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The Soybean – Our Great Treasure

by Mary E. Norton

(Biology 110 and English 130: Honors Seminar)

The Assignment: Conduct a simple life-cycle analysis of a food product from the provided list and write a paper on what you have discovered about the history, cultural context, cultivation methods, use, and social and environmental impact of this food product from such research.

When I started researching the soybean plant, I really knew very little about it, except for the fact that its oils are utilized in modern food production; miso and tofu are common ingredients in Asian culture; its beans and the foods derived from them are high in protein; and that there has been much advice from the medical community, in recent years, to consume more soy foods for their cancer preventing qualities. I thought I knew enough, but what I ended up learning from my research is that, today, the soybean is most definitely needed by humans, it is becoming increasingly instrumental in our efforts to offset the strain on the earth's natural resources.

What I found most interesting, in tracing the history of the plant, is that this is not a new phenomenon. Throughout its approximate 5,000 year history, humans have consistently found uses for the soybean to accommodate nutritional, industrial, and, at the present time, environmental needs. Ancient Chinese farmers had such enthusiasm for the soybean, they gave special names to its varieties, one being "Great Treasure" (Imhoof, Washall).

In Han Dynasty China, during the first century, B.C.E., a census taken determined the population to be 60 million people. The soybean was considered one of the nine staples upon which those people depended and was subjected to intensive cultivation practices (Kiple, Ornelas 422). Another example is how laboratories attached to the Russian Army, during its war with Japan in Manchuria (just after the turn of the twentieth century), created a multitude of products containing the soybean as the main ingredient. These included soap, axle and artillery lubricants, and animal fodder (Wolff 245). The soldiers of the United States Civil War used soybeans as a substitute for coffee (Kiple, Ornelas 423).

In the 1980's, the soybean was introduced to Nigeria, a sub-Saharan African country with a population of over 100 million people, as a tool to offset the malnutrition of its infants and children (Babaleye). In 2001, the Agricultural Research Service (ARS) of the USDA, announced that soybean hulls, the seed's fiber coat, showed promise as a filter for removing toxic metals from industrial wastewater generated by such industries as electroplaters and jewelers (Suszkiw).

Today, soybean oil, in addition to being the most heavily used edible oil, is also being increasingly applied as a substitute for petroleum-based oils in various industrial products. It is biodegradable, and has all of the properties of petroleum, but without the toxicity (Imhoff, Warshall). Examples of commercially available soy-based products include wood adhesives, lubricants, herbicide adjuvants, diesel lubricity additives, metal and parts cleaning solvents, general cleaners and adhesive removers, and paint removal solvents; as well as The Cytosol Process which aids in soil spill clean-up (Stratsoy).

The environmental benefits resulting from substituting soybean oil for petroleum-based oils correspond to problems we studied during the seminar. Being derived from the soybean, soybean oil is itself a renewable resource – a positive factor – and is biodegradable and nontoxic. Unlike petroleum-based oil, there is no danger of polluting our fresh water supply, or the quality of air through emissions that damage the earth's atmosphere. Less dependence on petroleum-based oil reduces the stress on the world's supply of fossil fuel – a nonrenewable resource – which is in danger of depletion (Cunningham and Saigo 22).

As of 2001, testing had begun on the ability of soybean hulls (a low-value, high-volume agricultural waste) to act as a filter for the removal of toxic metals from industrial wastewater generated

by electroplaters, jewelers and other such industries (Suszkiw). The Agriculture Research Service of the USDA performed all of the research on this project, which has the potential environmental benefit of turning a former agricultural waste into an essential agent utilized in the clean-up of toxic waste, as well as the economic benefit of increasing the value of the hulls, which are normally sold at a low cost to animal feed supplement producers (Suszkiw).

Another area reaping the benefits of the soybean is human health. Soy is extremely low in cholesterol and saturated fat – the artery-clogging cause of coronary heart disease and is high in fiber and vitamin B6. Its protein offers all eight of the essential amino acids humans need to acquire from food sources, making it the healthiest protein source – a claim no other food can make (Downey). Soy also contains omega-6 fatty acids, which protect the body against strokes; and omega-3 fatty acids, which protect against heart disease (Lewandowski). I believe that, if properly endorsed, the consumption of more soy for its nutritional benefits – particularly protein – could positively affect the ever-growing problem of obesity (the malnutrition of abundant societies, as we discussed in the seminar), and its related health problems in the United States. It could also reduce the emphasis on meat products as a primary source of protein; which could, in turn, reduce the demand for beef, thereby reducing the need for the feedlot system of raising cattle.

