

Wesley Parker  
Cape Elizabeth High School  
Cape Elizabeth Maine  
Uganda, Factor 1: Plant Science

## **New Biotechnology to Feed Uganda**

In the 1950s, a grim future seemed to be approaching. Population growth in Asia was beginning to outpace agricultural productivity and this would mean starvation for millions of impoverished people. Luckily, before this could happen, Norman Borlaug used selective breeding to engineer a dwarf variety of wheat that nearly doubled its productivity (“Norman”). Today, as in Borlaug’s era, new tools of biotechnology are on our doorstep in the form of genetically modified organisms (GMOs). Already they have derived a combined 58.15 billion dollars for poor farmers in developing countries (“GM”). Burkina Faso, for example, has seen benefits of over 100 million dollars per year since introducing GMOs in 2004 (Adenle). However, Burkina Faso is an exception in Africa, where only five countries currently grow GM crops (Folger). Misperceptions about the safety and effectiveness of GMOs have infected most of Europe, and Europe has in turn dissuaded most of Africa from using this technology. Unfortunately, Uganda is one of the many African nations without GMOs. A landlocked country in East Africa, Uganda relies on agriculture for 20% of its GDP and 80% of its population’s employment. (“Uganda”/CIA). However, despite its paramount importance in Uganda, agricultural productivity there is still lagging. More than 38% of the population is calorie deficient while output per farmer is a fraction of that in the developed world (Uganda/"Uganda National"). Meanwhile, child marriage and polygamy are still common practices in the rural areas of the country (“Uganda”/Children). In contrast, urban areas are far more westernized, and nonfarm households there have a 70% higher average income than agricultural households (Kyatusiimire). However, breaking the cycle of poverty and reaching these higher paying jobs in the city often requires secondary education. Paying school fees and supporting children those extra years is very difficult since 19.5% of the population lives below the poverty line and many subsistence farmers can’t even adequately feed their families ("Uganda"/World Bank). Unfortunately, Uganda’s agricultural woes will only be exacerbated by its explosive growth rate, which was at of 3.3% as of 2013, and the effects of climate change ("Uganda"/World Bank). In order to combat these issues, Uganda will need to address its lack of plant sciences.

In rural areas of the country where about 86% of the population lives, tradition still holds firm (“Our”). Most rural Ugandans live in large extended families called clans. In the clans, women usually attend food crops while men handle the cash crops (“Uganda: Division”). A man’s social status is based on the number of children he has, for children are helpful for working in the fields and assisting their parents when they become elderly ("Uganda"/Children). These factors have led Uganda to have the fifth highest fertility rate in the world with 5.97 births per woman in 2014, making the average family size quite large (“Uganda”/ CIA). Meanwhile, the Ugandan diet is poor. The Ugandan household survey of 2012-2013 showed that 29% of Ugandan households have low dietary diversity (consuming less than five out of the seven main food groups) (Uganda/"Uganda National"). In rural areas where the vast majority of the population relies on subsistence farming, 71% of the dietary energy consumption (DEC) came from cereals, roots, and tubers. Another 12% of the DEC came from nuts and pulses, while the last six food groups (vegetables, fruits, milk, sugar, oil and fats, meats and fish and eggs) combined only made up a total of 17% of the rural Ugandan DEC (Uganda/"Uganda National "). In terms of education, Uganda has made progress, but is still lacking in many ways. Reforms made by the government have reached into the rural areas and led to an improvement in net enrollment for primary education (ages 6-12). In fact, the World Bank reports that net enrollment in primary school in 2013 reached 91% of the population, equal to that of the United States (“School Enrollment Primary”). However, the 2013 net secondary school enrollment (ages 13-17) was only 22% (“School Enrollment Secondary”). This dramatic drop represents the difficulty Ugandans face in advancing through the academic world and out of the cycle of poverty.

Children are needed for work in the household, and parents don't want to pay the school fees. To make matters worse, access to health care is highly limited for most Ugandans. Only 34.9% live near a government health center (Uganda/"Uganda National"). This distance problem is worsened by the lack of transportation in Uganda. In 2013, seven out of ten sick persons arrived at a health facility on foot, while only 5% had access to car or ambulance (Uganda/"Uganda National"). This means that someone in urgent medical need may have to wait more than two hours and travel multiple kilometers in order to secure treatment (Uganda/"Uganda National").

