

# Transgene Escape! - But No One Has Called Out the Guards

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*As New Scientist and others have recently reported, transgenes are now known to have established themselves in wild populations even while their application for commercial release is still under consideration. Dr Gurian-Sherman is the author of a recent report on transgenic field trials.*

## Introduction

One route by which transgenes (the genes engineered into crops) may cause harm is by permanently escaping from agricultural environments into wild or natural areas. This is not likely to happen with most GMO crop plants, because most crops have been hobbled by millennia of breeding and cannot survive without human intervention, such as planting and weeding. The addition of one or several transgenes generally cannot overcome this long history of domestication. However, most crops have wild relatives that they can interbreed with, thus passing crop genes and transgenes into these wild species. For example, over 20 important crops grown in the U.S. have related wild species they can mate with (1).

Unlike the crop, these wild plants can thrive without human assistance. In fact, some are also troublesome weeds that can harm the wild environment or farmers' fields. In some cases, the addition of transgenes may make the wild plant a more aggressive weed, or harm wildlife that consumes the plant.

## Transgene escape

Recently, *New Scientist* (NS) magazine reviewed new research that found just such an escape (2). Although not a food crop, the escape artist, creeping bentgrass, is widely grown on golf courses and lawns in the U.S. As the NS review noted, 9 of 20,400 wild bentgrass plants were transgenic, and the plants were found as far as 3.8 km from the edge of a "control district" that contained the field trials. This is the first documented escape of transgenes in the U.S., and probably the first known escape from a field trial anywhere. The review acknowledges that if the transgenic grass reaches sensitive waterways (a typical habitat for this grass species), controlling it with Roundup® (glyphosate) would not be an option. Roundup® is one of the few herbicides allowed for this purpose because it degrades rapidly in water. The article also briefly quotes one of the researchers as saying, somewhat cryptically, that the bentgrass story is a cautionary tale of what could happen with other GMOs that could be of greater concern, and that he expects more examples of escape to be discovered.

Despite these warnings, the NS review is rather dismissive, beginning by noting that the bentgrass escape is "hardly an alien invasion," and ending with a comment from another scientist remarking that people probably would not worry about lawns and golf courses if they have not shown worry over GMO foods. However, as discussed below, this perspective misses the bigger picture. This story of runaway transgenes actually began more than four years ago when the field

trial of herbicide tolerant transgenic creeping bentgrass was planted with the blessings of the U.S. Department of Agriculture. It came to the attention of the public two years later, in a predecessor to the current research paper, in which US Environmental Protection Agency (EPA) scientists demonstrated pollination of wild creeping bentgrass plants by field trial plants carrying the experimental transgenes (3).

Although field trial operators followed USDA recommendations to prevent such pollination by separating the field trial from wild bentgrass plants by 900 ft, pollination was found as far away as 21 km. Such pollination is the first step in the permanent escape of experimental transgenes into the environment.

In the new research paper, the same group of scientists has shown that the wild plants were not only pollinated, but that some of the resulting seeds successfully grew into GMO plants containing the gene for Roundup® herbicide tolerance, and are now established in the environment (4).

In addition to the points mentioned in the *NS* review, the new paper notes that only about 10% of the suitable bentgrass habitat in the area was surveyed for escaped transgenic plants, so many more such plants may be happily growing unobserved. The paper also notes that the Roundup® resistance trait combined with the use of Roundup® can facilitate the spread of the transgene.

Although considerable attention has rightly been devoted to contamination of food by commercialized GMO crops, little attention has previously been given to contamination or transgene flow from field trials. This is in part because most field trials are small and of short duration, reducing the chances of contamination. However, if transgenes that increase the fitness of wild plants escape into wild relatives of crop plants, they can spread, and these 'wild' transgenic plants could occupy much more of the environment than the original field trials. In some cases, they could ultimately occupy more land than many commercialized GMOs. And although the current research and *NS* review focus on the Roundup® resistance transgene, hundreds of other types of experimental transgenes have been used in field trials.

The significance of escape of a GE Roundup® resistance transgene is given short shrift in the *NS* review, by suggesting that wild creeping bentgrass is not an invasive or noxious species. However, the lack of listing as a noxious weed is overshadowed by official comments to USDA by several US national agencies and private wild-land managers, expressing concern about creeping bentgrass and the importance of glyphosate herbicide to control it (5).

