Biotechnology Update

BioEROC

Working Towards Sustainable Development

Biotechnology-Ecology Research & Outreach Consortium (BioEROC)

Volume 15, Issue 5

October 2016

Editorial

Welcome to October 2016 edition of the ***Biotechnology Update***. In this edition, Brexit seems good for biotech in the UK as researchers kick start applications for GM crops field tests. A report from South Africa shows that perceptions towards biotech have improved and the economy has positively benefitted from the technology. On a similar note, Australian farmers rush to adopt new Bollgard 3 cotton while Indian farmers still prefer biotech to conventional cotton. Elsewhere, studies show that soybean can double its yield and total elimination of GM crops would hike greenhouse gas emission. Lastly, GM tobacco produces malaria drugs. *Read on*

Inside this issue:

"The use of more precise technology and the greater regulatory scrutiny probably makes GMOs even safer than conventional plants and foods".

The European Commission.

Brexit unshackles UK from EU' green hysteria

The promise of Britain's exit from the EU is to liberate the U.K. from the shackles of damaging EU regulations. So congratulations to Theresa May's government for scoring its first Brexit victory by getting away from one of Brussels's worst food obsessions.

"As part of the preparations for EU exit," Agriculture Minister George Eustice wrote to Parliament in October 2016, "the Government is considering possible future arrangements for the regulation of genetically modified organisms." He added: "The Government's general view remains that policy and regulation in this area should be science-based and proportionate."

This represents a significant shift from when London's food policy was hostage to GMO-phobia across the EU. To allow GMOs to be regulated like other food products means that they will no longer be a taboo product in Britain.

Mr. Eustice's emphasis on "science-based" decision making is especially welcome, since the anti-GMO hysteria prevalent in the rest of the EU has no scientific basis. The European Food Safety Authority has ruled repeatedly that GM soybean, maize and cotton, among many other products, are safe for human and animal consumption. Numerous other medical and scientific bodies on both sides of the Atlantic have reached the same conclusion.

Yet the European Parliament has resisted the introduction of GMO products approved by the EU's executive arm, the European Commission, while the Green lobby continues to fan hostility to GMOs in Germany and France especially.

The Green movement always insists it has a lock on good science. Its opposition to GMO products is a reminder that it doesn't. The May government's good sense on the subject should set a precedent for future liberations from other Continental manias, and the bad rules they inspire.

On the contrary, the German cabinet has approved a draft law banning cultivation of crops with genetically modified organisms (GMOs), government sources told Reuters. *Dow Jones & Company*

Fastest GM cotton adoption shown in Aussie *Monsanto*

Australian cotton growers continue to live up to their reputation as the most innovative and advanced in the world, as they signal their intention to plant more than 95 per cent of this season's crop to varieties containing new GM cotton technology, Bollgard1 3.

Monsanto Australia Managing Director, Tony May said the rate of adoption of Bollgard 3 is the fastest for a new GM cotton trait seen anywhere in the world. This is particularly remarkable given this is the first commercial season Bollgard 3 has been grown by Australian farmers, in fact the first time anywhere in the world.

"The rapid adoption of Bollgard 3 in its first year shows cotton growers are willing to put their trust in new technologies from Monsanto combined with high yielding CSD varieties that offer them a clear and compelling value proposition, right off the bat." Tony said.

Early planting intentions indicate a strong season ahead, with forecast hectares already 120,000 ahead than at the same point last season. Indications are the area planted to Bollgard 3 varieties this year could be in excess of 400,000 hectares.

Tony said changes to the Resistance Management Plan (RMP) for Bollgard 3 make it easier to grow cotton.

GMO elimination would hike greenhouse gas emission, model predicts

Science X Network

A global ban on genetically modified crops would raise food prices and add the equivalent of nearly a billion tons of carbon dioxide to the atmosphere, a study by researchers from Purdue University shows.

Using a model to assess the economic and environmental value of GMO crops, agricultural economists found that replacing GMO corn, soybeans and cotton with conventionally bred varieties worldwide would cause a 0.27 to 2.2 percent increase in food costs, depending on the region, with poorer countries hit hardest. According to the study, published on Oct. 27 in the *Journal of Environmental Protection*, a ban on GMOs would also trigger negative environmental consequences: The conversion of pastures and forests to cropland, to compensate for conventional crops' lower productivity, would release substantial amounts of stored carbon to the atmosphere.

Conversely, if countries that already plant GMOs expanded their use of genetically modified crops to match the rate of GMO planting in the United States, global greenhouse gas emissions would fall by the equivalent of 0.2 billion tons of carbon dioxide and would allow 0.8 million hectares of cropland (about 2 million acres) to return to forests and pastures.

