing, and stronger crops than either of the original parents. By the 1930s, the hybrid seed revolution was sweeping across the United States in the form of hybrid corn, the crop that shows the greatest improvements due to hybrid vigor. Farmers began to plant hybrids eagerly. Hybrid vigor was too enticing to pass up.

Q7: While there is nothing inherently harmful about hybrid seeds, they radically changed farmers' relationship to their seeds. Can anyone guess how?

A7: **As we just learned, because hybrid seeds can't be easily saved and replanted to produce quality crops, companies could now control the seed marketplace.** If farmers want hybrid vigor, they have to re-purchase new seed every season, adding additional cost to their operations. In the film, the author Claire Hope Cummings calls hybrid corn "the atomic bomb of agriculture."[6] She is referring to the revolutionary and destabilizing impact that hybridization had on the lives of farmers and the practice of seed saving. This changed everything. Even though other crops do not show the same level of hybrid vigor as corn, farmers were eager to purchase hybrid versions of all their crops because of the success they saw in corn. The word hybrid became synonymous with vigor.

A homogenous moncoluture of hybrid corn.

The next milestone in the seed industry came with patenting laws. After decades of lobbying by ASTA, The Plant Patent Law was established in 1930 as the first such legislation applying to plant material. This law allowed for protection (ownership) of new *plant varieties* propagated vegetatively (i.e., clones taken from cuttings or tissue culture). Seed-producing plants were specifically excluded.

By this point, the seed marketplace was really heating up. However, it wasn't until the 1950s, after World War II, that the biggest transformation of the seed and food system took place with something called the "Green Revolution." You may remember Raj Patel, the economist and environmental activist, speaking about this in the film.

The Weapon Arsenal, by Diego Rivera 1928.

Q8: **What is the Green Revolution?**

A8: As Raj Patel puts it, the "Green Revolution is not about 'tofu-powered sandals'" but a reaction in the United States to the "Red Revolution" of communism.[7] America sought to race ahead of other industrial nations in food production to ensure that capitalism—and not communism—would dominate the world stage. The idea was to create food as cheaply and abundantly as possible.

This meant larger and larger farms, which relied on the uniformity of hybrid crops to scale up. Chemicals left over from the war were repurposed as fertilizers and pesticides. For instance, nitrate ammunition production lines were converted to fertilizer factories.[11]

Industrial "monocropping" agriculture was born. From the seed perspective, this also meant farmers were now using far fewer seed varieties. A trend began for "one-size-fits-all" seeds that could do well in many regions. This is the force that begins to eat away at our seed diversity.

Let's consider other ways that the Green Revolution changed our relationship with seeds. In order to expand into bigger farming operations, we needed larger seed distributors. Smaller seed companies were less competitive and disappeared or were swallowed up by large corporations.

To protect their investments, these large agrochemical corporations continued to innovate ways to consolidate market share of the seed industry. They began developing new chemical fertilizers and pesticides that worked well with the hybrid seeds they now owned. Farmers already hooked on hybrids could now control pest and fertilization conditions with chemicals from the big companies. Hybrid seed was the poster child of the Green Revolution, and with the increased yields and specialized chemicals came big profits for the seed corporations.

Aerial crop duster spraying fields.

Q9: Raj Patel also mentioned an important crossroads regarding our seed traditions as we moved into more chemical and hybrid agriculture. Do you remember what this was about? *[Hint: It has to do with tossing these traditions "into the dustbin of history."]*

A9: Raj Patel said, "The Green Revolution was taking this rich knowledge from peasant farmers that evolved over millennia and replacing it with modern agriculture. All of a sudden, men in white coats become the champions and sole arbiters of knowledge about seeds."[8]

GROUP ACTIVITY:

REFLECTING ON SCIENTIFIC AGRICULTURAL STUDY AND INDIGENOUS KNOWLEDGE

[Have participants break into groups of 2-4 people. Ask participants the question below and have them discuss their responses with their group for about 10 minutes, writing their responses if helpful. After 10 minutes, bring everyone back together, and ask for volunteers to share what they discussed with the room.]

Question: Some people would argue that it's more advantageous for seeds to be in the hands of scientists than in the hands of indigenous people and farmers. As we relegate power and control of seeds more and more to the institutional community, what potential problems arise? How should scientists interact with seeds, indigenous farmers and seed heritage in a responsible way? What loss could happen as indigenous people lose more farmers and elders pass away?

Seed Patents - 1970s-1980s

The next major milestone for the burgeoning seed industry came in 1970 with the implementation of the Plant Variety Protection Act (PVP). With this legislation, companies could now "own" seed-producing plant varieties they had developed through traditional crop breeding. Companies could claim new and distinct plant varieties as their own intellectual property. The actual genetics of the plant, however, still couldn't be owned.[9]

But the shift to patenting life itself was just around the corner. In the early 1970s, a scientist named Ananda Chakrabarty developed a genetically modified bacterium that could break down crude oil. He attempted to patent his creation but was turned down due to laws preventing living things from being patented and "owned."[9]

In 1980, the Supreme Court heard his case, which is known as Diamond vs. Chakrabarty. The landmark 5-4 decision ruled that living organisms, when modified or "improved on" by humans, were legally patentable subject matter. Chief Justice Warren E. Burger wrote the decision, stating that patents could extend to "anything under the sun made by man."[10]

This decision opened the floodgates for corporate consolidation. Chemical companies like DuPont, Dow, Monsanto, and others seized on the opportunity to buy up hundreds of small seed companies to get access to new plant genetic material they could now patent. The newly unfolding science of genetic engineering added to the possibilities and ushered in the era of extreme corporate consolidation we witness today.

Gene guns shoot genes within heavy metal particles into a plant.

GROUP ACTIVITY: PATENTS

[Have participants break into groups of 2-4 people. Ask participants the questions below and have them discuss their responses with their group for about 10 minutes, writing their responses if helpful. After 10 minutes, bring everyone back together, and ask for volunteers to share what they discussed with the room.]

How do you feel about patenting in general? Do you feel the same way about patenting living organisms? Why or why not?

You may have noticed seed companies that promote mostly organic and open-pollinated seeds have also begun patenting their varieties to protect them as intellectual property. How do you feel about this? What would you say if you found out your favorite organic seed company was selling patented seeds?

