PG Economics Limited

Briefing note: 17 April 2009

Union of Concerned Scientists report on GM crop performance is mis-leading

PG Economics[1] has reviewed the Union of Concerned Scientists (UCS) latest release *Failure to yield: evaluating the performance of genetically modified crops*, and concluded that the public, policy makers, stakeholders and media need to be aware of its misleading nature through a combination of inappropriate use of data and omission of representative, relevant analysis.

PG Economics concludes that the UCS report title does not reflect the report findings. Fundamentally, the UCS report confirms that GM crop technology has improved crop yields and productivity in the US.

PG Economics has, below, identified a number of deficiencies in the UCS report and presented a summary of the key real impacts of GM technology. For those reviewing the UCS report, it:

- *Misleads by examining issues from a narrow geographical perspective:* Given GM crops have been grown commercially worldwide on a large scale since 1996, any appropriate evaluation of GM trait performance should be undertaken from a global perspective, rather than the US-only perspective adopted by the UCS. It is in developing countries where GM technology has delivered the highest positive impacts on operational yield (eg, corn in the Philippines, cotton in India) and facilitated the wider use of second cropping in a season (eg, soybeans following wheat in Argentina)
- *Misleads by examining issues from a narrow crop perspective*. The UCS report focuses only on soybeans and corn, yet ignores the two other crops in which GM traits are widely used; cotton and canola. GM trait use in these crops has resulted in higher operational yields for most users, increased production and improved standards of living for those farmers using the technology (including US farmers). For example, the average operational yield impact of GM insect resistant (GM IR) cotton technology (1996-2006) has been +11.1% across all global users
- *Is inconsistent:* the UCS document claims in the executive summary that '*GE (genetic engineering) has done little to increase overall yields.* The headline to the release also says *'failure to yield*', yet the detailed content of the report shows the opposite and subsequently acknowledges that GM insect resistant corn has increased (operational) yields in the US. The UCS report also states that *'now that transgenic crops have been grown in the US for more than a decade, there is a wealth of data on yield under real world conditions*'. This gives the reader the impression that the paper is drawing on such research to come to its conclusions. Yet the vast majority of references cited in the report are of crop trials, not studies of real world experiences of commercial farmers using GM technology
- *Makes inappropriate use of data.* The UCS discusses the importance of increasing food production to feed a growing world population and especially the importance of improving agricultural productivity in developing countries. However, the vast majority of the data and studies drawn on do not examine agricultural productivity issues and the use of GM technology in developing countries but are almost all drawn from the US. The UCS also claims that public resources should be re-directed from GM technology research to low input/organic research. However, no data on the

[1] As authors of a number of peer reviewed published reports and papers on the impact of agricultural biotechnology

relative expenditures of public funds on each of these categories of research and no analysis of any benefits of such a change are presented.

A summary of key real impacts of GM technology and comments on the main deficiencies in the UCS report are presented below. *For additional information: contact Graham Brookes on 00 44 1531 650123 or graham.brookes@btinternet.com*

The real impact of GM crop technology

1. Peer reviewed research in scientific journals[2] consistently shows that GM crop technology has delivered substantial economic and environmental advantages. In the first eleven years of commercial use (1996-2006), incomes of the 10.25 million farmers using the technology increased by over $33.8 billion and pesticide use is 7.8% lower (a saving of 286 million kg of active ingredient) than it would otherwise have been if this technology had not been used. The reductions in the use of insecticides and herbicides, coupled with a switch to more environmentally benign herbicides, have delivered significant net environmental gains. Important savings in carbon dioxide emissions were also made, equivalent to removing over 6.5 million cars from the roads in 2006.

2. GM crops, through two main traits of insect resistance and herbicide tolerance[3] have, since 1996, added important volumes to global production of corn, cotton, canola and soybeans (Figure 1) - adding 53.3 million tonnes and 47.1 million tonnes respectively to global production of soybeans and corn. The technology has also contributed an extra 4.9 million tonnes of cotton lint and 3.2 million tonnes of canola.

3. Across the countries using insect resistant biotech crops, the average positive yield impact of the technology has been +5.7% and +11.1% respectively for biotech insect resistant maize and cotton respectively. Positive yield impacts have been highest in developing countries – eg, an average yield impact of +50% for biotech insect resistant cotton in India and an average of +24% for biotech insect resistant maize in the Philippines

4. In terms of contribution to feeding the world's population, the additional production arising from GM crops (1996-2006) has contributed (after taking account of non food and feed use), enough energy (in kcal terms) to feed 310 million people for one year (similar to the annual requirement of the combined populations of Indonesia and Vietnam). The contribution of additional protein and fat was enough to meet the requirements of 920 million and 390 million people respectively.