The average subsistence farm family owns from 1 to 2.5 hectares of land (Uganda/"Uganda National"). The typical food crops grown are cereals, which accounted for 30.2% of total area planted in 2013, root crops (23.7%), pulses (13.3%), plantains (16.8%), and oil crops (16%) (Uganda/"2013 Statistics"). Cassava and bananas are especially important crops. Bananas provide a major food source for over seven million people ("Matooke"), while Cassava adds around 13% to daily calorie intake for Ugandans (Kawuki). Cash crops include coffee, cotton, tea, and tobacco (Uganda/"2013 Statistics"). Coffee is the biggest cash crop, and Uganda is the African leader in coffee exports (Ojambo). Most parts of Uganda have two rainy seasons for growing food. One usually occurs from March until May, and the other in October and November. Irrigation is nearly nonexistent for most subsistence farmers in Uganda, which means that rain, which feeds about 97% of Ugandan crops, is vital ("Farming"). Lastly, most farmers still use low-tech tools to tend to crops. Only 1% of plots use fertilizers of any sort, and very few farmers have access to technologies like a tractor or a weather forecast (Gollin).

There are multiple barriers to increasing agricultural productivity in Uganda. With an equatorial climate, pest and diseases run rampant in crops. Meanwhile, climate change has already had an effect on weather patterns. For example, the length and timing of rainy seasons has been changing, and drought has become more prevalent in many regions ("Uganda's Agricultural"). Agricultural shocks, including floods, hailstorms, and droughts take a particularly hard toll on subsistence farmers who may see their whole crops destroyed. Lastly, a lack of farmer knowledge on modern agricultural practices also serves as a major obstacle to increasing yields. Overcoming these barriers is essential to feeding farmers as well as providing them an income. After all, earning an income in rural Uganda is inextricably linked with agricultural production. In fact, in 2013, 42.4% of the population cited subsistence farming as their main source of income (Uganda/"Uganda National"). However, access to markets is an important factor in augmenting incomes as well. According to the Ugandan Household Survey of 2012-2013, only 5.5% rural communities have a market center for selling produce (Uganda/"Uganda National"). The rest of farmers have to travel to other communities in order to access a market, but this is made difficult by a severe lack of roads. In 2011, Uganda had only 2,028 miles of paved roads, while in contrast, the UK, a country of similar size, had about 245,068 miles of paved roads ("Uganda"/CIA). Farmers often lose profit in the process of transporting the crops to the nearest market, and some farmers may not even be able to reach a market at all. Meanwhile, nutrition is also an urgent issue in Uganda. Low income, created by these previously mentioned factors, prevents Ugandans from purchasing the crops that would most improve their nutrition. Additionally, trying to alleviate nutrient deficiencies by growing a diversity of crops is also an unrealistic option for most subsistence farmers. Land is scarce. Staple crops are most important. Adding others to fulfill nutritional needs is not usually an option.

Presently, a lack of plant science allows three of the previously mentioned barriers to continue to go unchecked, greatly reducing agricultural productivity. First, pressure from pest and diseases preventable by new tools of genetic engineering greatly harms Ugandan yields. In Uganda, average crop losses as a consequence of pests and diseases are around 10-20% during the pre-harvest period and 20-30% throughout the post-harvest period (Uganda/"Pest"). Additionally, out of the 2 million agricultural households that reported experiencing food shortages in the 2008/2009 Uganda agricultural census, 1.3 million (66.0%) experienced damages due to pests and diseases (Uganda/"Uganda National"). Worst of all, diseases have infected many of Uganda's staple crops. Take the banana for example. In Uganda, about

75% of farmers grow banana plantains, and the crop accounts for about 30% of total food consumption (Kafeero). Overall, Ugandans consume more bananas than any other country in Africa. In 2001, an outbreak of banana xanthomonas wilt (BXW) struck Uganda (Uganda/"Pest"). Since then, banana losses from BXW have contributed to over 200 million dollars (Uganda/"Pest"). BXW destroys all of the banana, and can cause up to 100% damage for a field for any variety (Uganda/"Pest"). Losses have decreased slightly due to help from the government, but still no fully resistant varieties occur outside GMO technology (Uganda/"Pest"). Another example of ravaging disease can be seen in cassava. In Uganda, Cassava is an essential source of food for the 12-15 million farmers who grow it ("ACDI/VOCA"). Today, the recent emergence of brown streak virus coupled with the old cassava mosaic disease cost \$80 million dollars annually. (Uganda/"Pest"). The brown streak disease is particularly dreaded because in some cassava variety little or no visible symptoms occur except in the roots (Kawuki). When farmers go to harvest their crop, they end up with a devastating surprise. Other diseases and pests have a hurt whole range of other crops from sweet potato to maize (Uganda/"Pest").

