
# Summary of
# Center for Food Safety's Science Comments to EPA on Monsanto's Request to Register Dicamba Herbicide for Use on Monsanto's Dicamba-Resistant MON 87708 Soybean

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The Monsanto Company has genetically engineered soybeans to withstand direct application of dicamba, a chlorinated broadleaf herbicide of the synthetic auxin class. Monsanto is seeking USDA approval of these dicamba-resistant soybeans (MON 87708) and EPA approval for use of dicamba on them. Below is a summary of CFS's science comments to EPA concerning the adverse impacts that would likely result from registration of dicamba on MON 87708. The full comments may be found at: http://www.centerforfoodsafety.org/wp-content/uploads/2012/10/CFS-Science-Comments-on-Dicamba-Use-Registration-for-Dicamba-Resistant-Soybeans.pdf.

In brief, the introduction of MON 87708 would trigger a huge increase in the use of dicamba herbicide in American agriculture. This in turn would trigger numerous adverse impacts, including: 1) Rapid evolution of weeds resistant to dicamba and related herbicides; 2) Much increased crop damage from the highly volatile dicamba drifting onto neighbors' crops; 3) Potential health harms to farmers and the public from greater exposure to dicamba; and 4) Injury to wild plants and animals that depend on them, including threatened and endangered species, from dicamba drift and runoff. Each of these issues are discussed below.

**Herbicide use**

The proposed registration would permit the use of dicamba herbicide on Monsanto's MON 87708 soybean, which is genetically engineered to withstand direct application of high rates of dicamba without risk of crop injury. Like many other herbicide-resistance genes used or envisioned for herbicide-resistant crops, the dicamba-resistance gene is derived from a soil bacterium that was originally intended for bioremediation. Public sector research intended to ameliorate pesticide pollution has been "repurposed" by pesticide-biotech firms to increase it. At present, dicamba is little used in American agriculture, and hardly at all in soybean production, with drift-related crop injury a major deterrent to wider use. The anticipated widespread adoption of MON 87708 would lead to an estimated 50 million lbs. of dicamba applied to soybeans, from just

16,000 lbs. at present. Because fear of injuring soybeans currently constrains use of this herbicide on naturally tolerant corn, MON 87708 would also lead to an additional 8 million lbs. of dicamba applied to corn. The projected dicamba use of 58 million lbs. per year would represent a more than 20-fold increase over current agricultural dicamba use (2.7 million lbs.). The anticipated introduction in several years of dicamba-resistant varieties of corn and cotton would drive dicamba use still higher. This increased dicamba use is unlikely to displace much if any of the glyphosate that currently dominates weed control in soybeans, meaning that overall herbicide use will rise sharply as well.

**Herbicide-resistant weeds**

U.S. agriculture's undue reliance on single-tactic, chemical-intensive weed control generates huge costs in the form of herbicide-resistant weeds – costs that could be avoided or greatly lessened with sustainable weed management techniques. Characteristic features of herbicide-resistant crop systems make them much more likely to foster evolution of resistant weeds than other (non-HR crop) uses of the same herbicide(s). This is clearly demonstrated by the history of glyphosate-resistant weeds, which have emerged almost exclusively in the Roundup Ready crop era. Weeds resistant to synthetic auxin herbicides, the class to which dicamba belongs, are already numerous, indicating that auxin-resistance is prevalent in the plant world. The proposed registration would facilitate greatly increased dicamba use on weeds already resistant to glyphosate and other herbicides, leading to still more intractable, multiple herbicide-resistant weeds. Clear evidence of cross-resistance to auxin herbicides in various weeds exacerbates the threat. Multiple herbicide-resistant weeds lead to increased selection pressure for resistance to evolve to the ever fewer remaining effective herbicidal control options. Volunteer HR soybeans with resistance to multiple herbicides may become ever more problematic weeds.

