



Impacts of GM crops on agrochemical use in the US

This is a summary of a paper by Dr Charles Benbrook. It confirms the conclusions of our report *Seeds of Doubt* (September 2002) about GM herbicide tolerant (HT) crops resulting in increased dependency on herbicides and shows that herbicide use on GM maize and soya has increased dramatically in the US in recent years. This completely undermines the recent claims the biotechnology companies have been making about reduced herbicide use on GM crops and the positive findings of the Farm Scale Evaluations (FSEs) about GM HT maize.

Summary

- In the US, reductions in agrochemical use on GM crops were only temporary. After a few years GM crops have led to a substantially greater use of herbicides than non-GM crops with significant year on year increases particularly for GM soya and maize.
- In 2001, 5% more agrochemicals (herbicides and insecticides) were sprayed than if non-GM varieties only had been grown; in 2002 7.9% more was sprayed; and in 2003 an estimated 11.5% more was sprayed. In total, 73 million pounds lbs more agrochemicals were sprayed in the US during 2001-2003 as a result of GM crops.
- Chart 5 is very striking showing the year on year percentage increase in agrochemicals used in the US as a result of GM crops: from the maximum reduction of 3.2% in 1997, to a small net increase in 1999 of 0.7%, to the increase of 7.9% in 2002 and preliminary estimated increase of 11.5% in 2003.
- The data shows that during 2002-03, an average of 29% more herbicide was applied per acre on GM HT maize than non-GM maize and an average of 46% more herbicides was applied per acre to GM HT soya than non-GM during 2001-2003.
- This is the first study of agrochemical use on GM crops which looks at the most recent impacts (since 2002). It is in agreement with USDA estimates for earlier years. The only other estimates have been from a pro-GM organisation, which did not correlate with US Department of Agriculture (USDA) data and were not based on such recent data.

Quotes from the report

- "Proponents of biotechnology claim that GE varieties substantially reduce pesticide use. While true in the first few years of widespread planting it is clearly not the case now"
- "There is now clear evidence that the average pounds of herbicides applied per acre planted to herbicide tolerant (HT) varieties have increased compared to the first few years of adoption ... Herbicide tolerant crops have increased pesticide use an estimated 70 million pounds [lbs] over the last eight years,"
- "Changes in herbicide use now need to be monitored over full crop rotation cycles, not just in the years when a field is planted to an HT variety." [Only the first year was monitored in the FSEs.]
- "The efficacy of HT technology is now seriously threatened by weed shifts and resistance. Herbicide use and costs are bound to rise for the foreseeable future."

General points

- This paper was produced 25 November 2003 by Dr Charles Benbrook, agronomist and Director of the Northwest Science and Environmental Policy Center.

- Benbrook CM (2003) *Impacts of Genetically Engineered Crops on Pesticide Use in the United States: The First Eight Years*, BioTech InfoNet, Technical Paper No 6, Nov 2003, <http://www.biotech-info.net/technicalpaper6.html>
- It analyses agrochemical (herbicide and insecticide) use over eight years (1996-2003) on the three main GM herbicide tolerant (HT) crops in the US (soya, maize and cotton) and the two main GM Bt crops (maize and cotton).
- The figures for 2003 are preliminary as final USDA data is not yet available
- The current % of total crop acreages which are GM in 2002 in the US are as follows. 75% of soya was GM (all HT). 9% of the maize was HT, 22% was Bt and 2% was 'stacked' with both traits (34% was GM in total). 71% of the cotton acreage was GM. (The figures for 2003 are all higher but only estimates are available at the moment).