A deficiency of adequate plant sciences severely harms Ugandan farmers during natural shocks as well. By far the worst shock is drought. This is partly because of the lack of irrigation in the nation. Almost all crops are rain fed, which means without rain, big issues occur. According Uganda's 2009/2010 census of agriculture, of the 2 million agricultural households that experienced food shortages, 1.8 million (91.5%) had droughts (Uganda/"Uganda Census"). Additionally, 1.1 million (53.9%) endured extreme damage to agricultural produce (Uganda/"Uganda Census"). Furthermore, another important Ugandan crop, maize, has experience great damage due to droughts with crop losses as much as 70% in some regions (Ssali). Aside from drought, flooding affected 30% of the 2 million households that had food shortages with 3.1% experiencing extreme damage to produce (Uganda/"Uganda Census"). Another 46.6% experienced hailstorms, with 7.7% suffering serious losses from them, and lastly, 40.6% had erratic rains, with 7.4% experiencing extreme agricultural damage (Uganda/"Uganda Census"). To make things worse, climate change may already be starting to worsen the situation. Climate change has been affecting the usual way rainfall is distributed throughout the country ("Uganda's Agricultural"). Some parts have been experiencing a high proportion of rain while other parts get little at all ("Uganda's Agricultural"). These changing weather patterns have made planning crops very difficult for farmers who usually rely on previous knowledge about when the rainy seasons occur. Unfortunately, climate change likely won't be reversed any time soon. The Earth's average temperature has risen 1.6 degrees Celsius since the 1800s and is predicted only to accelerate (Khan).

A dearth of proper plant sciences has also prolonged the devastating effects of malnutrition. For example, in Uganda, 33% of children are stunted, while another 14% are underweight ("UNICEF"). Stunting is a particularly bad condition where a child from the time of conception to the age of two is not given critical nutrients. It can leave crippling effects on mental and physical health for the rest of one's life. Specifically, two important nutrients that are severely lacking among Ugandans are iron and vitamin A. In 2007, iron deficiency anemia was 34% for women of reproductive age and 64% for children under 15 (Balikowa). The deficiency causes tiredness and lack of mental focus, while attributing to about 20% of maternal deaths (Balikowa). Unfortunately, 41% of pregnant Ugandan women had iron deficiency in 2009 ("Uganda Nutrition"). Another lacking nutrient is vitamin A. As of 2009, 23% of pregnant women were vitamin A deficient, along with 28% of preschool aged children ("Uganda Nutrition"). Overall, the combined impact of stunting, low birth weight, and anemia cost the country around 310 million dollars each year ("UNICEF"). These are problems that new bio-fortified crops could possibly prevent.

Improving plant science could break through the barriers halting farmer productivity in Uganda. The key is genetically modified organisms (GMOs). A GMO is an organism in which some genes have been added or altered in order to increase desirability to farmers and consumers. In contrast to traditional breeding, GM crops can take a gene from any source, such as bacteria, animals, or completely unrelated plants. This provides a massive advantage over traditional breeding methods where plants are crossbred