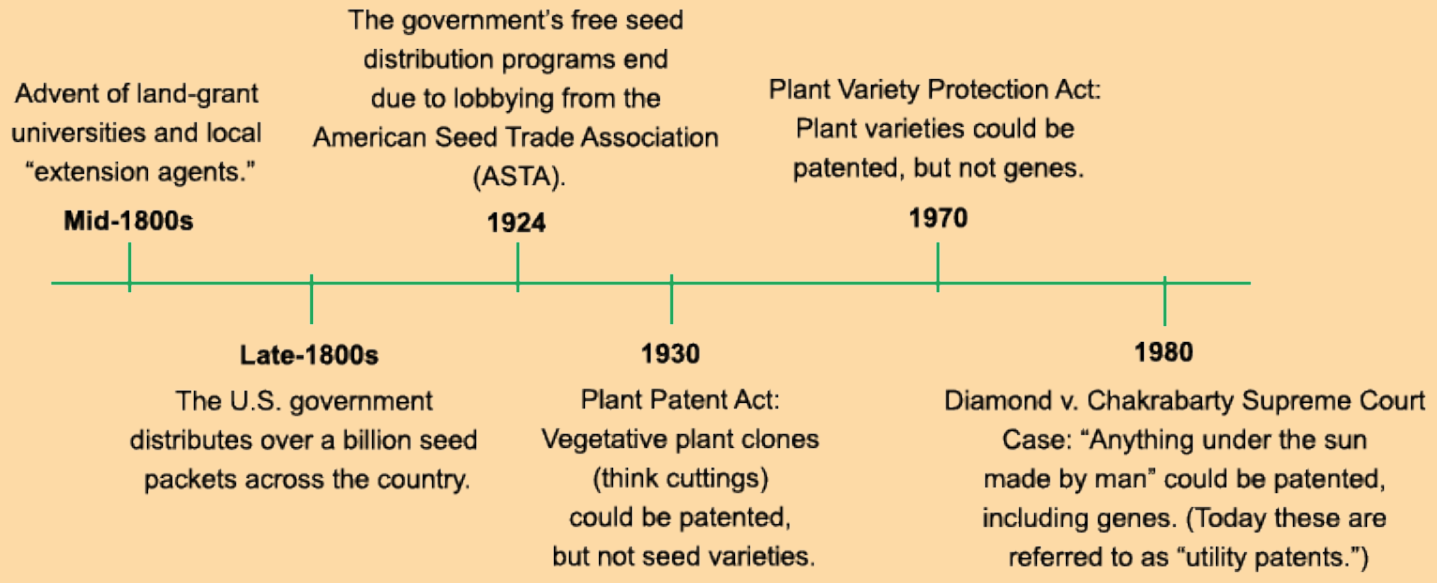
Genetic Engineering and Corporate Consolidation–1980s to Present

By the mid-1980s, the genetic engineering genie was out of the bottle and agrochemical companies were eager to take advantage of the new marketplace. Biotechnology lobbyists set to work on government agencies and politicians to ensure their work would not be impeded by legislation. This culminated in a 1986 policy laid out by President George H. W. Bush called the Coordinated Framework for Regulation of Biotechnology.

Under this policy, no new laws could be created to regulate biotechnology products (GMOs). GMOs would be assessed only by applying existing federal statutes for distribution, commerce, and safety. This ensured that any novel concerns surrounding biotech processes would not be able to be addressed by new legislation. **To this day, no new laws have been passed to monitor or test genetically modified crops and seeds.**[13]

In the meantime, the large agrochemical businesses started buying up smaller seed companies and consolidating their product lines. Their goal was to streamline the seed industry so that the varieties they sold worked in broad regional environments and relied upon their trademarked chemical fertilizers and pesticides. **This created a monopolistic arrangement with farmers purchasing seeds and the complementary chemical**

LETS REVIEW THE MAJOR EVENTS THAT GOT US HERE:



QUICK REVIEW OF THE IMPACTS OF PATENTING SEEDS:

How does plant and seed patenting affect biodiversity?

Patenting of plant material prohibits seed saving, which prevents farmers from creating their own locally adapted varieties. This limits the expansion of biodiversity in our food crops. Also, the corporate consolidation of seed supplies into the hands of large businesses has greatly reduced seed diversity, as these companies focus their distribution on a smaller number of "one-size-fits-all" varieties that they own and control, and are targeted to larger markets.

How does plant and seed patenting affect our land-grant universities?

Land-grant universities involved in crop breeding and research are now often affiliated with large agribusinesses. Most universities now require some form of intellectual property protection before new varieties can be released.[12] Companies are typically engaged in creating patentable crops that they can profit from. This has shifted the purpose of the land-grant institutions away from supporting community initiatives and toward the interests of industrial agriculture.

How does plant and seed patenting affect our right to save seeds?

Patenting of plant material often makes it illegal to save seeds. This is true not just of genetically modified seeds, but also of varieties that have been bred using traditional methods and reserved under a utility patent. As the seed industry shifts more and more to patenting the varieties available for sale, seed saving rights are diminished.

inputs from the same companies. Just as with the hybrid revolution, corn became the flagship crop for this new era of genetic engineering.

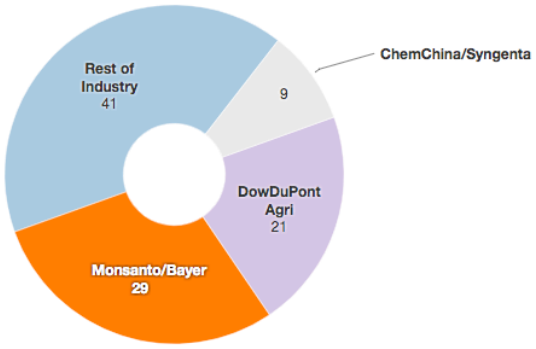
The gobbling up of small seed companies has been a dramatic trend in the corporatization of global seed supplies. Take a look at the Seed Industry Structure chart below to get a sense of this consolidation trend.[14]

After buying up many of the small seed companies in the global market, these giant corporations have begun the next stage of consolidation—by merging with each other. In 2015, we saw Dow and DuPont—two massive agribusinesses in the U.S.—successfully merge their operations. Later that same year, the Swiss agrochemical giant Syngenta joined with its former competitor ChemChina in another huge merger.

The most recent announcement is shocking: Monsanto and the German corporation Bayer, two titans of the agrochemical industry, are set to merge in 2018. If the deal is approved by the Federal Trade Commission and the Justice Department's antitrust division (which many insiders expect to happen), the impact on corporate consolidation will be massive: **Three chemical companies (Monsanto/Bayer, Dow/DuPont, and Syngenta/ChemChina) would be in control of 59% of the world's seeds and production of 64% of the world's pesticides.**[15]

Three Companies Would Sell 59% of the Globe's Seeds ...