Findings of the report

- There was an initial reduction in herbicides sprayed as a result of GM HT crops, but there have been year on year increases and since 1999 there has been a net increase in herbicides sprayed with now substantially more being used (eg. 25 million pounds lbs more were applied in 2002 and an estimated 36 million pounds lbs more in 2003). Meanwhile, herbicide use on non-GM crops has been falling steadily.
- Over the first three years of GM crop production in the US (1996-98), the amount of agrochemicals used was reduced by a total of 25.4 million pounds lbs as a result of growing GM varieties. However, over the latest three years (2001-2003), there was an increase of 73 million pounds lbs as a result of growing GM crops.
- Over the whole eight years, there has been a 70.2 million pounds lbs increase in herbicides used as a result of GM HT crops and a 19.6 million decrease in insecticides sprayed as a result of growing Bt crops, giving a net increase of 50.6 million pounds lbs sprayed over the eight years because of GM crops.
- The data in the paper shows that during 2002-03, an average of 29% more herbicide was applied per acre on GM HT maize than non-GM maize. An average of 46% more herbicides were applied per acre to GM HT soya than non-GM during 2001-2003. 11% more was applied to GM cotton than non-GM during 2001-2003.
- The year in which a net increase in herbicide use manifested was 1998 in the case of HT soya (ie. in only three years); 2000 for HT cotton; and 2002 for HT maize (in seven years) [The figures for HT crops are the only ones relevant to the UK as only GM HT crops are being considered for commercialisation.]
- The figures for agrochemical use on Bt crops do not include the continuous production of Bt insecticide by the Bt plants themselves, to which all wildlife feeding on the plants and consumers are exposed; this would be significant in quantity.
- HT soya: from a reduction in agrochemicals of 0.36 pounds/acre in 1996 compared to non-GM soya; there was 0.47 pounds/acre more sprayed on HT soya than non-GM soya in 2003. During 2001-2003, an average of 46% more herbicides were being applied/acre to HT soya than non-HT. In total as a result, 24% more herbicide was sprayed in the US in 2001 because of growing HT soya, 22% more in 2002 and an estimated 31% more in 2003.
- HT maize: from a reduction of 0.8 pounds/acre in 1996, there was an increase of 0.58 pounds/acre of agrochemicals applied in 2003. During 2002-03, an average of 29% more herbicide was being applied /acre on HT maize than non-HT maize. 1.9% more agrochemicals were being sprayed in 2002 in the US because of growing HT maize and an estimated 3.6% more in 2003. The reasons for greater agrochemical use include an increasing need for other herbicides to achieve adequate weed control as the efficacy of the intended herbicide falls, changes in tillage systems, and a downward trend in herbicide application on non-GM varieties.
- HT cotton: from a reduction of 0.64 pounds/acre in 1996; there was 0.17 pounds/acre more being applied in 2003.

- **Bt crops (maize & cotton):** the total amount of insecticides on Bt crops is not known because the amounts produced by the plants cannot be calculated. In total on both crops, the amounts *sprayed* fell by 2-2.5 million pounds lbs annually; the reduction in 2002 was 2.3 million pounds lbs which is c.7% of total. These reductions, moreover, are decreasing. On Bt maize, the reduction went from 0.33 pounds less/acre in 1996 to 0.06 pounds less/acre in 2003. On Bt cotton, the reduction went from 0.38 pounds less/acre in 1996 to 0.2 pounds less/acre in each year 2001-03.

Reasons for the increase in agrochemical use

- The main reason for the increase in herbicides is that, as predicted by scientists, the heavy reliance on a single herbicide with HT crops (mainly glyphosate) resulted in the fast spread of more resistant weeds species ('weed shifts') and the development of resistance among weeds that were previously easily controlled by a single spray.
- For GM maize, the reasons also include changes in tillage systems [the use of minimum tillage systems in non-organic farms means a greater use of herbicides] and the falling use of herbicides on non-GM varieties.
- Lower herbicide prices combined with the much greater flexibility of applying herbicides on GM HT crops. The price of glyphosate herbicides has fallen by half since the introduction of HT crops, from \$12/acre treated to less than \$6/acre.
- The level of herbicides and insecticides used on non-GM crops is continuously falling due to the increasing use of lower-dose agrochemicals and regulatory restrictions on high-dose herbicides.

Methodology of the analysis

- The annual USDA data was used for crop acreages and for the proportions which were GM
- Data was used from the USDA National Agricultural Statistical Survey (NASS) surveys of agrochemical use on each of the different crops in each state.
- The comparative amounts of herbicide used on GM vs. non-GM varieties were estimated using industry and official sources and expert advice. Eg. for HT maize, data from weed management programmes used by Monsanto, actual NASS reported application rates, and weed management consultants' advice were used. (The USDA does not routinely collect and compare data on agrochemical use on GM and non-GM crops).

Other studies

- US government (ERS) estimates of the impacts of GM crops on agrochemical use were only based on data from 1997 and 1998. These are in agreement with the findings of this report, eg. both found an increase in herbicide use of 2.3 million pounds from HT soya in 1998.
- NCFAP (a pro-GM organisation) made estimates for the impacts on agrochemical use in 2001. Their findings are in agreement with this analysis for Bt crops, but not HT crops. The NCFAP data does not correlate with USDA data for herbicide use on HT soya; it seems they overestimated herbicide use with a greater overestimate for non-GM soya (as a result they estimated 0.57 pounds less/acre with HT soya than non-GM in 2001 while this study found HT soya resulted in 0.34 pounds/acre more being applied).

Soil Association Campaigning for organic food and farming and sustainable forestry
 Bristol House, 40-56 Victoria Street, Bristol BS1 6BY
 T: 0117 929 0661 F: 0117 925 2504 E: info@soilassociation.org
www.soilassociation.org

Version 010.2 Approved: