

# CROP SCENE

*A quarterly review reflecting on commercial, technical and policy developments that affect crop production and uses world wide*

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*December 2011*

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## COMMODITY CROP PRICE TRENDS

The prices of key commodities in the table are based on FAO monthly average figures. Details of definitions and sources are given in the web site: [www.fao.org/es/esc/prices/CIWPQueryServlet](http://www.fao.org/es/esc/prices/CIWPQueryServlet)

All prices are in US \$ per ton.

Commodity	May 2011	September 2011	December 2011
Wheat	362	274	243
Corn	307	306	258
Soya	519	497	438
Rice	419	497	570
Cotton	3652	2332	2222 (Oct)

Note: Cotton prices are calculated from US\$ per lb @ 2200 lb per ton.

It was noted in the September issue of Crop Scene, that the grain and oilseeds markets moved sharply lower at the very end of September partly in response to larger than expected US stock levels. This trend has continued over the last quarter. The better than expected yields in Brazil for soya and corn, partly attributed to the impact of GM crops, is also influencing global prices. The general uncertainty in the Eurozone and the global economic scene has contributed to the lack of confidence.

The wheat price has continued to decline. The corn price, although down since September, showed some sign of recovery in late December as reports of drought conditions in Argentina came through. Asian rice production levels are generally high but prices are holding up as many growers and millers are holding back stocks. The cotton price had declined more markedly than most commodities since the spring, although extreme drought conditions in Texas are predicted to bring about a recovery later in the year (December figures were not yet available).

## *THIS MONTH'S FEATURE*

### What will be the true impact of climate change, and climate change policies, on global crop production ?

Leading up to the Durban Climate Change conference, COP17, there were calls for agriculture to be given priority by the negotiators. Agriculture is the sector most vulnerable to climate change, but it is also a major cause, directly accounting for about 14% of greenhouse gas emissions ([Climate Change 2007, the Fourth Assessment Report \(AR4\) of the United Nations Intergovernmental Panel on Climate Change, IPCC](#)).

#### Calls for a global policy

The call, in the form of a letter released on December 3, came from 17 organisations including several UN agencies: FAO, UN World Food Programme (WFP), International Fund for Agricultural Development (IFAD) as well as the World Bank and the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS). When it came to it, however, the negotiators deferred the discussion on specific targets involving agriculture. Pressure to bring agriculture into the discussion had come largely from the developed countries but was not supported by many developing countries. For African countries, in particular, agriculture is much more important as an issue under adaptation, not mitigation. They want to see the industrial nations acting to reduce emissions from industry as a priority.

So there was no work programme on agriculture established at COP17, merely an exchange of views. A working group on Long-term Cooperative Action did however conclude that a decision on agriculture will be made at COP18 which takes place November 2012 in Qatar. But it is very clear that developing countries will only move the agenda forward if adaptation is also covered

However, a number of UN agencies will be managing events during 2012 at which the agriculture and climate change agenda can be progressed. It does not necessarily require the involvement of the Climate Change forum for progress to be made. The CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), the FAO, and some of its products, such as a roadmap for "*Greening the Economy with Agriculture*" will be launched at key meetings over the course of the year. This will include the Rio+20 meeting to be held in Rio de Janeiro next June.

#### Which crop growing regions are most affected ?

- In Europe

The impact of climate change on crop productivity agriculture is complex. Changes in climate can affect water availability and therefore yields, risk from storm damage and incidence of pests and diseases. A useful information sheet has been published by the European farmers' organisations, the Committee of Professional Agricultural Organisations and the General Committee for Agricultural Cooperation in the European Union, Copa-Cogeca. This covers some of the more potential impacts on the more important crops that are grown in Europe

([www.copa-cogeca.be/img/user/file/FT\\_EN/DOC/5658E.pdf](http://www.copa-cogeca.be/img/user/file/FT_EN/DOC/5658E.pdf)).

Based on the PESETA study published in 2007 ([ftp.jrc.es/EURdoc/JRC55386.pdf](http://ftp.jrc.es/EURdoc/JRC55386.pdf)) Copa-Cogeca, quote that, by 2030, yields (compared with the period 1961-1990) could increase up to 70 % for certain northern EU regions but decrease by more than 22 % in southern regions. However, it is also pointed out that EU-27 reported emissions from "cropland which remains cropland" and "land converted into cropland" have decreased in the period 1990-2007 by 24% and 16% respectively.

The changing climate in Europe could lead to a shift of crop production to the north and to some higher altitude regions. There would be positive impacts as a consequence of longer growing seasons, new cropping opportunities from warmer winters as well as the reduction of frost frequency in autumn and winter.

In terms of potential mitigation actions, Copa-Cogeca highlight the opportunity from growing alfalfa as it can be important as a source of feed protein as well as delivering environmental benefits. In some EU areas, 0.4 ha of alfalfa is enough to produce one tonne of protein. This compares with 1.3 ha needed for soya. In the area of land freed up it would be possible to grow alternative food crops, energy crops or to reforest the land. Alfalfa, being a legume, captures atmospheric nitrogen and therefore does not require high mineral fertiliser application. This is potentially important as 48 % of the agricultural emissions in the EU-27 in 2007 were soil-related.