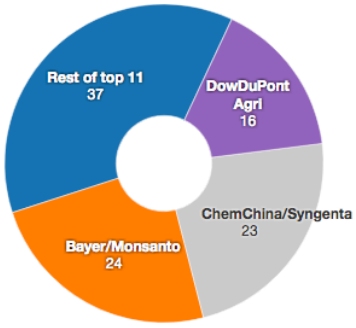
Percentage share in the global seed market if the Bayer-Monsanto and Dow-DuPont deals consummate.



Source: ETC Group Get the data

..And 64% of Pesticides

Percentage share in the global pesticide market if the Bayer-Monsanto and Dow-DuPont deals consummate.



(15) Philpott, T. (2016, September 13). Monsanto Now Belongs to Bayer. Mother Jones. Retrieved from http://www.motherjones.com/environ-ment/2016/09/whoa-monsanto-about-get-swallowed-german-giant-bayer/

WHAT IS GENETIC ENGINEERING?

Let's unpack the concept of genetic engineering. How does it differ from hybridization or traditional crop breeding? While all of these processes can take place in laboratories, genetic engineering is distinctly different. It involves taking genes from other species (such as animals or viruses) and inserting them into the DNA of a different species (such as a tomato or corn plant), which transfers certain characteristics or traits to the recipient crop.

Although we often hear that "humans have been genetically modifying plants for millennia," this is a somewhat misleading statement. Modifying plants through traditional crop breeding is not the same as the highly technical process of genetic engineering, which can combine genes from different species. This technology is still in its infancy compared with traditional cro breeding. [16]

Genetically engineered crops are commonly referred to as "genetically modified organisms," or GMOs. Some GMOs, such as Hawaiian "Rainbow" papaya, contain a specific trait to resist a pest or disease. Others, like the recently released non-browning Arctic Apple, are modified to provide a novel consumer convenience.

However, the majority of GMO crops are engineered to either produce their own pesticides internally, like Monsanto's Bt cotton, or withstand applications of chemical pesticides. Well-known examples are Monsanto's "RoundUp Ready" brand of crops (e.g., corn, cotton, and soy), which can survive being sprayed with RoundUp herbicide. These seeds are protected by genetic patents and cannot be saved by farmers.

Conclusion

Corporate consolidation of our seed supplies represents a monumental shift in humanity's timeless relationship with seeds.

Legal and technological developments have also played a significant role in this process, which is continuing to evolve today.

With the control of our seed supplies in the hands of an increasingly tiny number of multinational corporations, we are losing many vital things that defined our lives for millennia. **Seed diversity, indigenous wisdom, and the public commons of seed stewardship are all at risk in this new paradigm.**

Understanding these historical, legal, and cultural issues is essential to protecting our seed sovereignty from further loss.

TAKE ACTION

Feeling inspired? Here are some things you can do today to get started.

- Deepen your knowledge about seed consolidation issues. Share this information with your community, friends, and family. Host a screening of *SEED: The Untold Story* and lead a group discussion.
- Support seed conservation organizations in your region.
- Source seeds from small bioregional seed companies that are not affiliated with major seed corporations. Avoid purchasing hybridized or patented seeds, so you can save and share your seed harvests.
- Utilize your local seed library to access and expand regional seed diversity. If there is no seed library

KNOW YOUR GMOS

Nearly 80% of processed foods in US supermarkets contain GMOs. Though these genetically engineered crops are widespread in the American food system, there are not yet that many GMOs on the market. **The most common GMOs currently being grown include corn, soybeans, cotton, canola, yellow squash, Hawaiian papaya, White Russet potatoes, Arctic Apples, and alfalfa (for animal feed).** This list changes occasionally as new GMO crops are approved and enter the food system. [17]

Many gardeners wonder if they are accidentally growing GMO seeds. At this point, the only way to purchase GMO seeds is by signing a legal contract with the seed producer. Since these seeds contain a proprietary technology, their use is carefully tracked by the seed manufacturers. These seeds are also considerably more expensive than non-GMO seeds of similar varieties. Only large farms are typically buying and planting genetically engineered seeds, as they are better able to make this profitable due to their scale. **In other words, if you are a gardener, you don't need to worry about accidentally purchasing GMO seeds at the nursery or from a seed company!**

near you, start one! Visit www.seedlibraries.net for resources and refer to Section 2 of this guide ("Seed Saving") for more information.

- Learn seed traditions from indigenous communities where you live. Become an ally for indigenous seed rights by supporting their initiatives and buying Native products.

Corporate Consolidation of Seeds – Resource List:

- For more information on the corporate consolidation of our seed supplies, check out the following books and resources:
  - "Seeds of Sustainability" by Bill McDorman and Stephen Thomas in ACRES: USA, January 2011.
  - Uncertain Peril: Genetic Engineering and the Future of Seeds by Claire Hope Cummings
  - Center for Food Safety (*www.centerforfoodsafety.org*)
  - Open Source Seed Initiative (*www.osseeds.org*)
  - Rocky Mountain Seed Alliance (*www.rockymountainseeds.org*)
  - Seedsave.org
  - Native Seeds/SEARCH (*www.nativeseeds.org*)
  - Saving Our Seeds (*www.savingourseeds.org*)
  - Southern Exposure Seed Exchange (*www.southernexposure.com*)
  - Seed Savers Exchange (*www.seedsavers.org*)

- Seed library resources (*www.seedlibraries.net*)
- Nature Institute - Unintended Effects of Genetic Manipulation (*http://natureinstitute.org/nontarget/report_class.htm*)

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Grocery aisle: By Retail. Sheetz interior. PA. January 2014.

*Visit **SEEDTHEMOVIE.COM/GUIDE** for useful online resources and links that appear in this guide.*

SEED: THE UNTOLD STORY DISCUSSION GUIDE

The Chemical Conundrum

Section 4: Pesticide Issues & Impacts

Background for Facilitators:

Chemical pesticides, like many modern technologies, have their benefits and drawbacks. For industrial-scale farmers, they are usually seen as indispensable to produce a viable crop. Smaller farmers and gardeners may view them as a necessary evil or useful tools when faced with a sudden infestation. And of course, others choose to avoid chemicals altogether, following organic practices that mirror the way our ancestors grew food for millennia.