### **The greater escape?**

Left unsaid in the *NS* review is that there have been not one, but about 170 GE creeping bentgrass field-trial approvals in the US, and most occurred after the field trial that was the subject of the new paper. Many of the other creeping bentgrass field trials are for traits like fungal disease resistance that may spread in the environment more readily than glyphosate resistance and may also cause more harm (6).

Although glyphosate resistant bentgrass provides the first documented example of transgene escape from an experimental GMO field trial, it is unlikely to be the only one. In the US alone, there have already been several thousand approved field trials of experimental transgenes in crop plants which have wild relatives (7).

Furthermore, many of the hundreds of transgenes that have been used in other field trials, such as those conferring pathogen resistance, have the potential to provide a large fitness advantage to escapees or wild relatives. Yet, as far as can be determined, there have been very few other cases where scientists have tried to discover whether these experimental transgenes have made their escape. Another concern is that most of the transgenes in field trials have not undergone any significant risk assessment – certainly much less than for commercialized GMOs. Therefore, transgenes that escape from field trials will often have largely unknown risks (8).

While the USDA takes credit for the current in-depth review of the safety of GMO creeping bentgrass, they neglect to mention that their hand was forced by the concern of other federal agencies, a Center for Food Safety (CFS) lawsuit, and the original paper on pollination from the bentgrass field trial.

The reluctance of the USDA to perform thorough risk assessments of experimental field trials, unless forced to do so, can be gauged by the similar lack of scrutiny to the many GMO field trials of other perennial grass species. Likewise, no increased scrutiny has been devoted to field trials of the over 20 other crops which have wild relatives in the US.

Many of these crops, and others, have related wild plants that also grow in Europe and other parts of the world. And although the chances of gene flow from any one field trial may be low, the case of GMO bentgrass shows that many more gene escapes can be expected. This will likely result in the permanent escape of transgenes, that have undergone little risk assessment, into the natural environment.

**For more detail on the regulation of field trials for GMO crops with wild relatives, as well as lists of those crops, field trial information, and the science behind gene flow, see the recent Center for Food Safety Report: *Contaminating the Wild?* [http://www.centerforfoodsafety.org/pubs/Contaminating\\_the\\_Wild\\_Report.pdf](http://www.centerforfoodsafety.org/pubs/Contaminating_the_Wild_Report.pdf)**

## References

1. Doug Gurian-Sherman, 2006, “Contaminating the Wild? Gene Flow from Experimental Field Trials of Genetically Engineered Crops to Related Wild Plants,” Center for Food Safety, Washington, DC [http://www.centerforfoodsafety.org/pubs/Contaminating\\_the\\_Wild\\_Report.pdf](http://www.centerforfoodsafety.org/pubs/Contaminating_the_Wild_Report.pdf).
2. Andy Coghlan, “Escaped golf-course grass frees gene genie in the US,” *New Scientist*, August 9, 2006; <http://www.newscientist.com/article.ns?id=mg19125643.100>.
3. Watrud L *et al*, 2004, Evidence for landscape-level, pollen-mediated gene flow from genetically modified creeping bentgrass with CP4 EPSPS as a marker. *Proc. Natl. Acad. Sci. USA* **101**(40)14533-14538.
4. Reichman JR *et al.*, 2006, Establishment of transgenic herbicide-resistant creeping bentgrass (*Agrostis stolonifera* L.) in nonagronomic habitats. *Molecular Ecology* doi: 10.1111/j.1365-294X.2006.03072.x.

5. Center for Technology Assessment/Center for Food Safety, Re: Docket No. 03-101-1, petition from Monsanto Co. and The Scott's Co. seeking a determination of nonregulated status for glyphosate-tolerant creeping bentgrass (*Agrostis stolonifera* L.),

<http://www.centerforfoodsafety.org/pubs/CommentsGEBentgrass3.4.2004.pdf>.

6. Gurian-Sherman, 2006, "Contaminating the Wild?", op. cit.

7. Gurian-Sherman, 2006, "Contaminating the Wild?", op. cit.

8. Gurian-Sherman, 2006, "Contaminating the Wild?", op. cit.