- In North America

Jerry L Hatfield, ARS - USDA, in "*Crop Adaptation to Climate Change*" ([www.eu.wiley.com/WileyCDA/WileyTitle/productCd-0813820162.html](http://www.eu.wiley.com/WileyCDA/WileyTitle/productCd-0813820162.html))

explains that climate change is occurring across North America with changes in both temperature and precipitation patterns. He predicts that although the changes are not uniform, temperature patterns will increase overall. The southern US is expected to warm more than the upper portions of North America. Precipitation patterns show a very distinct seasonal and regional trend. The southwest US and northern Mexico show dramatic decreases in annual precipitation compared to the rest of North America.

Overall, in North America, the trends are for decreased summer precipitation. This will result in increased water stress on crops since most of the crops are grown during the summer and under rain-fed conditions.

There will need to be an increase of water availability to the crop to reduce water stress and the development and selection of crop varieties capable of coping with temperature extremes and exposure to water stress.

- In developing countries

CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS) released in October 2011, a series of studies focused on "climate proofing" crops critical to food security in the developing world ([www.ccafs.cgiar.org](http://www.ccafs.cgiar.org)).

The studies describe how specific adaptation strategies could neutralise or at least significantly lessen the impact of climate change on food production. They argue that investments are urgently needed to identify important genetic traits, including drought tolerance and pest resistance, which will be critical for helping farmers adapt to new growing conditions.

The studies developed by an international team of the world's leading climate and agricultural researchers aim to provide adaptation strategies for more than a dozen crops -- such as potatoes, beans, bananas and cassava.

The studies indicate that many of the critical traits farmers will need to deal with the hotter, drier, and in some cases, wetter conditions probably are to be found in seeds now safeguarded by international crop gene banks, many of which are controlled by multinational companies. However, there is also a rich vein of traits contained in the wild relatives of key crops. It will, therefore, require more intensive application of cutting edge biotechnology, including the use of the new tools of genomics and transgenics.

This led Bruce Campbell, CCAFS director to comment on the studies' findings: "These results offer plant breeders a strong foundation for establishing research priorities for the next two decades, which is about the time they will need to develop new generations of crop varieties suited to shifting agriculture environments."

As widely reported it is Sub-Saharan Africa which is most vulnerable to the impact of climate change. The scientists report that the potato, for example, is especially vulnerable to heat stress, which reduces growth and starch formation. Rising temperatures in southern Africa and tropical highlands worldwide could be particularly hazardous. Scientists believe that developing and distributing heat-tolerant potato varieties could reduce climate-related damage for about 65 % (7.7 million hectares) of the world's potato crop.

The potato crop could also be affected by the spread of the potato tuber moth, *Phthorimaea operculella*, which could spread northward and to higher elevations as a result of climate change.



*Potato tuber moth - potential to spread north*

On the positive side drier, warmer summers in some regions could depress the incidence of late blight, *Phytophthora infestans*.

- Tomorrow's growing conditions today

An initiative planned under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CAAFS) is to show some farmers what conditions will be like for growing crops in 2030 when temperatures have increased, and to demonstrate how these farmers should adapt.

Julian Ramirez, a scientist based at the International Center for Tropical Agriculture (CIAT) in Colombia commented: "Climate change will significantly alter growing conditions, but in most places the new farming environment will not be novel in the global context - rather, the situation in the future will closely resemble conditions that already exist in other parts of the world."

For example, according to CCAFS analysis, by 2030, maize producers around Durban, South Africa, could face a one degree increase in temperature during the maize growing season. Studies by Stanford University and others indicate that such an increase would reduce yields by about 20% in the absence of adaptive measures. But maize farmers in Argentina and Uruguay are growing maize successfully today under average temperatures that are three degrees higher.

Similarly, soya bean farmers in Argentina, as well as in the central and southern US, are already managing conditions similar to the ones that soya bean growers around Shanghai, China, will experience within about 20 years.

Andy Jarvis, a research theme leader for the CCAFS said: "If Chinese farmers want to continue growing soya beans, they need to look at the kinds of farming practices and crop varieties that farmers in northern Argentina and other analogue regions are growing."

Patti Kristjanson, another research theme leader at CCAFS summarised the situation for the developing countries: "Farmers already adapt to variable weather patterns by changing their planting schedules or moving animals to different grazing areas. What this study suggests is that the speed of climate shifts and the magnitude of the changes required to adapt could be much greater. In some places, farmers might need to consider entirely new crops or new farming systems.....in parts of East and Southern Africa, for example, temperatures may become too hot to maintain maize as the staple crop, requiring a shift to other food crops, such as sorghum or cassava, to meet nutrition needs."

# *FOOD PRODUCTION POLICIES*

## Rethinking Agriculture - World Agricultural Forum

Technical, political and international trading policies were addressed at a three day conference held in Brussels by the World Agricultural Forum, WAF, November 28 - December 1.

### A global problem requiring global solutions

Professor Paolo de Castro, Chairman of the Agricultural and Rural Development Committee of the European Parliament, in his keynote address, spelled out the challenges now set for the agricultural industry to meet rising demands for food.

He called for improved co-ordination and political response to volatile food prices and, for example, extreme weather phenomena. With only 15% of global production traded in agricultural markets it only takes a minimal shock in prices to cause widespread price instability. A problem, not yet fully addressed, is the fact that most political approaches still belong to the era of abundance of food rather than the new era of food scarcity.