The combination of genetically engineered seeds (GMOs) and pesticides is the standard practice for industrial agricultural production. However, as we will see, this is a short-term solution with many negative impacts to our environment and communities. In the market-driven capitalist system currently in place in the U.S. and elsewhere, markets are often not required to account for many costly impacts on the environment and human health. Massive monoculture farms reliant on GMO crops and pesticides might make sense (and reap huge profits) under these conditions for a while. But over time, this strategy has pitfalls and dangers. **What are the real problems with the pesticides used on our seeds? And where is the oversight to keep our food system secure and our communities safe?**

This section will address these questions and discuss the most commonly used pesticides and their applications, side effects, and impacts on humans and the environment. As this material can be dense and complex at times, make sure to gauge your audience's attention.

Here are some key concepts to guide your exploration of this theme:

What is a pesticide?

The term "pesticide" refers to a chemical preparation or substance used for destroying insects, weeds, or other organisms harmful to cultivated plants or to animals. Pesticides include herbicides, fungicides, germicides, or biocides of any kind. Not surprisingly, the suffix *-cide* means "to kill."

History of Pesticides:

Various types of naturally occurring pesticides (e.g., sulfur, arsenic, and mercury) have been used for thousands of years.[1] The advent of chemical pesticide applications began as early as the 1930s with DDT to control malaria and typhus. Following World War II, it was discovered that nerve gas and other military chemicals could be repurposed as agricultural fertilizers and pest-killers. This chemical-based approach to agriculture began with the Green Revolution in the 1940s and '50s, heralding a dramatic shift toward industrial methods of farming.

Sparking New Solutions:

At the end of this section, you'll find many references and sources on the topic of pesticides and their potential dangers. Our focus is to stimulate conversations around this contentious issue that may generate new, innovative thinking and solutions to the problems we face, as presented in *SEED: The Untold Story.*

[Text in brackets are notes for the facilitator]

Q1: Why did people start using pesticides in the first place?

A1: Simply put, farmers and gardeners use pesticides because they work—at least, for a while. Pesticides are particularly effective in industrial agricultural systems. However, there are many side effects and diminishing returns linked to pesticide use over time, as we will see later in this discussion.

Chemical pesticides began to be used heavily following the Second World War. A host of new chemicals had been developed to use in warfare, and companies soon discovered that they could be equally effective weapons against the enemies of agriculture—namely, insects and weeds. The boom of industrial farming known as the Green Revolution was fueled by these leftover wartime chemicals, repurposed and now turned toward our food supply (see Section 3 of this guide, *Corporate Consolidation,* for more on this topic).[2]

PESTICIDE IMPACTS ON COMMUNITIES—SCENES FROM *SEED*

In *SEED: The Untold Story*, the children in the Hawaiian town of Waimea suffered severe allergic reactions when crops were sprayed with pesticides in the fields next to their school. You may remember the emotional scene where residents described respiratory issues and serious health problems, which they believed were caused by the pesticide spraying in town.[3] Rare birth defects are also rising sharply in the communities in and around Waimea, which have particularly high Native Hawaiian populations. A people's movement to ban GMO farming and curb pesticide use is taking the fight to the courts and the streets.[4]

During the segment of the film on India, we heard tragic stories of peasant farmers committing suicide by drinking pesticides after "buying in" to the promises of Monsanto and chemical-based farming. When these promises fall apart and their crops fail, the farmers face crippling debt and personal shame. As the Indian seed activist Dr. Vandana Shiva relates in *SEED*, around 300,000 Indian farmers have taken their lives since the mid-1990s[5]—a trend which can, in part, be attributed to this woeful predicament.[6]

These examples reflect concerns and experiences of the people of Hawaii and India. Later in this section, we will present research outlining the documented dangers of pesticides.

Communities protest pesticide spraying next to schools in Hawaii.

Over 300,000 farmers have committed suicide in India.

Over the years since the Green Revolution, the use of chemicals in our food system has continued to expand along with the vast scale of industrial farming. Seeds have become the centerpiece of this booming industry.

In the film, Dr. Shiva states that modern seed varieties have been bred specifically to tolerate more chemical pesticides.[7] The same companies that make these agrochemicals also produce the seeds that are designed to work with their patented chemical pesticides.

Q2: Can you think of some examples of crops that are bred to withstand applications of a specific pesticide, and what that pesticide may be? *Hint: you might even use this product in your yard.*

A2: Many people have probably heard of Monsanto's Roundup pesticide. The Monsanto product line of Roundup Ready seeds includes corn, soy, cotton, canola, and alfalfa.

Roundup, which contains the herbicide *glyphosate*, is the most widely used chemical pesticide on the planet with more than 1.4 billion pounds sprayed every year.[8] In addition to consumer applications (typically around lawns and gardens), Roundup is used industrially in genetically engineered crops. When a field of Roundup Ready crops are sprayed with Roundup, the surrounding weeds will die while the crops (which have been engineered to tolerate glyphosate) will survive.

Agrochemical companies claim this technology lowers overall pesticide use. But this claim is being challenged by recent research. In 2016, a major study from Iowa State University scientists was published analyzing the pesticide use of 5,000 U.S. farmers who grow corn and soybeans. They found that while certain varieties of GMO crops bred to produce their own insecticides resulted in less pesticide use, others (specifically, glyphosate-tolerant corn) are getting sprayed with increasingly more pesticides compared with non-GMO crops.[9]

Q3: Why do you think farmers are spraying increasing amounts of pesticides on their GMO crops?

A3: A major reason for this increase of pesticide use is the rise of herbicide-resistant weeds, or "superweeds."[10] **Just as our seeds become better adapted over time through seed saving, the weeds in farmers' fields are developing adaptations to survive the pesticides that are sprayed.** These tenacious weeds are spreading rapidly across U.S. farmlands, spurring farmers to spray increasingly more pesticides on their fields.[11] This is a losing battle that will only lead to stronger weeds and heavier chemical use.

Agrochemical companies are doubling down on this failing strategy. Instead of changing course, they are introducing new, more toxic pesticides that the weeds and insects haven't yet developed a resistance to. You can see where this is going!

Q4: If Roundup is safe to use in our yards, then can we assume it is safe to use on crops?

A4: Maybe it isn't safe to use in our yards after all. Contrary to Monsanto's official claims, there is much ongoing debate and uncertainty about the health risks of Roundup. This issue is making regular headlines after several high-profile institutions have issued warnings that glyphosate may cause cancer. The World Health Organization's cancer agency published a report in 2015 labeling glyphosate as "a probable human carcinogen."[12] While the conclusions of this report have since been challenged[13], the truth about Roundup's safety remains murky and mired in controversy.