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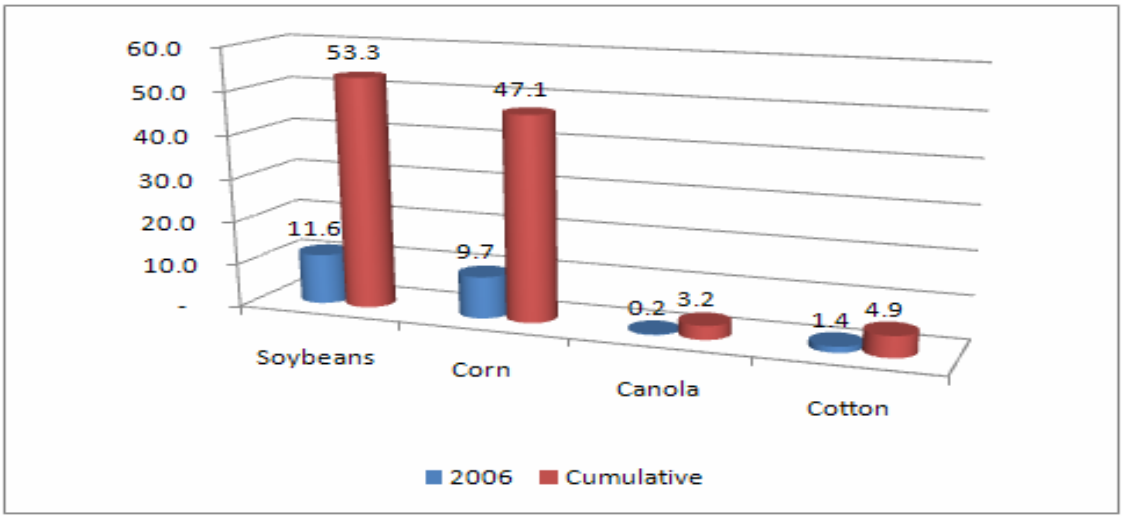
[2] *Note to readers – the evidence presented derives from peer reviewed scientific journal articles and is representative of real impacts at the commercial and subsistence farm level. For further information see Brookes G & Barfoot P (2008) Global impact of biotech crops 1996-2006: socio-economic and environmental impacts, Agbioforum 11 (1), 21-38 – www.agbioforum.org and its extensive reference list*

[3] Insect resistance in corn and cotton and herbicide tolerance in corn, cotton, canola and soybeans

5. In 2006, GM crops contributed enough energy, protein and fat[4] to meet the requirements of about 67 million (similar to the population of Thailand), 207 million and 124 million people respectively.

6. Production of soybeans, corn, cotton and canola on the areas planted to biotech crops, in 2006, were respectively +20%, +7%, +15% and +3% higher than levels would have otherwise been if GM technology had not been used by farmers.

Figure 1: Additional crop production arising from positive yield effects of biotech traits 1996-2006 (million tonnes)



7. If biotech traits had not been available to the (10 million plus) farmers using the technology in 2006, maintaining global production levels at the 2006 levels would have required additional plantings of 4.6 million ha of soybeans, 2 million ha of corn, 1.8 million ha of cotton and 0.15 million ha of canola.

8. About half of the $33.8 billion increase in farm income has been to farmers in developing countries (in 2006, 53.5% of the total benefit went to developing country farmers). This has added to farm household incomes which, when spent on goods and services, have had a positive multiplying effect on local, regional and national economies. In developing countries, the additional income derived from biotech crops (of which insect resistant (IR) cotton has delivered the highest levels of income benefit per hectare in countries such as India and China) has enabled more farmers to consistently meet their food subsistence needs and to improve the standards of living of their households. For example, household income levels have typically increased by over a third for many farmers using IR cotton in India and for farmers using IR corn in the Philippines.

9. 90% of the farmers benefiting from using the technology are small, resource-poor farmers in developing countries like China and India.

[4] After taking account of non food and feed use

10. GM crops have also delivered a number of other more intangible benefits to farmers. These include:
    - Herbicide tolerant crops have facilitated a switch from a plough-based to a no/reduced tillage production system which has helped reduce soil erosion (and cut carbon dioxide emissions)
    - Insect resistant crops have resulted in improved quality of food (eg, less cancer-causing mycotoxins in corn) and reduced exposure to insecticides for many farm workers in developing countries where use of protective equipment has traditionally been limited
    - Shortening the growing season allowing some farmers to plant a second crop in the same season (eg, maize following cotton in India, soybeans following wheat in South America). This has made an important contribution to increasing production levels of crops like soybeans (see 2. above)