Professor de Castro emphasised that food security is a global problem calling for global solutions, and that sustainable agricultural production requires more, not less, technology and innovation.

There were over 170 delegates at the WAF with a number of experienced policy makers present including Clayton Yeutter, former US Secretary of Agriculture and Franz Fischler, former EC Commissioner of Agriculture.

### China improving productivity of cotton and maize in dry-land areas

One of the more focussed papers was given by Dr Ren Wang, vice president, Chinese Academy of Agricultural Sciences. He gave examples of how improved productivity of cotton and maize is being achieved in dry land areas of North and West China.



*Xinjiang province*

The Xinjiang province of north west China is a dry-land low rainfall area where cotton yields were, in the 1980s, little more than 6 tonnes/hectare. The introduction of drip irrigation methods has now brought yields up to 12-15 tonnes/hectare. The first systems tried were borrowed from Israeli methods, with irrigation under mulch. But costs were high until a local adaptation reduced the operating costs. Today, the crop in the region needs 570 billion cubic metres of water per season with natural rainfall delivering no more than 400 billion cubic metres and so the deficit

is supplied through irrigation, 90-95% of which is drip irrigation.

China has a large area of dry-land in the North, which accounts for over 50% of the nation's total land area, covering 17 provinces. About 22% of the total population live here. Although maize and wheat are the main cereals grown in the dry-land areas this only accounts for 28% of the nation's cereal production. Most is grown in the east and in coastal regions. Maize is scheduled to be strategically the most important cereal crop in China. It accounts for 53% of grain production currently but the aim is to lift it to 65% by 2020. Most is currently produced in the yellow river area and the north east, but the increase in production will need to come from the north west and the south west. The need will be to make use of drip irrigation, hybrid varieties and improved crop management.

On a more general note the importance of agricultural research in China was explained by Dr Wang. With a projected population of 1.54 billion by 2025 in China, there is no holding back on the commitment to agricultural science. R & D expenditure is now 0.8% of GDP, up from 0.25% in 1990 and projected to reach 1.5% by 2020. The aim for China is to be 95% self-sufficient in grain through the adoption of new technologies, ecologically acceptable intensive production systems, and financed through public-private partnerships.

### The GM debate continues

The discussion at the WAF, inevitably came round to the role of genetically modified crops. Dr Ren Wang challenged the western biotechnology companies to come forward with a new model on how the intellectual property rights of biotechnology could be made more accessible to developing countries, so that smallholders could benefit. The view was strongly endorsed by several delegates from the Indian sub-continent. Although not specifically referring to GM crops Sandra Peterson, Bayer CropScience CEO, in her presentation strongly advocated that more support for smallholder farming is called for, to ensure food security worldwide ([CPM November 2011](#)).

With regard to the EU, Dr Christoph Wegner, Senior Vice President, Global R & D, BASF Crop Protection Division, did not see a quick solution to the EU regulatory impasse. He was, reluctantly, beginning to accept that we are years away from having significant GM crop production in Europe.

### Whither the WTO ?

During the WAF discussions, a number of speakers, and delegates painted a negative picture on there being harmonious agreement on international agricultural trade through the now stalled WTO talks. Such agreement is seen by most to be critical if price volatility is to be controlled. However, Clayton Yeutter, offered some optimism that if the WTO talks failed, bilateral agreements may prove to be important and referred to preliminary discussions underway which could lead to a US-EU free trade agreement.



## Will the control of vineyard planting in the EU be maintained ?

In 2009 the EU wine reform proposed that planting rights, which prevent vineyard expansion without approval from ruling bodies, would be gradually phased out from 2015.

However in September it was reported that grower organisations were calling for the existing planting right legislation to be retained. The concern expressed by Copa-Cogeca is that the freeing up of planting rights could accelerate a move to industrialised wine-growing. It is argued that this would put the quality of EU wines at risk, causing the EU to lose market share. Europe has already lost significant market share to new world wine producers.

The relatively small number of English wine producers had supported the removal of planting restrictions. Bob Lindo, of Camel Valley and former chair of the United Kingdom Vineyards Association, UKVA, was reported as saying: "Balancing supply and demand is a universal wine problem, but controlling production within the EU ignores the fact that the rest of the world is unfettered by such controls."

The argument in favour of removing the planting restrictions, promoted by the European Commission, is that EU wine production would become more competitive in world markets. The economies of scale from expanded vine producing areas would reduce production costs.

Copa-Cogeca was calling on the EU Commission to release a proposal by the end of the year to maintain EU planting rights in the wine sector, and to overturn the decision to phase them out.

However, by December 9, 12 EU countries had registered their disagreement and formally asked the European Commission to reconsider an amendment to liberalise planting rights, from January 2016, within proposals for the reform of the Common Agricultural Policy. Should the reform go through, then by 2019 there will be no restrictions to planting vines across the EU, even in countries that today have no vineyards.

To overcome the EC proposal it will require a majority vote, which means 14 member states. The fact that those opposing the lifting of restrictions include all of the major EU wine producing countries is not in itself a sufficient argument.

The 12 member states are Germany, France, Italy, Cyprus, Luxembourg, Hungary, Austria, Portugal, Romania, Spain, the Czech Republic and Slovakia. By December 16, a 13th had joined the lobby group, Greece.