In June of 2017, California state health officials added glyphosate to their list of cancer-causing chemicals, prompting legal threats from Monsanto.[14] At the same time, a lawsuit against Monsanto is underway with more than 800 plaintiffs claiming that exposure to Roundup caused their cancer.[15] Adding to the controversy, internal Monsanto emails have emerged from the lawsuit demonstrating the company influenced journalists and researchers to sway their findings on Roundup's safety. The emails also reveal a heated debate between Monsanto's own scientists and executives about the human health risks of their most popular product.[16]

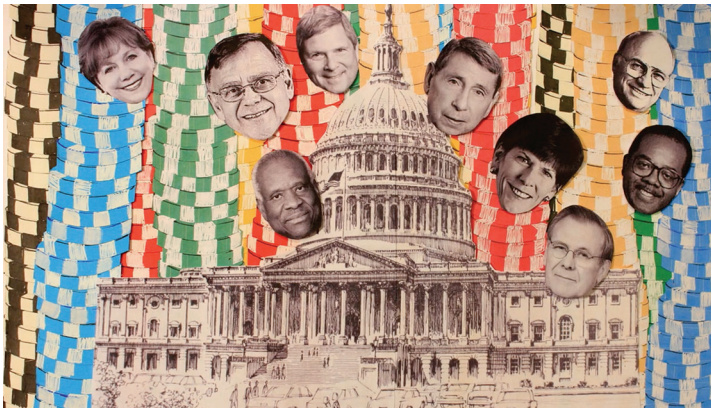
Government Regulation of Pesticides

Q5: At this point, you may be wondering who is watching out for the public interest. Any ideas?

A5: In the United States, the group tasked with regulating pesticides is the Environmental Protection Agency, or EPA for short. But the EPA is facing its own controversy for failing to properly monitor the safety of Roundup. Recently released internal documents from the agency show that officials lacked data on the full ingredient list in Roundup, possibly for decades. This is troubling as reports indicate the added chemicals (or "inert ingredients") in the Roundup formula can make glyphosate more toxic. Some of these ingredients can be cancer-causing on their own.[17]

U.S. government regulation of pesticides, or lack thereof, is further complicated by the "revolving door" that exists between agribusinesses and the agencies that oversee our agriculture system. This was pointed out in the film by Andrew Kimbrell, attorney and Executive Director of the Center for Food Safety.[18] There have been many cases of people holding top positions in the U.S. government with clear ties to big agribusinesses.[19]

A prominent example is Michael Taylor, who most recently served as "food czar" at the Food and Drug Administration under President Obama. Mr. Taylor was the chief lobbyist for Monsanto before taking his FDA position, and has moved back and forth between Monsanto affiliations and U.S. regulatory jobs several times in his career.[20] When the agencies meant to protect us from dangerous pesticides are staffed by *former employees of pesticide companies*, the question arises: Who is minding the store?



Animation segment from SEED: The Untold Story

Of course, you would expect there to be some research done by the manufacturers of these pesticides to test their safety. This does take place in the form of Material Safety Data Sheets (MSDS). But since this research comes from the people that make and sell the pesticides, the company-produced safety data must be viewed with some suspicion. It is possible to find MSDS documents from independent pesticide monitoring groups (such as the Northwest Center for Alternatives to Pesticides, or NCAP)[26] that provide additional information and shed light on potential health risks that the pesticide companies don't divulge.[27]

Common Pesticides

We've spent a lot of time discussing Roundup. Let's move on to some other commonly used pesticides.

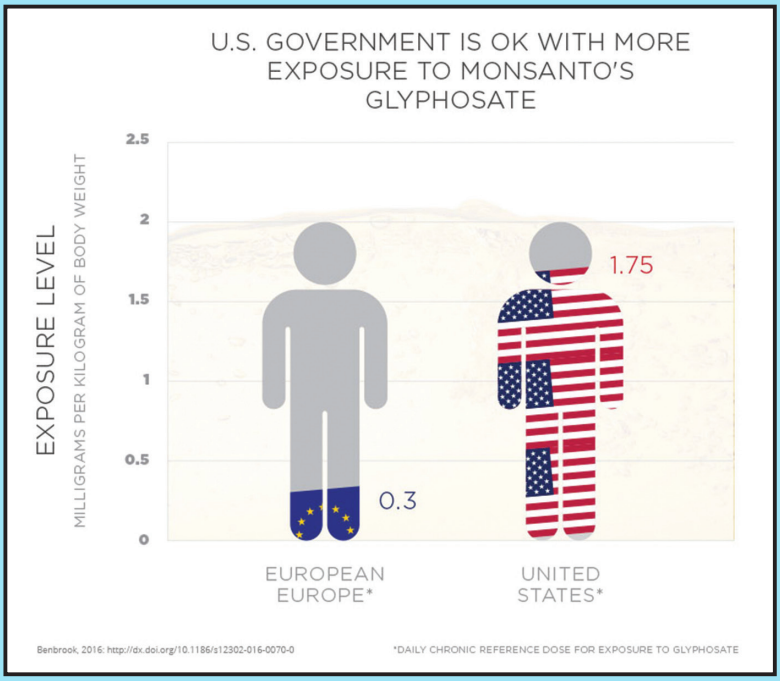
Q6: Besides Roundup/glyphosate, can you think of any other pesticides used by farmers?

A6: Here is a partial list of pesticides being used in the U.S. and around the world:

Atrazine: We learned of atrazine in *SEED: The Untold Story* from Dr. Tyrone Hayes, the Berkeley biologist whose controversial research found that

ROUNDUP EVERYWHERE—THE PERVASIVE PESTICIDE

Roundup's key ingredient, glyphosate, has earned the distinction (some would say dubiously) as the world's most heavily used pesticide—*of all time.* A jaw-dropping 9.4 million tons are estimated to have been sprayed worldwide since 1974.[21] With this much Roundup coating our food and soaking into the soil, it's not surprising that scientists are finding it in just about everything.



