

Contaminants and Mechanical Harvesting¹

Dr. Bruce A. Richards

Chief Scientist

Weedoo^{INC} Shoreline Workboats, Inc.

West Palm Beach, Florida

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Overview: One of the most popular pesticides used to reduce weed growth for decades has recently come under intensive public scrutiny. **Glyphosate**, the key ingredient in **RoundUp**, has no doubt saved the average consumer millions of dollars in lower food costs. Third world countries in danger of mass starvation look to all the pesticides, like glyphosate, as life savers. The benefits of herbicides in agricultural production cannot be overstated. Glyphosate is used on virtually all the corn, soybeans, turf and cotton grown in the United States. In 2012, the United States Geological Survey (USGS) estimated that 283.5 million pounds were used on farm fields in that year alone. Internationally, glyphosate is used in 160 countries with applications reaching approximately 1.4 billion pounds of the chemical per year. Concerned scientists are wondering if it is now time to explore better ways to grow crops, to negate the consequences of glyphosate on the environment and public health.

What does glyphosate do? This chemical inhibits the growth of plants by disrupting the way the plant assimilates certain proteins. So, why doesn't it harm corn, soybeans and cotton? The answer is that glyphosate would most certainly harm those plants if the corn, soybeans or cotton were they not genetically modified to resist glyphosate exposure. So, we have developed resistant genetically modified organisms (GMOs) to prevent the weed-killing ability of glyphosate.

Potential Danger of Glyphosate: The USGS found glyphosate in virtually all tested bodies of water including ponds, lakes, rivers, wastewater systems, ditches and even rain water. One study placed a modest amount of glyphosate in a moderately sized pond and found all the frogs were killed within a day. Current concerns about the toxicology of glyphosate in humans are getting the attention of national regulatory agencies, consumer groups and the World Health Organization (WHO). Glyphosate has been linked to lymphoma and kidney disease in humans. The WHO now classifies the active ingredients in *RoundUp* as a "probable" cause of cancer. Prior to this classification, proponents of glyphosate claimed the herbicide was virtually harmless.

Controversy: Advocates for *Roundup* are skeptical of the epidemiological studies that criticize the use of glyphosate. The concern is valid since it is extremely hard to prove cause and effect with any substance. Having said that, is the potential harm of glyphosate to human health neglected due to the agricultural economic pressures? Since we do not have an alternative, why are some condemning this herbicide since the science is contradictory? For now, glyphosate is needed to reduce weed growth. After all, we have millions of children dying of hunger in third world countries. Furthermore, the trade group CropLife points out that glyphosate acts on plant enzymes only, and these plant enzymes aren't present in mammals.

Perhaps this is true, but we consume glyphosate-rich plants, and we know little about the long term human exposure of consuming glyphosate over time. New research is finding glyphosate alters the

growth of certain bacteria like *salmonella* contributing to the potential of antibiotic resistance. Some research is showing a link between human hormonal changes and glyphosate. Since glyphosate is everywhere many scientists believe more scrutiny is needed to examine the potential deleterious effects of a chemical so ubiquitous.

Biomagnification: When reviewing chemicals like glyphosate we need to consider how small harmless levels of poisons “amplify” as they move up the food chain. For example, we know that some algal species absorb small amounts of various pollutants like arsenic at levels barely detectable. In the absence of phosphorus, algae will take in arsenic because it is chemically similar to phosphorus. Next, one common zooplankton eats perhaps 100 cells of arsenic-rich algae. This one zooplankton animal now has the accumulated total of all the arsenic from the consumed algae. Following zooplankton, a fish will eat 1000 zooplankton animals also high in arsenic. Consequently a human catches and eats the toxic, contaminated fish. Another common example is the way mercury has bio-accumulated in the tissue of tuna making the overconsumption of tuna a possible health hazard. We know the process of biomagnification increases the potential exposure of any chemical that remains and moves up in the food chain. This makes some of us concerned about chemicals like **RoundUp** and the real potential danger of using this pesticide.

Opportunity for Improving the Water: A good white paper should also offer ideas for improving our lives through sound science and good business practices. With **Roundup**, I believe we have an opportunity to lower the levels of glyphosate in water using precision aquatic harvesting. My proposal is simple, what if we sample a large group of aquatic plants in a pond or lake and next measure the levels of glyphosate we detect for each plant. Suppose after sampling *Plant-A, Plant-B, Plant-C, etc...Plant-Z*, we learn that *Plant-Q* absorbs glyphosate 100x more than all the other plants studied. Wouldn't it make sense to use these plants in certain water bodies near farms to absorb the glyphosate and then harvest *Plant-Q* from the water body? Next we could either extract the glyphosate or safely dispose the contaminated plants. This may offer a way to lower the amount of glyphosate in water and improve the ecosystem for the beneficial aquatic plants and animals and may decrease human exposure as well. If we continue to use glyphosate, good environmental stewardship requires us to curb the persistence of this chemical before more plant and animal tissues are damaged.

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