To reach a majority the group still needed 54 more votes to sway the final EU Council decision. However, the chair of the European Wines of Origin in asking for the debate to be reopened argued that: "the Commission cannot turn a deaf ear to 13 member states representing 66 % of the population and 97 % of total wine production.

The French appellation chief also said that the industry wants "the European Parliament and the Council to show openness and political courage and to help it in its fight to maintain planting rights as part of the CAP".

Other wine-producing countries being encouraged to join the group are Bulgaria, Slovenia and Malta. The UK is also being asked to join by virtue of its importance as a consumer country.

## CAP Revisions - potential impact on EU cropping plans

The revisions to the Common Agricultural Policy, CAP, of the EU are still very much at the discussion stage. Should the proposals released by the agriculture Commissioner, Dacian Cioloș, in October be agreed in full it will have major impact on cropped areas and crop rotations.

General changes proposed are the "capping" of the direct support going to individual farmers at a maximum of 150,000 euros and ensuring that payments only go to "active farmers" rather than non-practicing landowners. Both of these proposals have their detractors but it is the more direct proposals on land use which is causing the most reaction.

As part of the "greening" policy it is proposed that 30% of the payment due to the farmer will be withheld until certain environmental criteria are met.

The criteria include:

- Maintaining an "ecological focus" area equivalent to 7% of the farm area (excluding permanent pasture). The area to be made up from field margins, trees and hedges, fallow land, etc.

Critics have described this as another form of enforced set aside. There is also some question as to whether the 7% has to be over and above areas already included in voluntary stewardship schemes. The UK Government has come out firmly stating that it will argue that stewardship schemes must be taken into account.

- Maintaining at least 95% of the existing permanent pasture on the farm
- Cultivating at least three arable crops, each with more than 3 hectares. No one crop to exceed 70% of the cultivated area and no crop to be less than 5% of the area.

There has been much criticism that the proposals are in contrast with the call for greater food security in the EU.

UK's Department of Environment, Food and Rural Affairs, defra, Secretary Caroline Spelman, is reported to have described the plans as 'a missed opportunity' which fail to respond to the challenges of securing food supply in the face of climate change and rising costs. In Brussels on November 14, Caroline Spelman, suggested to the Commissioner that the proposals did not offer the best deal for farmers, taxpayers or the environment and that they would actually prevent farmers from becoming more sustainable.

There is plenty of time for more debate. Acceptance of the proposals is already expected to be delayed beyond the originally set January 2014 deadline.

## BIOTECHNOLOGY

### Development of frost tolerant eucalyptus trees cleared in the US

ArborGen is a South Carolina based company which is employing biotechnology methods to improve the productivity of forest trees. The US biotechnology regulatory body, Animal and Plant Health Inspection Service, APHIS, in October authorised ArborGen to plant genetically modified eucalyptus trees on 28 sites in seven states.

This followed a failed attempt to block the development by environmental groups who opposed the trials arguing that the GM eucalyptus could become an invasive species, harming other native wildlife and plants. In July 2010, the group made up from the Centre for Biological Diversity, the Centre for Food Safety, the Dogwood Alliance, the Global Justice Ecology Project, the International Centre for Technology Assessment and the Sierra Club brought the case against APHIS and USDA.

The environmental groups alleged that APHIS did not comply with federal law in issuing certain permits to ArborGen. The Biotechnology Industry Association, BIO, helped in the defence against these allegations and on October 6, 2011 the US District Court for the Southern District of Florida ruled in favour of the government, ArborGen and BIO.



Eucalyptus trials showing benefits of frost tolerance

Before granting the permits, APHIS prepared an Environmental Assessment and opened it to public comment. APHIS then issued a finding of no significant impact and determined that an environmental impact statement was not necessary.

The company's first-generation frost tolerant tropical eucalyptus is targeted at the south eastern US states. The trees are based on the characteristics of Brazilian eucalyptus, but grow in areas significantly farther north than conventional tropical eucalyptus. The trials will be carried out in Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina and Texas.

## Asian countries close to introducing GM Rice but will California follow ?

Although regulatory approval for GM Rice was granted in the US ten years ago, none is grown commercially. Unlike the situation with the other major GM crops, soya, maize and cotton, now well established in the US, GM rice commercialisation has been delayed by a series of industry mistakes and objections from environmentalists. The area of US rice in 2009 was around 1.25 million hectares. Arkansas, California, Louisiana, Mississippi, Missouri, and Texas are the main rice production states. Although this area does not put the US in the top league of rice growing nations it is an important exporter of rice. The US is in fact the second leading rice exporter with 18% of the world market.

### Asian GM rice has its problems too

The GM rice which is reported to be closest to market is 'Xianyou 63', or Bt63, an insect-resistant Bt (*Bacillus thuringiensis*) variety that was approved by China in 2009 and is expected to be available by 2012. The situation in China is not straightforward. Two strains of GM rice have been approved for open-field experiments but not commercial sale.