Here are some statistics on Roundup in our environment:

- The U.S. Geological Survey has identified glyphosate (or its degradation products) in 69% of Midwestern streams near farmland where Roundup is heavily used, and in lesser amounts in groundwater, rain, air, and soil samples. [22] [23]

- A study by the University of California, San Francisco found glyphosate in the urine of 93% of the 131 people tested. The levels of glyphosate in Americans were much higher than similar results from Europe, and children showed the highest levels of all.[24]

- Tests commissioned by public interest groups found glyphosate residues in a wide variety of processed foods including Cheerios, Oreo cookies, and Whole Foods 365 brand organic crackers.[25]

atrazine affects the endocrine and reproductive systems of frogs.[28]

Atrazine is the second most used pesticide on U.S. farms (mostly corn and sugarcane). An EPA report in 2016 found that atrazine seriously impacts the health of many animals and plants in the broader environment. It is found in high amounts in groundwater and surface water.[29]

2,4-D: The third most popular pesticide in the U.S., 2,4-D is considered more toxic than both glyphosate and dicamba.[30] It was an ingredient in Agent Orange, the notorious plant-killing chemical used during the Vietnam War. Dow AgroSciences has developed a pesticide called Enlist Duo, which combines 2,4-D with glyphosate, to be used on new genetically engineered corn and soy seeds. The EPA approved the pesticide and its use is expected to increase rapidly in the coming years. Human safety studies on 2,4-D present conflicting results, and many experts are concerned about potential health risks such as cancer.[31]

Dicamba: Though this herbicide has been around for decades, its use is rising as a response to glyphosate-resistant weeds. Dicamba selectively kills broad-leafed plants and is more toxic than Roundup. Monsanto has recently developed genetically engineered dicamba-tolerant soybeans and cotton. Controversy is already flaring around a new formulation of the dicamba pesticide after farmers began reporting contamination from "dicamba drift" floating into their fields and damaging crops. States have begun banning dicamba use in response to 1,400 complaints of dicamba drift since the start of 2017.[32] [33]

Neonicotinoids: Also called "neonics," this relatively new class of pesticides were developed in the

1980s and '90s by the companies Shell and Bayer. They are the world's most widely used insecticides (a subcategory of pesticides) and work by attacking the nervous system of insects, causing paralysis and death. Recent research published in *Nature* shows neonics can be toxic to bees and are linked to colony collapse.[34] The European Union has placed them under a partial moratorium, and the EPA is currently reassessing their safety.

Bees and other pollinators are collateral damage from pesticide use.

Pesticide Controversies and Critiques

Q7: Who remembers the 1962 book *Silent Spring* by Rachel Carson? How is this related to today's debate around pesticide use?

A7: Rachel Carson was an environmentalist and author who warned of the ecological dangers of wanton pesticide use, specifically from the chemical DDT. One of the earliest industrial pesticides, DDT was widely used around the world to kill crop pests and malaria-carrying mosquitoes. It was banned by the U.S. in 1972 (and globally in 2001) following public outcry and scientific concern sparked by Carson's book. Studies found that DDT harmed life throughout the ecosystem, especially impacting birds like bald eagles.[35]

Carson's campaign against pesticides also brought the first major controversy surrounding these chemicals. Pro-pesticide groups attacked her as an alarmist and blamed her for the future malaria deaths that would result from a DDT ban. The heated debate on DDT in the 1970s and 80's is being repeated today with glyphosate, atrazine, and other pesticides. Interestingly, Monsanto was one of the original manufacturers of DDT and has a long history at the center of these contentious disputes around pesticide safety.

GROUP ACTIVITY: PESTICIDES

[Have participants break into groups of 2-4 people. Ask participants the questions below and have them discuss their responses with their group for about 10 minutes, writing their responses if helpful. After 10 minutes, bring everyone back together, and ask for volunteers to share what they discussed with the room.]

Question Part I:

What was your first experience with pesticides (could be in person or something you saw in a movie)? What were your thoughts? Were you afraid, unphased? Knowing what you know now, how do you look at those past experiences?

Question Part II:

Do you think it's important to raise awareness about the issues with pesticides? If so, what are some next steps you can do to help the general public and lawmakers understand the issues?

Q8: Overall, has the use of pesticides increased crop yield?

A8: This is a crucial question that gets to the heart of the narrative propagated by agrochemical companies like Monsanto[38] that pesticides and genetically engineered seeds are necessary to "feed the world." The best answer is, **"Yes, pesticides increased crop yields *at first*—but not for long."**

PESTICIDES AND THE SOIL

If seeds are the source of life, soil is the womb it springs from. You can't have a healthy food system—or a living planet—without the robust and complex web of life in our soils. Scientists at the Food and Agriculture Organization (FAO) are sounding the alarm about the plight of this essential resource due to the impacts of industrial farming, such as "erosion, salinization, compaction, acidification, and chemical pollution."[36]

Chemical pesticides, like glyphosate, may be adding to this destructive impact on the soil. Recent research suggests that glyphosate is toxic to certain types of bacteria and fungi crucial to plant health. It also appears to repel earthworms and increase root-borne diseases.[37] More research needs to be done on the dangers pesticides pose to the underground biome. But with so many compounding factors damaging the soil, it's safe to say that soaking the earth in toxic chemicals isn't helping.

There's no question that pesticides were instrumental in scaling up food production to an industrial-sized system. This, along with the rise of hybrid seeds *[see Section 2 of guide, "Seed Saving"]*, caused crop yields to soar. However, after decades of increasing pesticide use, we are seeing the law of diminishing returns come into play. For all the reasons we've discussed so far (pesticide-resistant weeds and insects, declining soil health, etc.), the promise of pesticides to steadily boost crop yields is falling short.

The latest and most damning report on this comes from a 2016 feature by *The New York Times* titled "Doubts About the Bounty of Genetically Modified Crops".[39]

Using United Nations data, the *NY Times'* analysis showed that pesticide- and GMO-dependent farms in the U.S. and Canada had "no discernible advantage in yields" when compared to farms in Western Europe, where cultivation of these GMO crops is banned. Several other reports with similar conclusions have been published in recent years. You can find them in the Resources section below.

Economic and Social Justice Impacts

Q9: We've talked a lot about the environmental and potential health impacts of pesticides. What are some other ways they affect people's lives and communities?

A9: Pesticides are affecting large populations of people around the world in various economic, social, and cultural ways. Migrant farm workers, for example, get exposed to much higher concentrations of pesticides than the average person. This is a social justice issue that is intricately linked to economics—especially in the United States, where nearly half of all agriculture jobs are done by between 1 and 3 million migrant workers each year.[43]

Spraying by hand is a dangerous but common practice globally.