"Some of the same groups that want to reduce greenhouse gas emissions also want to ban GMOs. But you can't have it both ways," said Wally Tyner, the James and Lois Ackerman Professor of Agricultural Economics. "Planting GMO crops is an effective way for agriculture to lower its carbon footprint."

GMOs have been a source of contention in the US and abroad, as some believe genetically modified crops pose potential risks to human health and the environment. Three U.S. regulatory agencies, the Department of Agriculture, the Food and Drug Administration and the Environmental Protection Agency, have deemed GMO foods safe to eat, and the US is the global leader in planting GMO crops and developing agricultural biotechnology.

But in many European and Asian countries, consumer and economic concerns have led to strict regulations on GMO crops, with partial or full bans on their cultivation.

Tyner and fellow researchers Farzad Taheripour, research associate professor of agricultural economics, and then-master's student Harry Mahaffey used an extension of the Purdue-developed Global Trade Analysis Project (GTAP-BIO) model to investigate two hypothetical scenarios: "What economic and environmental effects would a global ban on GMO corn, soybeans and cotton have?" and "What would be the additional impact if global GMO adoption caught up to the U.S. and then a ban were implemented?"

The model is set to 2011 crop prices, yields and growing conditions and encompasses the ripple effects of how a change in one sector impacts other sectors.

GTAP-BIO predicted a modest and region-specific rise in overall food costs under a global GMO ban, a result of the lower productivity of non-GMO crops. Tyner said people in poorer regions would be most burdened by the price increase, as they spend about 70 percent of their income on food, compared with about 10 percent in the U.S.

Countries that export crops would gain economically by the increase in food prices, while countries that import crops would suffer. As a result, the U.S., despite being the biggest planter of GMO crops, would profit under a GMO ban because of its strength as a crop producer and exporter. China, a major crop importer, would suffer a welfare loss, a measure of economic well-being, of $3.63 billion.

"The U.S. is the largest agricultural exporter, so if the price of agricultural products goes up, we benefit," Tyner said.

Banning GMO crops would also lead to an increase in global cropland of 3.1 million hectares (about 7.7 million acres), as forest land would be cleared to compensate for the lower yields of conventional crops.

UK researchers to field test GM wheat

Phys.org

A team of researchers with the Universities of Lancaster, Rothmamsted and Essex has submitted a request to Britain's Department for Environment, Food and Rural Affairs asking for permission to grow genetically modified (GM) wheat in an outdoor research effort, consultation by the department is expected to take approximately six weeks. If permission is granted, the team plans to plant the GM wheat this April at a site near Rothmamsted, leading to a harvest and a second planting the following year.

The GM technique used by the researchers is new. It involves splitting the wheat seed in half and then bombarding it with gold particles that have been infused with genetically coded material for SBPase, an enzyme that has been found to be important in the photosynthesis process. In greenhouse studies, the technique has been shown to increase crop yields from 20 to 40 percent. The researchers do not expect to see such gains in crops grown outdoors, of course, but are hopeful, they suspect they may see gains as high as 20 percent. They plan to use two types of GM techniques, one that adds two genes and another that adds six genes.

GM plants to make them more disease resistant or to improve yields is not new, of course; many studies have been carried out over the past several decades, but results have been mixed due to a variety of constraints. One factor holding back research has been public fear and rejection of the technology, some groups have even mounted campaigns to stop such research, fearing it will contaminate natural plants. Protesters stomped on GM crops, for example, planted for testing back in the 1990s, generating headlines and instilling fear in the general populace.

But times have changed, the researchers have told the press. They believe that as more research has been conducted and the public has been given more information regarding GMO crops, there is less resistance to the idea. Now, they add, there appears to be more concern regarding how to feed the growing population, estimates suggest that world food production will have to increase by 40 percent over the next 20 years and 70 percent by the year 2050 just to keep up with the demand. The researchers note; wheat yields have not increased in 30 years.

Biotech crops' impact on economy positive in South Africa

The Department of Science and Technology Director General, Dr Phil Mjwara, says biotechnology or genetically modified (GM) crops have had a positive economic impact on South Africa.

He said this when he briefed journalists upon releasing the second survey on the Public Perceptions of Biotechnology in South Africa. The survey was conducted by the Human Sciences Research Council (HSRC).

"It is estimated that the economic gains from biotech crops for South Africa for the period 1998 to 2013 was US$1.6 billion and US$313 million for 2013 alone.