However, according to the anti GM group, Gmfreeze ([www.gmfreeze.org/news-releases/175/](http://www.gmfreeze.org/news-releases/175/)), the European Commission has revealed that four illegal GM rice traits have been found in Chinese consignments at EU ports. The website for the European Union's Rapid Alert System for Food and Feed, European countries records that the UK and Luxembourg have reported illegal presence of GM rice during 2011. As a consequence the EC has issued a draft regulation regarding unauthorised genetically modified rice products originating from China and repealing the previous regulation 2008/289/EC. This legislation is intended to come into force in mid-January 2012, it stipulates a series of new measures to try to prevent illegal GM rice shipments reaching European outlets.

In China in April it was reported a joint investigation by four government departments had found that "illegal GM seeds are present in several provinces because of weak management".

A report from Reuters last year ([www.reuters.com/article/idUSTRE62FOT720100316](http://www.reuters.com/article/idUSTRE62FOT720100316)) suggested that the Philippines, the world's largest rice importer, is next in line for introducing GM rice.

Robert Zeigler, director general of the Philippines-based International Rice Research Institute (IRRI), said at the Reuters Food and Agriculture Summit in 2010 that: "There is some possibility that it would be the Philippines that will get approval next for Golden Rice, probably late 2011 or early 2012." Golden Rice, a Vitamin A-enriched grain developed by the IRRI is being bred into local varieties elsewhere, namely Bangladesh, India, Indonesia and Vietnam. Zeigler added: "Bangladesh will follow very shortly thereafter and India, probably a year or two later."

A number of environmentalist organisations are active in protesting against the introduction of GM rice in the Philippines. But if Zeigler's predictions are realised, and commercialisation in China encourages a wave of GM rice approvals and adoption, this could have major implications for the rice industry in the US.

## Will US GM rice put exports at risk ?

D R. Mulvaney et al ([California Agriculture 65\(3\):161-167. DOI: 10.3733/ca.E.v065n03p161. July-September 2011.](#)) has reviewed the status of the marketability of Californian produced GM rice.

California produces about 20% of the US rice crop and half of the production goes for export. A number of studies suggest that GM rice would benefit California rice growers, particularly with herbicide-tolerant, HT, varieties. Currently weed control management requires multiple herbicide applications. Growers can spend up to \$200 per acre on herbicides. HT rice would allow herbicides to be sprayed shortly after seedlings emerge, when rice-weed competition is highest and the potential for weed-inflicted yield losses is greatest.



Herbicide-tolerant rice has been developed to help farmers with costly weed problems. Above, Colusa County rice with at least three severe weed species.

However, there are also significant marketing risks. Some export buyers could refuse to purchase stocks contaminated by GM rice, impose costly testing requirements or shut down markets permanently.

In 2001, University of California Co-operative Extension surveyed 213 California rice growers, and 37% stated that if herbicide-tolerant rice were available they would not plant it. A subgroup of 78% suggested that this was due to "market concerns." Their concerns are understandable. As much as 40% of the crop, 80% of the export crop, goes to Japan.

The progress of GM rice in the US has had two major setbacks due to incidents of contamination. In 2006, the Food and Drug Administration, FDA, announced that Bayer's long-grain LibertyLink transgenic rice (LL601), before it was approved for human consumption, had

been found to have extensively co-mingled with long-grain 'Cheniere' rice and foundation seed grown in five southern US states. As a consequence, major importers of US rice: Japan, South Korea, Taiwan, Mexico, Russia and the European Union, banned or halted all imports of long-grain rice from the US.

The FDA retroactively approved LL601 for human consumption to reassure consumers that it was safe. But by that time, rice futures prices had fallen on the Chicago Board of Trade. Some growers ended up realising much lower prices from their futures contracts than they had anticipated, when they signed up. Although the price drop was relatively short lived confidence in GM rice was severely dented.

A further contamination problem occurred when another of Bayer's *LibertyLink* varieties (LL604) was found in 'Clearfield 131' rice seed marketed by BASF. The Clearfield seed was recalled after the USDA intervened, costing BASF millions of dollars in lost seed sales.

Additional testing requirements were established for export markets, and significant resources were mobilised to remove *LibertyLink* rice from the seed supply. Some estimates put the cost to growers at between \$80 million to \$100 million. The US Rice Federation stated that rice exports to the European Union fell 68% from 2005 to 2007.

The contamination issues are costing Bayer considerably in claims. They have lost seven cases so far. In one case a jury awarded a dozen growers a \$48 million judgement against the company based on contamination from *LibertyLink* varieties grown, during 1999 and 2000, in experimental field trials in Louisiana. On December 21 it was reported ([www.usagnet.com/story-national.php?Id=2685&yr=2011](http://www.usagnet.com/story-national.php?Id=2685&yr=2011)) that Bayer had agreed an out of court settlement of up to \$750 million to amicably resolve claims submitted by growers of long grain rice. This applied to affected growers known to be growing the crop between 2006 until the end of 2010 and will apply whether they had submitted a lawsuit or not.

California was not so directly affected by the contamination issue because for the most part California grows short grain rice. Nonetheless concerns on the potential negative impact of GM rice are apparent. The California Rice Certification Act (CRCA) which is administered by the California Rice Commission (CRC), allows for the establishment of an Identity Preserve, IP, management process designed to minimise the risk of contamination, from special or experimental crops.