In light of these considerations, weed scientists have recently called for mandatory stewardship practices to address the likely emergence of auxin-resistant weeds with auxin-resistant crop systems. Monsanto's stewardship recommendations for MON 88708 are entirely inadequate. Because herbicide-resistant weeds, once evolved, can spread their resistance traits via cross-pollination and seed dispersal, stewardship recommendations that focus on persuading individual growers to "do the right thing" are ineffective, and risk undermining the utility of valuable herbicides for non-HR crop uses. Regulation is a rational response to this "tragedy of the commons" dilemma, in which the susceptibility to weeds is the common resource rapidly being squandered.

**Crop injury from dicamba drift**

Herbicide-resistant crop systems promote greater use and later application of the associated herbicide(s), thus posing greater risks of crop damage than other uses of the same herbicide(s). Dicamba is extremely prone to drift. Despite very limited use, it is already one of the leading culprits in herbicide drift-related crop injury episodes. Like all herbicides, dicamba can drift during application. Unlike most others, dicamba can volatilize from plant surfaces days after application and move long distances, when weather conditions are right. In either case, dicamba can drift to neighboring fields and

cause severe crop damage. Less volatile dicamba formulations may pose comparable risks to more volatile ones in the field, despite apparent differences in controlled experiments. Soybeans are injured at 1% of a typical dicamba application rate, tomatoes at 0.3-0.5%. Practically any broadleaf (non-cereal) crop is at risk of dicamba drift damage, particularly at flowering stage. The huge increase in dicamba use that would occur with widespread adoption of MON 87708 would greatly increase crop damage in rural America, leading to litigation and dissension in rural communities.

**Potential health impacts from dicamba**

Epidemiology studies have tentatively linked exposure to dicamba to increased incidence of colon, lung and immune system cancers in pesticide applicators. Other pesticide applicators exposed to dicamba exhibited a 20% inhibition of an enzyme critical to brain function. Children who ingest residues of other pesticides that have this effect exhibit higher rates of attention deficit hyperactivity disorder. Pregnant mice that ingested water spiked with low doses of a commercial herbicide mix that includes dicamba had smaller litters, suggesting developmental toxicity. Dicamba has been found to damage DNA at high rates, and to be transformed by sprayed plants into forms that are mutagenic in standard assays. Vastly increased use of dicamba in the context of MON 87708 can only exacerbate any adverse impacts it may have on human health.

**Environmental impacts**

As explained above, MON 87708 will foster rapid evolution of weeds resistant to dicamba and multiple herbicides. The use of tillage will increase to control such intractable weeds, triggering greater soil erosion. Contrary to conventional wisdom, it is clear that federal farm policy – not herbicide-resistant crops – is responsible for declining use of tillage in American agriculture. Most environmental impacts of MON 87708 will stem from dicamba use. Dicamba will be used in much greater quantities, on much more acreage, and later in the season, resulting in more injury to wild plants and animals via dicamba in runoff, spray drift and volatilization.

Dicamba is mobile and persistent, and is thus found in surface and ground water. Plants can take up dicamba via contaminated water, a particular threat to plants along rivers and in wetlands. Spray drift and volatilization of dicamba will impact vegetation near MON 87708 soybean fields, and also at a distance, so that plants in many types of habitats will be at risk. Increased use of dicamba later in the summer with MON 87708 will harm many plants that are vulnerable when they are flowering. Drift levels of dicamba may also foster plant pests and pathogens. Harm to plants will also affect the animals that depend on them. Biodiversity may suffer. Studies showing that dicamba has adverse reproductive and nervous system effects suggest that wild animal may be directly harmed from increased dicamba use. Also, dicamba is metabolized differently in MON 87708 tissues than in non-engineered soybeans, and the toxicity of the new metabolites has not been assessed. The effects of these dicamba metabolites on animals that eat soybean tissues, and on pollinators that consume nectar and pollen, need to be determined. Threatened and endangered plants and animals are vulnerable to the same harms from increased dicamba use with MON 87708, but the stakes are higher.