in particular that should be "genetically modified" are the organisms producing the enzymes for lignocellulose degradation. Algae as a source of liquid biofuels or hydrogen are not mentioned anywhere, yet their culture in seawater has considerable potential to solve the fuel versus food debate discussed at length in the report[2].

Worse yet they ignore the toxicological and environmental dangers of some of these crops. Castor bean and *Jatropha curcas* (common name: vomit nut), sources of the closely related, exceedingly potent ricin and curcin are widely discussed, and *Jatropha* has an entire box dedicated to its culture ("Jatropha—a 'miracle' crop?"), where the answer on balance is "yes." Nowhere in the report do curcin or ricin appear, nor is there a mention of the cancer potentiators and allergens in *Jatropha.* Unlike soybeans, the protein of the seed of both crops is poisonous (but can be partially detoxified by autoclaving), so there is no possibility of feeding the protein to livestock. No environmental impact or worker toxicological studies have been published that deal with the implications of applying the residues to farmers' fields, as they suggest. The toxins could be eliminated by antisense or RNAi technology, and the residues used as feed. Where is the FAO in dealing with farmer safety? Imagine releasing a transgenic crop with such properties. They do not even cite those who have analyzed and questioned the economics of *Jatropha*[3]. Is the FAO really interested in keeping poor farmers poor? Alas transgenics could rapidly solve many of these problems in domestication that the FAO so glibly ignores[4,5]. So many of the troublesome genes are known, the crops have been previously transformed, but if organizations, such as the FAO, do not recognize the problems, who will deal with the biotechnological solutions?

COMPETING INTERESTS STATEMENT
The author declares competing financial interests: details accompany the full-text HTML version of the paper at http://www.nature.com/naturebiotechnology/.

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4. Gressel, J. *Plant Sci.* **174**, 246–263 (2008).
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**Terri Raney replies on behalf of the FAO:** Jonathan Gressel claims that our report[1] inadequately addresses the potential of genetic modification to support the development of biofuels. The aim of the report is to examine the economic and policy drivers behind the recent rapid expansion in the production of first-generation liquid biofuels and the implications of this expansion for agricultural markets, food security and the environment. The report discusses the need for research and the importance of improved technologies, both in feedstock production and conversion to biofuels, to enhance the environmental and economic performance of biofuels. It also dedicates a short box to the application of biotechnologies (including genetic modification) to biofuels. Even so, technology is not the central focus of the report. (Readers may be interested in knowing that FAO published a comprehensive assessment of agricultural biotechnology, including transgenic crops, in a previous edition of *The State of Food and Agriculture*[2].)

The present FAO report[1] finds that the recent rapid expansion in liquid biofuel production offers both risks and opportunities for the global food and agriculture system primarily through its impact on commodity prices. The immediate risk is that higher prices hurt poor consumers in the developing world, who often spend more than half their total household income on food. The opportunities derive from the fact that agriculture is the engine of economic growth in many parts of the developing world, and higher commodity prices can provide the incentives and stimulate the investments needed to revitalize the sector. Most of the world's poorest people depend on agriculture for their livelihoods, so higher prices may translate into higher incomes for them. Minimizing the food security and environmental risks associated with first-generation biofuels and maximizing the potential opportunities for agricultural development would require a shift away from current policies that subsidize the production of first-generation liquid biofuels, toward a more balanced package of policies that consider environmental, food security, energy and agricultural development needs in a more integrated way.

Gressel is particularly critical of a short box in the report which he interprets as giving a positive assessment of the potential of *Jatropha curcas* as a biofuel feedstock. The box reports that *Jatropha* is receiving considerable attention in many developing countries as a drought-tolerant plant that can grow under marginal conditions with limited external inputs. The box notes, however, that many of the positive claims for *Jatropha* are not supported by current evidence, the crop has not been fully domesticated and thus is subject to wide variations in agronomic performance; furthermore, it has not been produced on a large scale and thus may have unknown environmental and economic implications. The box concludes that these risks warrant a cautious approach to *Jatropha* development. Gressel emphasizes toxicity as an additional risk associated with the crop, but it and other naturally toxic plants have a long history of safe use in the agricultural sector.

We would like to note that FAO conducts broader programs of work on bioenergy and biotech than could be covered in *The State of Food and Agriculture* biofuels report. Last month, for example, FAO hosted an electronic conference on biotechnologies for bioenergy production in developing countries[3]. This conference may address Gressel's concerns more directly. FAO is also considering bioenergy production systems that may be important in the future, such as those involving production of biodiesel from microalgae or of second-generation biofuels from lignocellulosic biomass. For their development, research and technology are fundamental. If second-generation biofuels are to become a reality in the future, technological breakthroughs will be needed, although they alone will not be sufficient. Second-generation biofuels will also have to be economically viable and environmentally sustainable.

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