## Japanese market sensitive

The CRCA first applied IP to GM rice in late 2003, when Ventria Biosciences sought approval to commercially plant out two rice varieties engineered to produce pharmaceutical compounds that have antimicrobial qualities. The proposed varieties were intended for use in the production of iron supplements and antidiarrheal medicines. Permission to plant the crops was still being considered when the California Department of Food and Agriculture, CDFA, received a letter from the Japanese Rice Retailers Association that stated, " .....It is certain that the commercialisation of [pharm] rice in the United States will evoke a distrust of US rice as a whole among Japanese consumers, since we think it is practically impossible to guarantee no rice contamination ... If the crop is actually commercialised in the United States, we shall strongly request the Japanese government to take measures not to import any California rice." The

production of Ventria's rice was vetoed by the CDFA and the trials were transferred to North Carolina.

It is clear that as Japan is particularly sensitive on the risk of non-approved GM crops reaching their shores. Furthermore on this evidence the Japanese authorities do not have faith in the CRC IP procedures. Although there are clear agronomic benefits from HT rice the risks to California growers of severe oversupply, lower prices and possibly decreased production are significant, given their dependence on the Japanese market.

It may well be that alternative weed-management options including breeding for weed-suppressive crop traits; alternative tillage methods to pre-germinate and then control weeds; and long-term strategies aimed at shifting weed communities to make broad-spectrum herbicides more effective, will be the way forward.

It is possible that California opts to be a GM free state as far as rice is concerned and so safeguards its place in the Japanese market.

## Biotechnology solutions for African crops

A number of opportunities for improving crops through the use of biotechnology and relevant to the African continent were presented at the Agricultural Biotechnology International Conference, ABIC, in Sandton, Johannesburg in September ([reported By Lezette Engelbrecht, ITWeb online, October 31st](#))

University of Cape Town professor Jennifer Thomson noted that the world will need to feed around nine billion people in 2050, and 10 billion in 2100. "Conventional crop improvements alone will not double crop production by 2050. Genetically modified and biotechnology crops are not a panacea, but they are essential."

## Protecting sweet potatoes from weevil losses



In Uganda sweet potato is grown by 44% of farmers and the average person consumes 82kg of sweet potatoes a year. Agriculture in Uganda, directly or indirectly, provides a livelihood to almost 90% of the population. Furthermore almost 10 million do not have enough food to meet their daily needs with a large number suffering from nutritional deficiencies.

During the conference it was described how Rachel (illustrated) had to hack away at each tuber to remove

the parts riddled by the tiny grooves caused by weevils, *Cylas formicarius*. Often what is left of the tuber is no more than the size of an egg.

The Bill & Melinda Gates Foundation (B&MGF) is investing nearly \$20 million into the development of tougher, more nutritious crops through its Grand Challenges in Global Health initiative. Lawrence Kent, senior programme officer focusing on agricultural research and technology transfer at the B&MGF, said the foundation supports a range of crop breeding techniques, with genetic modification being only one. "While it constitutes a small portion of the foundation's investments in agriculture and nutrition (about 6%) it is one that we believe has promise."

He further explained that for subsistence farmers, like Rachel, traditional pest control is often not an option, and developing a weevil-resistant sweet potato using conventional breeding methods has not been hugely successful. Although they are smaller than a fingernail, these tiny beetles can destroy 60% to 100% of sweet potato crops during intense and prolonged droughts. With climate change likely to create even hotter and drier conditions in sub-Saharan Africa, the impact of weevils may become unbearable.

"So why not create a weevil-resistant sweet potato using biotechnology?" said Kent. This involves implanting crops with *Bt* bacterium which produces a crystal protein lethal to the insects.

One initiative working in this area is the Sweet Potato Action for Security and Health in Africa project, a five-year initiative aimed at improving food security and livelihoods on the continent. With the B&MGF providing major funding, one of the programme components focuses specifically on developing weevil-resistant sweet potato varieties.

According to the UN's Food and Agriculture Organisation (FAO), biotechnology's chief benefit is the ability to create resilient, drought-tolerant crops, which could keep farming communities afloat during hard times.

## Superfoods

In countries where a single crop makes up the majority of the population's food intake, vitamin and mineral deficiencies are a major problem. According to the World Health Organisation, dietary vitamin A deficiency causes 250,000 to 500,000 children to go blind every year, and compromises the immune systems of approximately 40% of children under five.

Numerous research projects are busy investigating ways to boost the nutritional content of staple foods. One of the major projects being funded by the B&MGF is the HarvestPlus alliance, a global grouping of research institutions focusing on staple foods consumed by most of the world's poor living in Africa, Asia and Latin America. Funding is spread across several initiatives, including the BioCassava Plus programme, Africa Biofortified Sorghum Project, the ProVitaMinRice project (Golden Rice) and the National Banana Research programme in Uganda.





Golden Rice

Not all enhanced nutritional benefits are through the application of biotechnology. Nonetheless, communities are beginning to see the benefits. HarvestPlus orange-fleshed sweet potato variety, for example, which contains 50% of the daily vitamin A requirement, has been introduced with great success in Uganda and Mozambique. The B&MGF reports that a study of more than 24,000 households in the two countries found vitamin A intake among young children, older children, and women to be as much as doubled in homes that grew these new varieties.

While the orange sweet potato uses traditional breeding techniques, the Golden Rice and BioCassava Plus crops are genetically modified. Consequently, amid fierce opposition from some quarters further testing is needed before these foods are made available to the public.

