Geoff Bell, CEO Microbiogen

QUESTIONS ANSWERED:

Question 9

ANSWER:
The above technologies are not the only technologies and certainly not necessarily the best technologies for the development of organisms to convert biomass sugars to ethanol and other valuable products. The problem with genetic engineering is that understanding all the implications of gene changes is still not a well understood field and there are significant industrial limitiations when using this technology. For example, by using generically modified and exotic organisms to convert the sugars, the organism itself becomes a waste product at the end of the process. Sugars are wasted in growing the GM organism to do the fermentation and dilute and industrially unwanted waste by-products such as acetate and glycerol are often produced. Another problem with the GM and exotic organism approach is the the organism itself has been either "weakened" through the GM process or was not of industrial grade in the first instance. These two limitations mean that any process that uses exotic and GM organisms is typically low in efficiency, is capital intensive and limits the number of products that can be produced. We believe that the development of GM organisms should be supported and as the technology matures, some major industrial breakthroughs are likely to be acheived. In the meantime the technology applied by Microbiogen that uses accelerated evolution to develop micro-organisms presents a much more appropriate development route with results achieved to date showing that a much more environmently friendly "fuel and food" biorefinery can be developed instead.

Question 13

ANSWER:
The food versus fuel issue may well have been solved by Microbiogen through the development of a non-GM organism that is of insustrial grade that has already demonstrated that it could be used in th real world. To put this breakthrough into perspective... The Microbiogen natural yeast uses the less favourable carbon sources of biomass such as xylose, acetate and glycerol and converts these typically unwanted carbon sources into yeast biomass. The yeast biomass that was grown on the xylose, acetate and glycerol is then used to convert the cellulosic sugars into ethanol efficiently and quickly. In fact, the yeast not only convertes the cellulosic sugars to ethanol, but it cleans the waste streams of high BOD carbon products and any excess yeast is then able to be sold as a high protein food for animals or even humans. By way of example, one hectare of sugar cane can currently produce approximately 5 tonnes of ethanol from the sugar juice. Using the Microbiogen yeast and an appropriate pre-treatment and hydrolysis process to break down the sugar cane waste fiber (bagasse, trash and tops), the the amount of ethanol capable of being produced from one hectare doubles to about 10 tonnes. Most importantly, the by-product of the process is up to 3 tonnes of yeast (theoretical conversion) which would contain 1.5 tonnes of protein and other nutrients. In other words, one hectare of sugar cane would double its fuel producing capacity and still produce about as much protein as if a hectare of corn had been grown. In summary the enhanced yeast developed by Microbiogen through accelerated evolution is in a position to change the whole food vs fuel debate and land use issue.

Question 14

ANSWER:
By developing a "fuel and food" biorefinery the developing would has the potential to export fuel to the developed world and still increase its own production of food at the same time. This will be particlarly applicable in the wetter tropical countries. Note that the yeast by-product from the Microbiogen "fuel and food" biorefinery is expected to be able to be fed to cows, poulty, pigs and even fish amongst others. The yeast that Microbiogen has developed is already being produced around the world as a feed source -

expect that the current yeasts need to be grown on food.