I am a farmer and member of the Advisory Committee on Releases to the Environment (ACRE).

I welcome the informative approach taken by the panel and the wide coverage of the Review. I am grateful for the opportunity to comment on the document.

1. Issues relating to use of glyphosate-tolerant crops and weed resistance/shift.

Glyphosate is a widely used pesticide in conventional agriculture in the UK. In my opinion it is of particular importance because it is active against perennial weeds. I believe that changes in management that may increase the rate of appearance of weeds resistant to glyphosate are of concern.

I would like the panel to consider the following:

A. Are there any characteristics of the proposed use of glyphosate in GMHT crops that will increase the chances of weeds resistant to this chemical becoming more common or appearing sooner on UK farmland than is likely to be the case with the current pattern of use?

B. If weeds resistant to glyphosate become more widespread in the UK, what responses by UK farmers could be expected (in the growing of both GMHT and conventional crops)? What would be the environmental consequences of these responses? I particularly ask this with regards to the long-term and to resistance developing in perennial weeds.

C. Typical application rates of glyphosate to control perennial weeds seem to be higher than the rates that may be recommended per application for use with GMHT crops. It is also currently recommended that glyphosate is applied to perennial weeds when they have a well-developed leaf area. The use of glyphosate in GMHT crops will focus as much on control of annual weeds as perennials. It therefore seems likely that application will occur before perennial weeds have developed as much leaf area as would be preferred. Could reduced application rates (per application) and less than optimal timing increase the potential for perennial weeds developing resistance to glyphosate?

D. On page 179 the introduction of GM cereals is linked to potential reductions in herbicide use. If GMHT cereals are tolerant of glyphosate/glufosinate, could this increase the rate of weed shift/herbicide resistance to these chemicals (and so the chance of farmers deciding to use herbicide mixes)? It may be that GMHT cereals would be tolerant of herbicides other than glyphosate and glufosinate. If so, which are the most likely herbicides and is their environmental profile better than the current choice of herbicides?

The last paragraph on page 143 notes that paraquat is being recommended to control herbicide tolerant OSR voluteers in Canada, and that this chemical could cause harm to hares. It should also be mentioned that paraquat is highly toxic to people. An increase in use of paraquat could increase risks to sprayer operators among others. This may become an issue if a wider range of GMHT crops are widely grown in the UK (e.g. cereals).

2. Animal feeding trials

I am concerned that there appears to be no routine quality control on how animal feeding trials are designed, conducted and reported. It seems to me that these aspects of trials are not consistently carried out to high standards. There seems little immediate prospect of scientifically-sound, statistically powerful assessment of impacts on humans or wildlife of eating GM crops. I therefore believe that the quality of animal feeding trials needs to be high and we need to be checking that this is the case.

I would like to know whether there are consistently applied quality control standards for feeding trials. If there are not, I would like the panel's opinion on whether such controls would be desirable in order to ensure good standards in this aspect of the scientific assessment of GM crops?

3. Pest diversion to non-crop flora (page 155)

The study referred to here (Dewar *et al*. 2000) uses one conventional beet treatment and three different GMHT treatments (that have different dates for the application of glyphosate).

If my understanding of this paper is correct, the two later spraying dates for glyphosate do show reductions in number of aphids on beet compared to the conventional treatment (Table 3). But, they also show major reductions in crop yield (76 and 68% of conventional plot yield), and therefore are strategies farmers may be unlikely to adopt.

The earliest-sprayed glyphosate treatment, which showed a yield increase compared to the conventional treatment, had more aphids on the beet in mid-June than the conventional crop. This does not seem a good case for suggesting GMHT crops could reduce aphicide use. The opposite could equally as well be suggested, especially bearing in mind how farmers may actually respond to yield differences.

The paper refers to other work (Hani *et al* 1990) where band-spraying beet reduced aphid colonisation and virus infection. The Dewar *et al* paper does not detail the yields from the different treatments in Hani *et al*, nor is it clear whether the crop with reduced virus infection was GM or not (judging from the year, it probably wasn't).

If my understanding of the Dewar *et al* paper is correct, I think the suggestion in the Review that GMHT cropping may reduce aphicide use should only be made if there is more evidence to back this up (further work is referred to in the paper). The possible use of band-spraying with GMHT may seem to support the claim. However, as the Review points out (page 152), one reason US farmers have adopted GMHT technology is because weed control is more convenient. If convenience is an important factor in uptake of GMHT crops here, then use of band-spraying may be limited.

4. Saxena & Stotzky, 2001 ('Bt corn has a higher lignin content than non-Bt corn') and unexpected effects of a genetic modification.

A. The increase in lignin content of GM Bt maize stems in this paper seems unrelated to the actual intended effect of the introduced GM trait. As mentioned in the Review (page 187), RR soya bean experienced stem splitting that could have been related to higher lignin levels. This could be an example of an unexpected effect of a GM trait limiting the productivity of the crop – that is, there may be a significant price to pay for the benefits of the intended GM trait.

Do the panel have any evidence whether such unexpected impacts will limit the practical application of many/any of the traits mentioned in the horizon scanning section (6.6), or on page179? I particularly ask this with regard to GM crops with multiple traits (e.g. herbicide tolerance, insect resistance and raised protein level) or crops that alter potentially more complex aspects of plant metabolism (e.g. nitrogen efficiency).

To put this more generally - do the risks of unforeseen effects on a plant increase as the genetic modifications made to it become more numerous or complicated? If so, how should this be fed into horizon scanning/predictive exercises to make them more realistic – i.e. is there any expectation that:

- a proportion of the traits in 6.6 will not be realised because plants do not grow well enough once the traits have been introduced?
- we will have to make choices between traits because plants will only be able to cope with so much change (i.e. we could have an oilseed rape that combines herbicide tolerance and insect resistance, or oilseed rape with altered oil constituents, but all three traits in one plant is less likely to be viable)?

B Could unexpected changes, such as raised lignin levels, have effects on food chains or either GM crops or wild plants capable of cross-breeding with GM crops. For example, if HT oilseed rape had raised lignin levels, could this be inherited and become a selective advantage in sexually compatible weeds (perhaps by helping the weed resist insect attack)?

C Has there been an analysis of how common such unexpected internal (structural/metabolic) changes are in GM plants? If so, how does this compare with rates of unexpected change in conventionally bred cultivars? (e.g. you could develop a HT crop through conventional methods and by GM. Do we have any understanding which process would be more likely to lead to unexpected effects that would not show up in the crop's physical appearance, or be found in routine compositional analysis?).