Lawrence Kent observed that "anything that involves biotechnology involves a level of controversy". He added, that the approach needs to be "open and data-focused", and that the B&MGF was working to produce the data required for the two GM crops to meet safety regulations.

## Drought tolerant maize

In many developing countries, the threat of widespread hunger invariably overshadows the need for extensive testing. The development of crops capable of withstanding the effects of extensive drought is a high priority in much of sub-Saharan Africa.

The Water Efficient Maize for Africa (Wema) initiative is a five-year project which hopes to develop drought-tolerant maize varieties through various biotechnology breeding techniques. Also funded by the B&MGF, the long-term goal is to make this modified crop available royalty-free to small-scale farmers.

Maize is the main food source for more than 300 million people in Africa, but the crop suffers from frequent droughts, leading to widespread hunger, as seen in the recent drought in the Horn of Africa.

Led by the African Agricultural Technology Foundation, Wema is undergoing field trials in Kenya, Uganda and South Africa, with plans for the first hybrids to be available after six or seven years of research and development.

## Bananas for the 21<sup>st</sup> century

Professor James Dale, director of the Centre for Tropical Crops and Biocommodities at the Queensland University of Technology (QUT), in Australia said : "In 100 years' time, most of us will be eating GM bananas, papaya and other crops."

Professor Dale commented that bananas are the second biggest fruit crop in Africa, with the East African region alone producing 16.4 million tonnes per year - about 20% of global production. He pointed out that in the western world, bananas are considered as a dessert, but in many parts of the tropics and sub-tropics, bananas are a very important part of people's diet.

Both male and female domesticated bananas are sterile, therefore conventional breeding of bananas is very difficult. Successful outcomes following this route, are limited and tend to be very long and complicated.

The QUT's banana research programme is trying to genetically engineer nutritionally fortified bananas to make available to farmers in Uganda (the world's second largest banana producer after India). Run in partnership with Uganda's National Agricultural Research Organisation, the project is also being funded as part of the B&MGF's Challenges programme.

The project aims to grow bananas with higher levels of pro-vitamin A, vitamin E and iron, as the banana variety most commonly grown in Uganda is low in these nutrients. On average each Ugandan eats an average of 1kg of bananas daily, so a fortified version could go a long way to reducing deficiencies. The first field trial began in Australia in 2009. Professor Dale described how the objective is to develop the technology in Australia, and then transfer the techniques to Ugandan scientists for application to highland bananas in Uganda and other East African countries.

## EU fails to agree to authorisation for the importation of four GM crops

On December 15, EU agriculture ministers failed to decide on food use authorisation for three genetically-modified maize and cotton strains ([www.eubusiness.com/news-eu/biotech-food-farm.e7c/](http://www.eubusiness.com/news-eu/biotech-food-farm.e7c/))

Three maize crops from Syngenta have been engineered to be resistant to corn root worm, *Diabrotica virgifera*, as well as European corn borer, *Ostrinia nubilalis*. In the US reports have been recorded in several states where resistance to the insect has broken down. This may have been a factor leading to the failure of the EU Agriculture ministers to reach a decision. However, Syngenta is reported to have developed a second generation resistance trait.

The fourth GM crop, from Dow, is an insect resistant strain of cotton.

Poland, which chairs European Union ministerial meetings, said that no deal could be reached "neither for nor against." The decision means that the applications will go back to a committee of experts from the 27 EU states.

If the European Commission gives the go ahead, products containing the strains could be imported into the EU, but the strains themselves cannot yet be grown.

## ***PUBLIC SECTOR PROJECTS***

### US Plant Scientists call for a 10 year plan

US plant scientists have taken the first steps toward a 10-year plan to help improve global food supplies using sustainable practices and to make progress in understanding how plants work.

A meeting in September, organised by the American Society of Plant Biologists, was held in Bethesda, Maryland. The meeting was attended by 75 plant scientists from institutions around the country, as well as additional representatives from government, industry and professional societies ([www.danforthcenter.org/wordpress/?page\\_id=390](http://www.danforthcenter.org/wordpress/?page_id=390))

Food prices and the demand for food are increasing, climate change is affecting natural habitats as well as cropland, and there are increasing efforts to use plants for energy. However, chairman of the meeting Gary Stacey, University of Missouri, Columbia, said that plant scientists have largely been on the side lines in tackling these escalating problems. This view was endorsed by Keith Yamamoto, a molecular biologist at University of California, San Francisco: "They are not recognised for their potential [contributions], maybe not even within the plant community and certainly not outside of it."

Coming out of workshops at the meeting were a number of calls:

- A need for a second, greener Green Revolution
- New model systems,
- Intensively studied species that provide insights useful both in basic and applied research.
- More emphasis on describing genetic diversity, wherein genes for useful traits are tracked down in a wide range of species for potential transfer into economically useful plants.

Some delegates suggested that plants, whose environments can be tightly controlled because they do not move, might be better models than animals for understanding the relationship between genotype, phenotype and environment. Major questions include how genes dictate an individual's range of traits and how the environment affects the manifestation of those traits.

- New sensing technologies of scales from cells to ecosystems will be needed to explore these questions, the participants pointed out.
- Learning how plants tolerate drought, heat, and flooding is useful not just for agriculture but also for predicting how wild species might cope with climate change.
- Cheaper, faster genome sequencing is already revolutionising all aspects of plant science and including microbes that interact with roots.