with other plants only of the same or similar species. The process is also quicker and more precise. New GM crops are nearly completed that could greatly raise Uganda's agricultural productivity. Right now, many of these new plants are undergoing field trials in Uganda, overseen by its national agricultural research organization (NARO) (Afedraru). There, development is being finalized and plants are being tested against the Ugandan environmental conditions. Already, resounding success has occurred. For example, scientists have used a green pepper gene to develop a new banana resistant to BXW. In a field trial in Uganda, 11 lines showed 100% resistance to the disease (Tripathi). These lines will be further tested to determine the most durable and productive, and soon the devastating BXW ravaging Uganda may be halted (Tripathi). Similar breakthroughs have occurred in Cassava, with resistance being conferred for both mosaic disease and brown streak virus. Those plants are currently being tested for environmental and health impacts and could be ready for use in early 2016 (Afedraru). GMOs can also help the country fight against natural shocks. As discussed previously, maize is one example of a crop suffering from the repercussions of drought and changing patterns of weather. Luckily, as part of the Drought Tolerant Maize for Africa project, Ugandan scientists have also developed genetically modified maize varieties that can yield up to 30% more produce than normal maize in drought conditions, and match or exceed yields during regular conditions (Ssali). Now, even despite minimal irrigation, subsistence farmers will at least gain some produce during times when they would usually lose everything. Additionally, nutrition can also be addressed using GM crops. Vitamin A and iron deficiency are the two major nutrient deficiencies in Uganda. Recognizing this, scientists at the Queensland University of Technology in Brisbane Australia have been able to develop a new banana for Africa that is rich with vitamin A and iron (Milmo). It is undergoing human trials in the US right now and will later be sent for further testing in Uganda (Milmo). By 2020, the banana could be finished, and along with it thousands of Ugandan deaths due to micronutrient deficiency could be prevented, specifically those of mothers and children. Meanwhile, some other crops being developed in Uganda include: sweet potatoes resistant to weevils and fortified with nutrients, cotton with resistance to Bollworm and herbicides, bananas resistant to black sigota disease, bananas resistant to nematodes and weevils, and coffee resistant to coffee wilt disease (Ssali). Many of these crops will be ready by 2016 (Afedraru). If Uganda is ready too, then nutrition could vastly improve, and many of the crop losses to diseases and natural shocks could be eradicated.

For a long while in Uganda, a bill called the called the National Biotechnology and Biosafety Bill has been on the table that would allow the legalization of GMOs by establishing a biosafety regime to assess the risk of GM crops and help regulate them smoothly ("Uganda Takes"). However, its passage has been slowed by the negative misperceptions created from non-governmental organizations (NGOs) and leaders in Europe against GMOs. They are afraid of unintended health and environmental impacts resulting from GMOs, despite over 2,000 compiled studies confirming their safety (Wendel). Just recently, though, the majority party in parliament adopted the bill. This may finally allow it to pass, bringing GMOs to Uganda ("Uganda Takes"). Even if this bill does pass, however, problems may persist. First, many farmers in Uganda may not accept GMOs due the work of some NGOs. For example in 2013, Etem Iteso, a popular pressure group, brought 20,000 Ugandan signatures before parliament demanding the ban of GMOs (Oniro). This bill will allow farmers to choose between their old crops or new GMOs, and many may opt out of the new technology. Lastly, distribution of seeds may also be an issue especially in the more remote regions of the country.

In order to combat these issues, it is essential that charitable foundations and NGOs working on behalf of GMOs in Africa focus their attention on Uganda in order to ensure GMOs prevail during this critical phase. For example, the Bill and Melinda Gates Foundation, which has been a strong advocate of GMOs in Africa, should allocate funds for the purpose of helping GMO-positive NGOs keep policy makers and farmers informed on the true benefits of biotechnology. Meanwhile, policy makers will have to be willing to keep an open mind and listen to the evidence supporting the safety of biotechnology. Once this new bill passes, more work will still have to be done to educate farmers and ensure seeds are properly distributed.

One successful project led by the Gatsby Foundation could be reintroduced and scaled up to accomplish this. In the project, Gatsby partnered with NARO to distribute 10,000 kilograms of bean seeds improved through traditional breeding methods from 1997-2006 (“Beans”). They also helped farmers come to accept the new bean varieties. The project created 66 sites in 4 districts to demonstrate new bean varieties to local farmers (“Beans”). Farmers in the sites were given training about effective crops management, and groups of farmers were selected to raise awareness about the bean technology in their own communities (“Beans”). Overall, the project increased yields fourfold in the target districts (“Beans”). A similar project could be undertaken again with assistance from the government, but this time they would use GM seeds. Farmers could actually see the increased yields in demonstration plots. Having groups of farmers work to educate the community on GM crops would likely be a great strategy, especially since many farmers live in clans of extended family and value the input of other clan members greatly. The program will also ensure that enough sites are set up to reach farmers in all regions in the country. If such a plan works out, then community members should take action and participate in the project, especially women who are actually responsible for the majority of food crops (while men often focus on cash crops) (“Uganda: Division”). The government and citizens will certainly have a profound role to play in tackling the problem of lacking plant science in Uganda.