"In 2014, South Africa was growing more than 2.7 million hectares of GM crops. About 86% and 90% of maize and soya produced, respectively, are GM. Cotton is 100% genetically modified," he said.

Dr Michael Gastrow, from the Human Sciences Research Council, said one of his observations from the survey, which was conducted amongst 2 900 adults in 500 areas across the country, was that there was a better understanding of how much people know about biotechnology from the younger generation, and that attitudes tend to get more positive with the young ones.

Dr Gastrow also said that the privileged, from the level of education, to those with a better living standard, have a better understanding or knowledge about biotechnology.

"When you look at attitudes towards biotechnology in terms of health, safety, environment and economic contribution, there are significant proportions that are in favour of a particular attitude, a significant proportion [that are] against, and a significant third, that just doesn't know enough about biotechnology," he said.

He said most South Africans are aware they are consuming genetically modified food.

The survey revealed that 48% were aware that they were eating genetically modified organisms, while 49% believed it was safe to do so.

The first survey conducted in 2004 revealed that public familiarity with the term 'biotechnology', stood at only 21%, while public awareness of GM consumption was at 13%. The latest survey commissioned by the department last year showed that the figures have tripled, 53% and 48% respectively.

Dr Gastrow said there had also been a major increase in attitudes that favour the purchasing of GM foods.

The proportion of the public that would purchase GM foods on basis of health considerations increased from 59% to 77%, while that of cost considerations increased from 51% to 73%, and environmental considerations from 50% to 68%.

GM forms of maize, soybean and cotton have been approved for commercial production in South Africa and these crops have become established in some parts of the country.

Dr Mjwara said, that while genetically modified crops have been approved and adopted in South Africa and worldwide by science-based regulatory systems and farmers, they still remain a source of apparent public controversy. While it is entirely appropriate for the public to have varying opinions on the technologies and their applications, where misinformation or deliberate misinformation is offered, it needs to be countered with scientific evidence, he said.

"This controversy contributes to extreme precautionary approaches by some countries, resulting in increased regulatory burdens and delays, with associated development costs, timelines and risks that have limited the number of countries adopting the technology - including countries in Africa.

"This has limited the application of the technology to relatively few crops, with limited traits, and only a handful of developers, usually multinational companies, have the capability and the resources to commercialise GM crops," Dr Mjwara said. *AllAfrica*

Indian farmers still favour biotech crops

Hoosier Ag Today

With tight margins, many growers were talking about cutting back on biotech crops and going conventional to save money. While some of that did occur, biotech crops still ruled the day. According to the HAT Pioneer Poll conducted in October 2016, more Indiana farmers are planting biotech seeds than conventional. Fifty-eight percent of those who responded to our text and on-line poll said they planted GMO crops this year compared to 42% who went conventional. Seed companies reported that, while there was some switching, growers still like the traits that some biotech crops have.

Adrian Percy, with Bayer Crop Science, says yield is still the main concern growers have, "Today, farmers want to know how the technology works, they want you to explain it to them. In many cases, they are experts on what is going on in their soil and their fields, but, in the end, it is all about yield. If a product does not yield, it is going to be hard to sell in the marketplace."

In the future, he sees a combination of biological traits, genetic traits and chemicals, all playing a part in delivering yields to growers, "It is all about bringing results to the grower. Poncho/VOTiVO 2.0 is a great example of this, where the control of the insect is from the insecticide, but we have combined this with biologicals for the soil health and nematode protection." He added some traits are more effective in a biological than a chemical format.

Poncho/VOTiVO employs a biological mode of action with a unique bacteria strain that lives and grows with young roots, creating a living barrier that prevents nematodes from causing damage. It also has a systemic agent that is absorbed by new roots immediately, providing control of many critical early-season insects. In more than 150 replicated soybean field trials in 2011 and 2012, Poncho/VOTiVO provided an average yield advantage of 1.5 to 2.5 bushels per acre. Percy is confident that new technology will help growers get higher yield while impacting less on the environment.

Biotechnology-Ecology Research & Outreach Consortium (BioEROC)

Box 403, Zomba Malawi

Phone: 265-1-525682 Cell: 888877858, 888379478, 888303197
Fax: 265-1-525682, Email: wchanga@cc.ac.mw

GM tobacco yields malaria drugs

In 2015, the Nobel Prize in Physiology or Medicine was awarded in part for the discovery of artemisinin, a plant-derived compound that's proven to be a lifesaver in treating malaria. Yet many people who need the drug are not able to access it, in part because it's difficult to grow the plant that is the compound's source. Now, research has shown that tobacco plants can be engineered to manufacture the drug at therapeutic levels. The study appeared on October 20 in *Molecular Plant*.