Pesticide-dependent industrial agriculture would not be possible without this "invisible population" of mostly Mexican "guestworkers" who are often paid below minimum wage and without benefits. This scheme has been compared to modern day slavery.[44]
The unaccounted costs borne by guestworkers and their home countries—in the form of health risks, low wages, and poor working conditions—are an integral part of the pesticide and industrial agriculture industry and its profits. The documentary *Food Chains* is an excellent film on this topic.[59]

Farmers, too, are victims of the agrichemical seed paradigm. In order to compete in the industrial mar-

ketplace, farmers in the U.S. and around the world have bought into the promises of pesticide-based agriculture. In many cases, this means signing exclusive contracts with companies like Dow and Monsanto to use their patented genetically modified seeds and pesticides. Once they begin on this path, it is hard to break free as debts pile on and new seeds must be bought each year. Farm bankruptcies from crop failures are not uncommon and have been linked to thousands of suicides by Indian farmers.[6]

According to FarmAid, the monopolistic concentration of the chemical seed industry has created price spikes in the cost of seed supplies for farmers, with soybean prices climbing 351% per-acre from 1995 to 2014.[45] To keep this system afloat, the U.S. government heavily subsidizes farmers of commodity crops, like corn and soy (which are mostly GMOs), essentially funneling billions of taxpayer dollars into the pockets of the pesticide companies.[46] **While these companies get richer, U.S. farmers have seen their net income drop 45% since 2013.** Economic conditions are driving a rise in suicide rates among U.S. agriculture workers as well—up more than 50% since the 1980s.[47]

As you can see, the impacts and influence of this global industry run deep through nearly every aspect of our lives.

Busting the "Feeding the World" Myth

We are often told that we need pesticides and GMOs to "feed the world." By now, you may be questioning this belief. You are not alone in these doubts.
Many researchers (and everyday people) are coming to the conclusion that the chemical-dependent, industrial model of agriculture is unsustainable and unnecessary.

PESTICIDES AND GMOS AROUND THE WORLD

There is no standard pattern of use for pesticides internationally. In fact, the heaviest users may be surprising. Topping the list are the United States and China, followed in order by Argentina, Thailand, Brazil, Italy, France, Canada, Japan, and India. Since this list reflects overall use, the smaller countries have higher concentrations of pesticide use by landmass.[40]

Interestingly, several countries that use large amounts of pesticides also require consumer labeling of genetically engineered food, or GMOs. 64 countries including all 28 in the European Union, as well as Japan, Australia, Brazil, Russia, and China, have GMO labeling laws on the books. Additionally, 38 countries around the world currently have bans or moratoriums on the cultivation of GMO crops, including half of the European Union, Russia, Turkey, Saudi Arabia, Peru, Ecuador, and Venezuela.[41]

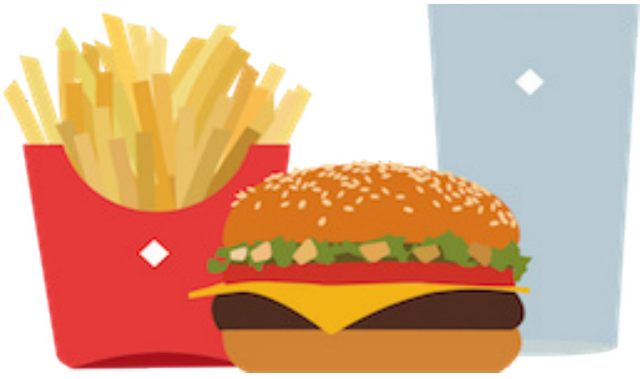
Did you know? In 2016, President Obama signed a weak GMO labeling bill into law that was backed by the food industry and opposed by labeling advocates. According to Center for Food Safety, the bill "allows companies and producers to use QR codes, 1-800 numbers and other difficult to access technology to label food products that contain GMOs, instead of clear, on-package text. The law also sets a dangerous precedent to override the sovereignty of states," as it nullifies existing state labeling laws and is designed to preempt future state labeling efforts.[60]

Additionally, "The FDA said the bill's narrow and ambiguous definition of 'bioengineering,' would 'likely mean that many foods from GE sources will not be subject to this bill.'"[60] An estimated 75 to 80 percent of food at supermarkets contains genetically engineered ingredients.[42]

Map courtesy of JustLabelIt.org

According to the Food and Agricultural Organization of the United Nations, about 90% of the world's 570 million farms are owned and operated by families.[48] These people grow food for a significant proportion of the world's population. The ETC Group reports that this "peasant food web" produces 70% of the world's food with just 30% of the world's agricultural resources.[49] So from the start, the idea that we "need" GMOs and industrial agriculture to survive should be questioned.

Let's look at exactly what kind of "food" most GMO crops are producing. Just a tiny fraction of the top two GMO crops grown in the U.S.—corn and soy—ends up as actual, nutritious food. The vast majority is used for biofuels (corn-based ethanol), animal feed, or food additives like high fructose corn syrup.[50] **When the overwhelming majority of GMOs grown on the planet are used to fuel cars, fatten up livestock, and fill out junk food, the narrative that these crops are helping solve world hunger falls apart.**



While food shortages and famine are very real and tragic occurrences in some parts of the world, there are many complex reasons for this. **Poverty, civil unrest, and lack of access to basic farming needs like water, fertilizers, and infrastructure are all underlying factors to global hunger that GMOs cannot address.**[51] Furthermore, many of these rural communities have maintained subsistence farming practices that are essential to long-term resilience. Introducing GMO seeds and pesticides will likely erode this traditional knowledge and add to their challenges the same mounting problems U.S. farmers are facing.[52]

Then how do we feed a hungry and growing global population? For starters, we can more equitably distribute food resources and reduce food waste. The United States alone throws away nearly half of all its produce—a whopping 60 million tons every year. More than enough food is already being grown for everyone on Earth, but economic inequality prevents it from reaching hungry people. These are deep problems that further industrialization of food production will not solve.[54]

Food and pollution experts at the UN recently summed this issue up nicely. In a March 2017 report, they denounce the idea that pesticides are needed to feed a growing global population as a baseless myth.[55] **The UN food experts state: "Reliance on hazardous pesticides is a short-term solution that undermines the rights to adequate food and health for present and future generations."** [56]

GROUP ACTIVITY: TRANSFORMING THE SYSTEM

[Have participants break into groups of 2-4 people. Ask participants the questions below and have them discuss their responses with their group for about 10 minutes, writing their responses if helpful. After 10 minutes, bring everyone back together, and ask for volunteers to share what they discussed with the room.]

Question: Think about how you buy and eat food. Based on everything you've learned, what are some actions you can do to help shift our food system away from pesticide-dependent farming? Have you seen any solutions in your community? Do you know any ways to get involved?

Some Possible Answers:

- Support CSA (Community Supported Agriculture) farm programs
- Buy organic and local food whenever possible
- Eat in season and know where your food comes from
- Practice Integrated Pest Management (IPM)

Alternatives to Pesticides – Addressing Consumption Habits

Q10: How can community seed saving reduce the use of pesticides? (To learn about seed saving, check out the second section in this guide, "Seed Saving").