The isoflavones found in soy, which are a type of phytoestrogen (a plant hormone similar to human estrogen, but not as strong), help to lower cholesterol, build bone mass, and aid nerve and brain function – especially helpful for women whose bodies reduce production of estrogen just before and during menopause (Lewandowski). Isoflavones guard the body against many hormone-related cancers such as breast, uterine and prostate cancer, and studies have shown that the consumption of tofu, soybeans and soymilk lowered the incidence of dense breast tissue, which is considered a high risk for breast cancer.

A new product being tested by the Food and Drug Administration, which has connections to breast cancer, is the triluent breast implant, which uses soybean oil in place of silicone and saline. Long-term clinical trials on humans and animals are currently being conducted in the United States and Canada. It is proposed that the negative effects on women's health associated with leakage of silicone do not occur with the triluent implant, because the body will absorb and metabolize the oil (Weingartner). Silicone implants are not radiolucent and obscure mammogram; the triluent implant is radiolucent, and therefore, does not obscure mammogram (Weingartner).

Many women who have mastectomies often forego breast reconstruction due to the aforementioned problems associated with silicone implants, but with the apparent health friendly properties of the triluent implant, possibly more women will choose to have reconstruction. Also, the fact that the triluent implant is radiolucent, and does not obscure mammogram, aids in cancer prevention.

The aforementioned factors, I believe, effectively support my position that the soybean is definitely a "need" for humans and the environment. There is, however, a dark side to the soybean. As the saying goes, "every positive has a negative," and this holds true for the soybean as well.

In the 1980's, after the U.S. Supreme Court extended patent protections to genetically engineered plants, seeds and tissue cultures, the Monsanto Company began to apply this technology to the soybean, and by 1999, roughly half of the U.S. soybean crop came from genetically engineered seeds (Harper, LeBeau 97). Monsanto eventually developed the "Roundup Ready" soybean, so called because it could withstand treatment with its best selling herbicide, "Roundup" (glyphosate) (Cunningham and Saigo 247).

Because crops with these genes can grow in spite of high herbicide doses, farmers can spray fields heavily to exterminate weeds (Cunningham and Saigo 247). This is terrible for the environment, considering that as of 2001, soybeans were planted on 74.1 million acres (42 percent were produced in the United States), producing a record 2.891 billion bushels – a frightening statistic when taking into consideration the volume of Roundup, as well as petroleum based fertilizers that are applied to the crop, together with the amount of water needed to irrigate the fields. This provides for significant losses and pollution of the earth's nonrenewable resources. Specifically, our fresh water supply becomes drained due to irrigation methods, and polluted from the chemicals; and, the soil becomes polluted from the chemicals due to the herbicide and fertilizer use.

There has been a general concern by critics of genetic engineering that so-called herbicide resistant "superweeds" would develop by genes jumping from domestic species to wild relatives (Cunningham and Saigo 247). Unfortunately, this fear has now come to fruition. According to Andrew Pollack of The New York Times:

In the last few years, weeds resistant to the herbicide [Roundup] have emerged in Delaware, Maryland, California, western Tennessee, and at the edges of the Corn Belt in Ohio and Indiana.

In South America, particularly Argentina and Brazil, there is a surge in soybean production, and there is a concern that additional rainforest may be lost to expanding soy production than to timber harvesting and pulp and paper (Imhoff, Washall). This is a grave concern for the devastation of the rainforest causes a loss of biodiversity and species, something which must be controlled in order for a balance to be maintained in nature. This was addressed by Aldo Leopold in "Conservation and Land Health," and John Tuxill in *Nature's Cornucopia*.

The soybean is at the heart of the controversy of the seed patenting, or "patenting of life," as it is called by Dr. Vandana Shiva, which she addresses in *Stolen Harvest*, as well as in the film *Deconstructing Supper*. Monsanto as well as other multinationals, as a result of globalization, has destroyed the livelihoods of multitudes of peasant farmers in the Third World who can no longer practice sustainable agriculture due to the monocultures of such crops as the Roundup Ready soybean.

I believe the soybean is still our "Great Treasure" because of the benefits derived from it for human health and the environment, which I have described herein; however, the way it is cultivated, and the social issues associated with the practices of the Monsanto Corporation are disturbing. The plant which is the source of so many positive applications to life on earth is also a current source of devastation of life on earth.

The only way I see to improve the cultivation of the soybean is through a concerted effort by activists, concerned politicians, farmers and an educated population to reduce the use of genetically engineered varieties of the soybean.

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