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Together we will protect our crops

Inside This Issue
(Focus :GM & GE crops)

From the Editors' Desk:

Climate Change - Nostradamus unplugged?

Global warming, global cooling and climate change all were in news at some point of time over the last half-century. During 1940-70, there was global cooling heralding the coming of ice age. In 1972, Washington first predicted about significant climate change that needs immediate attention of scientific community and the polity, brooking no scope for delay. This climate change was about global cooling. Since mid 1998, the scientists and the media are clamouring about global warming skillfully manipulated by ecological enthusiasts. Meteorologists backing up the warming scenario are the same who fail to predict the weather over 48 hrs. There speculations over 100 years are now held valid.

Actually, the geological evidence is replete with data that shows climate change from aridity during the Precambrian times (600 millions years ago) to wholesale refrigeration in Pleistocene through Permian ice age (118 million years). The sandstones of Madhya Pradesh give evidence of semi-arid climate (desert varnish) and localized torrential rains (pitted sandstones) about 600 million years ago. Volcanic eruptions led to an area covering about 5,00,000 sq. km across Madhya Pradesh, Gujarat and Maharashtra is represented by black rock around Mumbai - black colour being due to intense heat (65 million years ago continued up to one million years ago). In between there were periods of ice ages where sea level dropped by tens of metres. During Pleistocene period the sea was believed to have gone down by 13.5m. Yet, life survived!

The present shift towards global warming is an agenda where billions of dollars are available for the scientific community and the NGOs and is being ascribed to human activities primarily in the form of increased emissions of CO_2 and other greenhouse gases (GHG) (methane, nitrous oxide). Simulation models predict a shift in global mean temperature between 1 and 3.5°C by the year 2100 (IPCC , 2nd & 3rd Assessment Report,1996, 2001).The magnitude of climate change and its impact on biological and ecological processes and on human enterprise will become more clear from the 4th assessment report due later this year. It is good to remember at this point of time that as soon as the Kyoto Protocol on global warming came into effect on February 15, Kashmir suffered the highest snowfall and recorded the lowest temperature in last 40 years. This, however, was not news as it was not a disaster. The receding glaciers are focused but not those that are spilling over.Yet there is no denying that current warming is accelarated by human activities generating GHG. Given global warming prediction is onerously occurring,what are its significant effects on the climate and what will be its impact on agriculture, crop pest scenario and management?

The global warming is inexorably impacted with more droughts and more floods. We have seen this in 2006 through unwarranted floods in Rajasthan and drought in Assam thus negating the statement by Martin Parry *'Dry area gets drier; moist areas get moister'*. That's not what we like to see.

Natural vegetation is likely to be affected (through competition, migration and recovery from disturbances) leading to new species combinations. Elevated CO_2 would result in increased photosynthesis and water use efficiency leading to initial crop increases which are largely mitigated by other overriding factors (phytophagous insects, plant pathogens and weeds). N_2O is a more potent GHG than CO_2 and is released when fertilizers breakdown. A poleward shift of agroclimate zones predicted will enable crops to migrate to new regions. Hopefully the amensals, commensals and beneficial microbes will also do the same along with the plant pests. Plants growing in marginal climate may experience chronic stress that would predispose them to pest and disease outbreaks. Use of Geographical Information System (GIS) and climate matching tools may assist quarantine agencies in determining the threat posed by a given pathogen under current and future climates. Climate matching may be used for climate change impact assessment by identifying those locations on the globe with a current climate that is most similar to the predicted future climate through use of softwares like CLIMEX, HABITAT, WORLD etc.

The CGIAR (Consultative Group on International Agricultural Research) says yields of existing varieties will fall with concomitant reduction in wheat yield. The warming may shrink South Asia's wheat area by half in another 50 years. Researches show rice yields are declining by 10% for every degree celsius increase in night temperature. The livelihood of billions of people in developing countries particularly in the tropics will be severely challenged as crop yields decline due to shorter growing seasons (Ziegler, Director IRRI). Simultaneously areas not currently available for cultivation will open up (Siberia, Alaska) but that will not fully compensate for what is lost. This suggests, CGIAR says, that researches into the technological, social and economic dimensions need to accelerate.