"Artemisinin treats malaria faster than any other drug. It can clear the pathogen from the bloodstream within 48 hours," says senior author Shashi Kumar, of the International Centre for Genetic Engineering and Biotechnology in New Delhi, India. "Our research is focused on finding a way to make this drug available to more people." *Phys.org*

Advances in synthetic biology have made it possible to produce the drug in yeast, but the manufacturing process is difficult to scale up. Earlier studies looked at growing the compound in tobacco, a plant that's relatively easy to genetically manipulate and that grows well in areas where malaria is endemic. But yields of artemisinin from those plants were low. In the current paper, Kumar's team reports using a dual-transformation approach to boost the production of artemisinin in the tobacco plants: they first generated plants that contained transgenic chloroplasts, and the same plants were then manipulated again to insert genes into the nuclear genome as well. "We rationalized the expression of biosynthetic pathway's gene in different compartment that enabled us to reach the maximum yield from the double transgenic plants," he says.

Extract from the plants was shown to stop the growth progression of pathogen-infected red blood cells in vitro. Whole cells from the plant were also fed to mice infected with *Plasmodium berghei*, one of the microbes that causes malaria. The plant product greatly reduced the level of the parasite in the blood. In fact, the researchers found, the whole plant material was more effective in attacking the parasite than pure artemisinin, likely because encapsulation inside the plant cells protected the compound from digestive enzymes.

BioEROC EVENTS/OTHER NEWS

Readers comments and contributions should be sent to the following address:
Editor
Biotechnology Update
Biotechnology-Ecology Research & Outreach Consortium (BioEROC)
Box 403, Zomba, Malawi Tel.: 265-1-525 682 Cell: 265 888877858/999877858/888643488
Fax.: 265-1-525 682, Email: wchanga@cc.ac.mw

A breakthrough in soybean could feed the world

Science Daily

Washington State University biologist Mechthild Tegeder has developed a way to dramatically increase the yield and quality of soybeans.

Her greenhouse-grown soybean plants fix twice as much nitrogen from the atmosphere as their natural counterparts, grow larger and produce up to 36 percent more seeds.

Tegeder designed a novel way to increase the flow of nitrogen, an essential nutrient, from specialized bacteria in soybean root nodules to the seed-producing organs. She and Amanda Carter, a biological sciences graduate student, found the increased rate of nitrogen transport kicked the plants into overdrive.

Their work, published recently in *Current Biology*, is a major breakthrough in the science of improving crop yields. It could eventually help address society's critical challenge of feeding a growing human population while protecting the environment.

"The biggest implication of our research is that by ramping up the natural nitrogen allocation process we can increase the amount of food we produce without contributing to further agricultural pollution," Tegeder said. "Eventually we would like to transfer what we have learned to other legumes and plants that humans grow for food."

Legumes account for around 30 percent of the world's agricultural production. They consist of plants like soybeans, alfalfa, peas, beans and lentils, among others.

Unlike crops that rely on naturally occurring and artificially made nitrogen from the soil, legumes contain rhizobia bacterioids in their root nodules that have the unique capability of converting or "fixing" nitrogen gas from the atmosphere.

For years, scientists have tried to increase the rate of nitrogen fixation in legumes by altering rhizobia bacterioid function or interactions that take place between the bacterioid and the root nodule cells.

Tegeder took a different approach: She increased the number of proteins that help move nitrogen from the rhizobia bacteria to the plant's leaves, seed-producing organs and other areas where it is needed.

The additional transport proteins sped up the overall export of nitrogen from the root nodules. This initiated a feedback loop that caused the rhizobia to start fixing more atmospheric nitrogen, which the plant then used to produce more seeds.

"They are bigger, grow faster and generally look better than natural soybean plants," Tegeder said. "Some evidence we have suggests they might also be highly efficient under stressful conditions like drought."

Nitrogen is a macronutrient essential for plant growth. Large amounts of synthetic nitrogen fertilizer are applied around the world to ensure high plant productivity Application is an environmental issue in industrialized countries like the US because of high energy input, increased greenhouse gas emissions, water pollution and other effects.

There is need for public understanding of the science to gain their confidence, and the importance of media in informing the public and the policy makers about the new scientific developments. *BioEROC's outreach agenda*

Published by the Biotechnology-Ecology Research and Outreach Consortium (BioEROC), Box 403, Zomba, Malawi