A10: Ideally, the plants we choose to save seeds from will be the strongest, best adapted, and most disease- and pest-resistant specimens. These should require less pesticides (or none at all) to grow a healthy crop. When we save and replant seeds from these crops, we build up varieties that can thrive without chemical pesticides. Other factors also come into play when managing crop pests and diseases, such as soil health, irrigation, sun exposure, and companion planting. All of these must be considered in organic growing systems.

Q11: What about organic? Is this the best way to avoid pesticides in our food system?

A11: Organic food is an important element in the shift away from pesticides. By law, GMOs and many toxic pesticides are not allowed to be used in organic agriculture. However, not every farmer can afford the expensive process of becoming USDA-certified organic. Many dedicated growers that are not certified still follow organic practices, or even go "beyond organic" by implementing permaculture, biodynamic growing, and other holistic farming methods. Buying local food from farmers you know and trust is an excellent way to avoid pesticides and support food resilience in your local community.

Q12: Who has heard of Integrated Pest Management? Any ideas how this might work to help reduce or eliminate pesticide use?

A12: This is a holistic system that honors the life cycle and all that is needed to maintain it. The EPA calls it "an environmentally friendly, common sense approach to controlling pests."[57] Essentially, rather than blindly attacking an isolated pest, the whole ecological system is considered when looking to solve a problem.

Q13: What might some IPM solutions look like? Can you think of a garden or farming problem you might be able to overcome with this kind of thinking?

A13: For example, you might order ladybugs from an insectary to control an infestation of aphids that are attacking your sunflowers. Removing overgrown vegetation could be a solution to rodents attacking your lettuce crop. If your backyard is plagued by mosquitoes, you could clean up any trash or standing water in the area rather than spraying chemicals.

Q14: What role does soil play in managing pests?

A14: Maintaining healthy soil is vital to controlling pest populations. For one reason, poor soil with little organic matter and nutrients will lead to weaker plants. These become susceptible to pests and actually attract them. When plants are less "stressed," they are much more resilient and better able to ward off any potential insect attacks. Practices that boost soil health include adding compost, rotating crops, and avoiding tilling.[58]

Q15: There is one topic we haven't touched on yet in this section. It's also the theme of our very first section in the discussion guide. Biodiversity! How is biodiversity related to controlling pests?

A15: When a broad range of crop diversity is present in a farm or garden, there is more resilience built in. Not all pests favor every plant, so you will be less likely to be overrun by an infestation. Also, there's the important concept of adaptation to consider. Because certain plant varieties will have genetic resistance to particular pests, you can look out for those plants that do better when the aphids or caterpillars attack. Then by saving the seed from those plants, you are carrying those pest-resistant traits into your next season's crop!

Conclusion

Pesticides and the industrial agricultural system they support are an obsolete model. Scientists and experts at the highest levels are beginning to speak out on this and demand a more sustainable, just, and common-sense approach to how we grow our food. Thankfully, many solutions to the problems created by chemical agriculture are easy to find.

We can start by looking to the ways our ancestors farmed for thousands of years without chemicals. The future of food will need to look much more like the other 90% of farms in the world—smaller, more holistically managed, and with far less chemicals used. **By reincorporating these practices along with the ancient traditions of seed saving, we can truly feed the world—and save the planet as well!**

TAKE ACTION

Feeling inspired? Here are some things you can do today to get started.

- Join a local organic gardening group
- Contact your city government and ask if they are spraying harmful pesticides like glyphosate and neonicotinoids in public spaces. If so, organize community campaigns to get them to stop.
- Support pesticide action groups
- Grow your own food and save seeds!

Pesticide Issues & Impacts – Resource List

For more information on pesticides, check out the following books and resources:

- Pesticide Action Network (www.panna.org)
- Northwest Coalition for Alternatives to Pesticides (www.pesticide.org)
- Environmental Working Group (www.ewg.org)
- Center for Food Safety (www.centerforfoodsafety.org)
- Bio-Integral Resource Center (www.birc.org)
- Beyond Pesticides (www.beyondpesticides.org)
- Union of Concerned Scientists (www.ucsusa.org)
- Cornucopia Institute (www.cornucopia.org)
- Institute for Responsible Technology (responsible-technology.org)
- *Non-Toxic, Natural and Earthwise: How to Protect Yourself and Your Family from Harmful Products and Live in Harmony with the Earth*, by Debra Lynn Dadd
- "Failure to Yield: Evaluating the Performance of Genetically Engineered Crops", (2009), Union of Concerned Scientists
- "Impacts of Genetically Engineered Crops on Pesticide Use in the United States: The First Thirteen Years", (2009), The Organic Center

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*Visit **SEEDTHEMOVIE.COM/GUIDE** for useful online resources and links that appear in this guide.*

About the Authors

Belle Starr is co-founder of the Rocky Mountain Seed Alliance, an organization created to assure a diverse and abundant supply of seeds for the Rocky Mountain West. In 2010, Starr and her husband Bill McDormand developed the ground-breaking seed saving program, Seed School, featured in *Seed: The Untold Story*. Starr has an extensive background in media relations, grant writing, community organizing and nonprofit management, and she loves to grow sunflowers and zinnias!

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About the Filmmakers

Taggart Siegel and **Jon Betz** have produced work on agriculture and the environment for over a decade. During Taggart Siegel's 30+ year career he has produced and directed over 10 award-winning documentaries including *SEED: The Untold Story, The Real Dirt on Farmer John* (both theatrically released and broadcast on PBS's Independent Lens) and *Queen of the Sun: What are the Bees Telling Us?* (Theatrical release, New York Times Critic's Pick). Jon Betz's past work includes directing and producing *SEED: The Untold Story,* producing and editing *Queen of the Sun* and directing *Memorize You Saw It*, about former child soldiers in Uganda. Taggart Siegel founded Collective Eye Films, which is based in Portland, Oregon.
Jon serves as Collective Eye's Executive Director.

Credits

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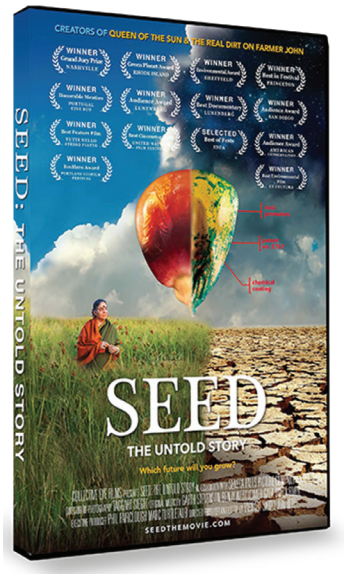

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SEED: The Untold Story is available for screenings, home viewing, and educational use worldwide.

To learn more, visit: SeedTheMovie.com