Uganda is a country filled with change. After expunging the Lord's Resistance army in 2006, the nation has enjoyed enough stability to begin to prosper (“Uganda”/Children). Cities are on the rise, predicted to grow from 6 million inhabitants in 2013 to 20 million in 2040 (Ssekika). Traditions are changing, with old values and practices being traded for more modern ones. Mortality rates have been decreasing, specifically for maternal women and young children (Mwesigwa, Mugisa) . In the last decade alone, life expectancy jumped almost ten years (“Uganda”/World Bank). Yet change comes slowly. The vast majority of Ugandans still eke out a living on their small plots of farmland, struggling to feed their families. Increasing agricultural productivity is the key to improving the lives of those Ugandans. Greater crop yields will lead to greater food security and incomes, helping push children into secondary education and out of poverty. However, barriers to increasing yields prove stubborn. Pest and diseases ravage crops, bringing heavy losses. On top of that, drought along with other weather issues can leave whole crops destroyed. Meanwhile, nutrition stunts 33% of children (“UNICEF”). These problems are not acceptable and these problems cannot fix themselves. Pest and disease aren't going away, climate change isn't going away, and malnutrition isn't going away. Genetic engineering is one of the greatest assets in the fight to break down these barriers. New crops can use modified genes to fight diseases, resist climate change, and fortify old foods with new nutrients. The battle to push GMOs through parliament in Uganda may be almost over, but there is still a lot to do to make them a reality. Charitable foundations and NGOs need to ensure that policy makers stay open to GMOs and promote a positive public image. Also, implementing a new project for GMOs based on the Gatsby project could allow farmers to learn about the new crops for themselves, and ensure that seeds spread throughout the country. By forming groups of educated farmers that teach others, whole communities could be convinced to adopt this new technology. Norman Borlaug once famously stated, “Food is the moral right of all who are born into this world” (“Norman Borlaug”).” If these recommendations are followed, and Ugandan policy makers and farmers keep their minds open to GMOs, then maybe Uganda can finally fulfill that right and experience a time of unprecedented growth.

## Works Cited

- “ACDI/VOCA Helps to Dramatically Increase Ugandan Cassava Production after Devastating Blow from Crop Disease.” *ACDI/VOCA*. ACDI/VOCA, n.d. Web. 3 Aug. 2015.
- Adenle, Ademola A. "Are Transgenic Crops Safe? GM Agriculture in Africa." *United Nations University*. United Nations University, 19 Jan. 2012. Web. 22 Feb. 2015.
- Afedraru, Lominda. “Biotech Crops Ready for Release, No Law in Place yet.” *Daily Monitor*. Daily Monitor, 10 Dec. 2014. Web. 3 Aug. 2015.
- Balikowa, David Ouma. “Social Determinants of Health: Food Fortification to Reduce Micronutrient Deficiency in Uganda.” *World Health Organization*. World Health Organization, Oct. 2011. Web. 3 Aug. 2015.
- “Beans.” *Gatsby*. Gatsby Charitable Foundation, n.d. Web. 3 Aug. 2015.
- Folger, Tim. "The Next Green Revolution." *National Geographic* 15 Oct. 2014: 45-60. Print.
- “GM Crops Continue to Boost Productivity and Farm Incomes Worldwide.” *GMO Compass*. GMO Compass, 28 May 2014. Web. 3 Aug. 2015.
- Gollin, Douglas, and Richard Rogerson. National Bureau of Economic Research. Agriculture, Roads, and Economic Development in Uganda. Cambridge, Massachusetts: National Bureau of Economic Research, 19 Mar. 2010. Web. 2 August 2015.
- Kafeero, Stephen. “Uganda Less Likely to Be Affected by New Banana Wilt Disease Scientists.” *Daily Monitor*. Daily Monitor, 19 Feb. 2014. Web. 3 Aug. 2015.
- Kawuki, Robert. “Cassava, Uganda’s Food Security Crop.” *Biovision*. Biovision, n.d. Web. 3 Aug. 2015.
- Khan, Brian. “State of Earth in 4 Climate Trends.” *Scientific American*. Scientific American, 22 Apr. 2015. Web. 3 Aug. 2015.
- Kyatusiimire, Sharon. “Uganda Urged to Shift from Subsistence Farming.” *Business Week*. East African Business Week, 8 Feb. 2015. Web. 3 Aug. 2015.
- “Matooke Agribusiness Incubator.” *PanAAC*. Pan African Agribusiness and Agro-Industry Consortium, 5 Feb. 2014. Web. 3 Aug. 2015.
- Milmo, Cahal. “GM Banana Designed to Slash African Infant Mortality Enters Human Trials.” *The Independent*. The Independent, 16 June 2014. Web. 3 Aug. 2015.
- Mwesigwa, Cathy, and Anne Mugisa. "Uganda's Maternal Death Reduces - WHO Report." Uganda's Maternal Death Reduces - WHO Report. NewVision, 3 June 2013. Web. 2 Aug. 2015.
- “Norman Borlaug.” *Wikipedia*. Wikimedia Foundation, n.d. Web. 3 Aug. 2015.