Key inadequacies and the misleading nature of the UCS report

1. The UCS report purports to relate to issues of global food security and the importance of improving crop yields to feed the growing world population. If so, the context and role of GM technology should have been examined at a global level. By focusing on the US, it is misleading because biotech's contribution to improving 'operational' crop yields relative to alternative/conventional pest and weed control practices is typically lowest in developed agricultural economies like the US, where farm practices tend to be more efficient and effective than developing countries (ie, the baseline for measuring impact in the US has been one which US farmers have made widespread and efficient use of herbicides and insecticides to control pests and weeds, whilst in developing countries, the baseline tends to be one in which pests and weeds are much less effectively controlled). Not surprisingly, in the US the yield gains associated with the use of GM technology have been modest (eg, an average of +5% for GM IR corn and +10% for GM IR cotton) relative to the impact in developing countries (eg, an average of +24% for GM IR corn in the Philippines, +14% for GM IR corn in South Africa and +50% for GM IR cotton in India). US farmers have used GM IR technology for reasons like cost savings, some yield gain, production risk management and safety. US farmers have also made widespread use of GM herbicide tolerant (GM HT) crops, even though there have been no reported average operational yield gains from the technology in the US, for reasons of cost saving, management convenience and facilitation of no tillage systems. In contrast, GM HT technology use in other countries has, in some cases, delivered operational yield gains (from improved weed control). For example, an average +30% yield gain with the use of GM HT soybeans in Romania, an average yield gain of +15% with the use of GM HT corn in the Philippines. In addition, the use of GM HT technology, by facilitating the adoption of no tillage production systems in South America has shortened the production cycle for soybeans enabling many farmers to plant a second crop of soybeans in the same season (after wheat). This additional production accounted, for example, in 2007 for 30% of the total Argentine soybean crop.

2. The UCS report ignores the crops of cotton and canola where GM traits are widely used and delivering operational yield benefits. Both crops are used in the food and feed sectors and hence the positive impact of the GM traits on operational yield has made a direct contribution to increasing production at both national and global levels. In addition, the higher incomes generated by farmers using biotech traits in these crops (even where used in non food/feed uses, like cotton fibre) make important contributions to household incomes, enabling farming families

to improve their standards of living. The additional expenditure made by farmers with higher incomes also benefits rural economies. This has had a significant positive economic and welfare effect in developing countries like India.

3. Neither GM HT or GM IR technologies so far used in the US corn or soybean crops have offered (or claimed to offer) improvements to 'intrinsic' yield (as defined by the UCS report). It should however, be noted that GM HT canola (specifically Invigor canola) widely grown in the US and Canada does offer intrinsic yield improvements, and evidence from representative studies of commercially grown canola in these countries, shows that this technology has delivered yield gains at the farm level. This technology impact evidence in canola is ignored by the UCS paper.

4. The UCS report acknowledges in its summary that *'we must not simply produce more food at the expense of clean water, soil and a stable climate'*. This recognition of the importance of global agriculture needing to deliver improved production performance and environmental impact (ie, be more sustainable) is laudable. However, it is interesting to note that the UCS report fails to acknowledge the important environmental benefits delivered by GM technology, both globally and in the US since 1996. As summarised above, these include reductions in pesticide use and their associated environmental impact coupled with contributions to reducing greenhouse gas emissions.

5. The UCS paper claims that *'organic and low external input methods generally produce yields comparable to those of conventional methods of growing corn and soybeans'*. The evidence cited to support these claims are largely based on research studies that do not reflect the reality of commercial and subsistence farming[5]. For example, organic yields of corn and soybeans in the US are consistently found (eg, by national organic farmers survey results) to be between 20% and 30% lower than conventional corn and soybeans. Evidence that compares yields of organic and conventional production systems in other developed agricultural economies (eg, Europe) is also consistent with the US experience (ie, organic yields are consistently lower by 20%-30%).

6. The UCS report promotes *'the use of low-external-input methods such as organic'* as a key way of increasing food production in developing countries. Such production systems have merits in some locations, but are evidently not applicable on a global scale, where there are currently 6 billion mouths to feed. In fact, these are the very farming systems that dominate in many developing countries and regions such as Africa, and which are primary contributors to the poverty, food insecurity and malnutrition that plague such regions. As organic agriculture, on average yields only 70% of the yield of conventional agriculture, if we were to adopt wholly organic production systems as espoused by the UCS report, the world would have to plough up the rest of its wilderness locations just to produce the same amount of food the world currently produces. At the same time the ploughing up of current wilderness areas would have a major negative impact on biodiversity and the environment.

[5] The UCS report also cites a paper by Badgley C et al (2007) Organic agriculture and the global food supply, which has been subject to considerable criticism (eg, by Avery A (2007) Hudson Institute) for lacking credibility and being fatally flawed (claiming yields from non organic farming as organic, comparing organic yields to non representative non organic yields, selective use of data and misreporting yield results)

7. Disingenuous and inaccurate claims are made. For example, the UCS report claims to be *'the first to evaluate in detail the overall, or aggregate, yield effect of GE after 20 years of research and 13 years of commercialization in the US'*. The evidence says otherwise, with numerous yield impact studies of the technology in the US (largely ignored by the UCS report) being available, some of which estimate aggregate impacts across the country and which can be found in peer reviewed scientific journals, all pre-dating the UCS paper. It also claims that *'the biotech industry and others have trumpeted them (biotech traits) as key to feeding the world's future population'*. As agriculture technology analysts, we are not aware of such claims having been made by anyone in the biotech sector, with the vast majority of pronouncements and literature on the subject *'trumpeting'* the importance of using a range of approaches and technologies to feed the growing world population, of which GM technology is one tool.