Yamamoto would like to see the use of systems biology and synthetic biology to create designer plants that can withstand, extreme drought or improve a food's nutrition quality. But he was not sure that this ambitious goal would make the final report to be issued. Yamamoto was also far from sure that a 10-year plan will lead to new funding, given the current tight budget situation.

Current expenditure on competitive plant science research is around \$350 million. Delegates indicated that tripling that amount, to \$1 billion, would not be unreasonable. Tom Brutnell, Boyce Thompson Institute for Plant Research in Ithaca, New York said: "We can easily spend that on one telescope, so isn't feeding the world worth as much?" It is hoped to circulate a draft report of the meeting for outside comments, with the ultimate goal of issuing a final report, outlining priorities, by March 2012.

## AGROCHEMICAL RESISTANCE

### Herbicide resistance problems profiled at the American Seed Trade Association expo

Resistance to widely used herbicides is becoming a significant issue particularly amongst seed producers and potentially affecting major crops in the US. Glyphosate resistance is the most widespread with resistance having been recorded in about 20 weed species worldwide and in 11 species in the US. While resistance is a phenomenon that usually results from the repeated use of the same herbicide, the resistance can affect more than one chemical.

A report from Nebraska in December described how a population of common waterhemp, *Amaranthus tuberculatus*, has developed resistance to post-emergent application of several different HPPD-inhibiting herbicides. These herbicides are pigment inhibitors (carotenoid biosynthesis inhibitors). Carotenoid is a red pigment that protects chlorophyll from harmful UV lights. By stopping the production of carotenoids, the chlorophyll is destroyed, and the plant turns white and eventually dies. HPPD herbicides are often referred to as "bleachers."

The resistance was recorded affecting *Callisto* (mesotrione), *Laudis* (tembotrione), and *Impact* (topramezone). Resistance to up to six times the recommended dose of mesotrione was recorded. This case of resistance occurred in a seed corn production system where these HPPD-inhibiting herbicides were repeatedly used over the last five years. Resistance was identified at only one location, but the herbicides are widely used in the mid west.

The Nebraska finding demonstrates how the use of the same herbicide can easily result in the evolution of weed resistance, regardless of the type of herbicide used. This is similar to what happened with atrazine and ALS resistance, commencing 30 years ago.

Rotating herbicides with different modes of actions is the best way to extend the effective life of all herbicides. However, it requires a range of herbicides to be available. At an interactive session of the American Seed Trade Association expo held in Chicago (and reported on December 13), Dr Larry Steckel, University of Tennessee said: "With this environment we are currently experiencing, there is really no new herbicide mode of action on the horizon." ([www.seedquest.com/news.php?type=news&id\\_article=22955](http://www.seedquest.com/news.php?type=news&id_article=22955))

Dr. Steckel addressed the session, which was hosted by Bayer CropScience, and outlined the severity of the growing weed resistance crisis. Bayer CropScience outlined its commitment to delivering sustainable solutions to the problem through its products *Ignite*, glufosinate ammonium, herbicide and *LibertyLink* trait. The combination can be used on corn and soya as well as canola.

Dr Steckel said that: "These traits are going to play an integral part on how we are going to manage weeds for the foreseeable future."

## **BIOFUELS AND INDUSTRIAL CROPS**

### **New chemical pulping technology for rice straw delivers paper and a novel insecticide**

The Chemical Industries Research Division of the Egyptian National Research Centre have developed a new chemical pulping technology which could eliminate the need to burn rice straw. ([SciDev.net Agriculture and the Environment/News - October 2011](#))

The method extracts more than 65% of the rice straw as pulp for use in the paper and cardboard industry. Current technologies only convert 30% of the straw into useful pulp, leaving the rest to waste,

Maha Al Khatib, a researcher in the division, described how the process extracts cellulose from the straw to make paper and natural phenolic materials. The phenolic materials are then refined to produce an insecticide that is "natural and non-toxic to humans", but particularly effective against flies and *Culex pipiens* mosquito.

The first industrial unit based on the new technology was scheduled for commercial introduction in December near rice farms in Noubariya, 120 kilometres north of Cairo.

An economic feasibility study estimated that the roll-out of the technology could net around US\$85 million in profits for one million tonnes of rice straw recycled per year, and lead to 100,000 new jobs. It would also avoid emitting 85,000 tonnes of carbon dioxide from burning the straw. As a consequence of this study, an EU funded scheme aiming to strengthen innovation and technology transfer in Egypt (the Research Development and Innovation Programme, RDI) agreed to provide US \$500,000 towards the industrial unit. The Egyptian Patent Office had granted a patent on the technology in 2010.

Galal A Nawwar, head of the division, was reported as saying that rice straw is one of the most prominent examples of agricultural by-product waste in Egypt. "Yearly, four million tonnes are burned, creating both an economic waste and an environmental problem from air pollution,"

Gamal M Siam, professor of agricultural economy at Cairo University, was also quoted. He said: "Any idea that does not provide a mechanism for transporting rice straw from the fields of farmers to the industrial units will face failure, even if it utilises effective technology". He added that for in order for it to work, the method must "provide added value to the farmers, making the 4.5 million rice farmers in Egypt stop burning rice straw in their fields".



**INNOVATION MANAGEMENT**

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