- "Norman Borlaug - Nobel Lecture: The Green Revolution, Peace, and Humanity". *Nobelprize.org*. Nobel Media AB 2014. Web. 30 Aug 2015.
- Ojambo, Fred. "Uganda Coffee Exports Climb to Six-Month High as Prices Rise." *Bloomberg Business*. Bloomberg, 11 Feb. 2014. Web. 3 Aug. 2015.
- Oniro, Tom. "Does Uganda Really Need GMOs?" *New African Magazine*. New African Magazine, 2 May 2014. Web. 3 Aug. 2015.
- "Our Work in Uganda." *Farm Africa*. Farm Africa, n.d. Web. 3 Aug. 2015.
- "School Enrollment, Primary (% Net)." *The World Bank*. World Bank Group, 2015. Web. 3 Aug. 2015.
- "School Enrollment, Secondary (% Net)." *The World Bank*. World Bank Group, 2015. Web. 3 Aug. 2015.
- Ssali, Michael J. "The Case for GMOs in Uganda." *New African Magazine*. New African Magazine, 11 Sept. 2014. Web. 3 Aug. 2015.
- Ssekika, Edward. "WB Projects 20m Ugandans Living in Urban Areas by 2040." *The Observer*. The Observer, 18 Mar. 2015. Web. 03 Aug. 2015.
- Tripathi, Leena. "Genetically Modified Bananas Resistant to Xanthomonas Wilt." *SlideShare*. LinkedIn Corporation, 30 Oct. 2014. Web. 3 Aug. 2015.
- "Uganda." *Children of the Nations*. Children of the Nations, 2014. Web. 03 Aug. 2015.
- "Uganda." *CIA World Fact Book*. CIA World Fact Book, 2015. Web. 3 Aug. 2015.
- "Uganda: Division of Labour in Agriculture." *IFAD*. International Fund for Agricultural Development, 2000. Web. 2. Aug. 2015.
- Uganda. Ministry of Agriculture, Animal Industry and Fisheries. *Pest Management Plan*. Kampala: n.p., September 2014. Web. 30 July 2015.
- "Uganda Nutrition at a Glance." *The World Bank*. The World Bank, 2015. Web. 3 Aug. 2015.
- "Uganda's Agricultural Season Is Changing over the Years." *East African Agribusiness*. East African Agribusiness, n.d. Web. 3 Aug. 2015.
- "Uganda Takes Big Step toward Approving GMOs, an African Breakthrough." *American Council on Science and Health*. American Council on Science and Health, 13 May 2015. Web. 3 Aug. 2015.
- "Uganda." *The World Bank*. World Bank Group, 2015. Web. 3 Aug. 2015.
- Uganda. Uganda Bureau of Statistics. *2013 Statistical Abstract*. Kampala: n.p., August 2013. Web. 1 August 2015.
- Uganda. Uganda Bureau of Statistics. *Uganda Census of Agriculture 2008/2009*. Volume III. Kampala: n.p., December 2010. Web. 2 August 2015.

Uganda. Uganda Bureau of Statistics. *Uganda National Household Survey 2012/2013*. Kampala: n.p., 2014. Web 28 July 2015.

“UNICEF: Ending Child Under-Nutrition Critical to Achieving Virtually All MDGs by 2015.” *UNICEF*. UNICEF, 2 Apr. 2012. Web. 3 Aug. 2015.

Wendel, JoAnna. “With 2000+ Global Studies Affirming Safety, GM Foods among Most Analyzed Subjects in Science.” *Genetic Literacy Project*. Genetic Literacy Project, 18 Oct. 2013. Web. 21 Feb. 2015.