Contd.on page 2

Why release GMs through special channels?

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Genetic engineering and GM varieties have changed agriculture. Complete gene sequencing of a crop species, identification of the sequences for its traits in the genome and incorporation of a 'foreign' sequence in the right place in the genome of a crop are expensive research procedures. As a result rich countries or more correctly transnational companies like Aventis, DuPont, Monsanto, Syngenta and others are largely controlling the GM-research. They have business interests. For instance in case of paddy 90% of the more than 250 gene sequences that are patented belong to these companies. Since as a food crop rice has a big market in Asia, they are trying to push seeds of new GM varieties and make business. In the crop fields, farmers are maintaining around 1.4 lakh varieties of rice with different traits. All these are left to the mercy of these companies who are capable of working out gene-sequences of any or all of their characters and go for patenting them. Under such a situation the only hope is China, whose scientists have thrown a challenge to the effort of these 'transnationals' by independently working out the genomics of rice plant and oppose these 'patenting' attempts on rice - a crop that is so very important in the life of millions of 'Asians'. India is one of the first few signatories of the International Treaty on Plant Genetic Resources for Food and Agriculture, 2001, that assures conservation of genetic resources of 64 crop plants producing food and fodder. The treaty under FAO not only emphasized conservation and sustainable use of these resources but also emphasized equal distribution of the benefits and advantages of the resources, particularly for the farmers since they are, the treaty accepts, the conservatories of these resources.

Keeping all these 'good wishes' within the pages of the treaty, our Government hastily allowed private companies to introduce GM varieties directly to the farmers' field without paying any attention to their critical examination. GEAC has authorized Mahyco to conduct field trials of varieties of cotton, rice, bhindi etc carrying possibly Bt Cry 1c gene to prevent lepidopteran larvae. Bt-cotton has already earned a name or bad name in southern and western states causing crop failures and successes. They have been put in farmer's field in north 24-Parganas keeping the State Government unaware. For release of GM varieties the union Government has flouted the long-standing procedure of variety release in this country only after multi-location trials under scientists of so many SAUs and ICAR. The authority has been vested with GEAC under the Dept. of Forest and Environment who do not have the system, infrastructure or scientists to do the particular job. Is it deliberate to bypass the strict scrutiny of the agricultural scientists and serve the interests of the companies?

There is no second opinion against the policy of using this very sharp tool for crop improvement. But the need for critical testing of their performance under strict supervision cannot be sacrificed. Because marketing of GM varieties in India have not only legal and commercial challenges but also their suitability in any local environment, their susceptibility to any of the local pests and diseases and their 'safety' for human health and environment. This is more important when we find that Bt-toxin proteins in the plants reached all parts to cause at least chronic toxicity to humans and plants and such other consequences. Thus the attempt to re-write the procedure of variety testing and release is being seriously questioned and debated in a number of transparent platforms to decide. Since this may even pollute and endanger our 'bioresearches', one can not allow this to go unchallenged. On the other hand we require GM-rice with enhanced transcription rate of the 'antiporter gene' that pumps more sodium to vacuoles so that the rice variety grows in high salinity areas. We may welcome GM-melons with rabies vaccine genes or extra vitamins or even rice that produces more in higher temperature but their release must follow critical multi-locational scrutiny.

The editors solicit comments, opinions for or against the problem muted by the author. They will be published in the next issue.

(Contd.from page 1)

CGIAR are trying to produce what they prefer to call 'climate proof varieties'. Scientists have developed rice varieties at IRRI that can withstand weeks of flooding as in Assam and Bangladesh.

One of the most exciting initiatives aims to make fundamental modification to rice so it becomes more efficient at using the solar energy by transforming it from its present C_3 plants status to C_4 one.

Genetic engineering is a potent tool for producing varieties adjusted to the climate change but has hazardous environmental and health implications. However,'in developing countries we are dealing with a crisis situation and whatever tools are available, we need to apply it to that situation' (Verchot) - a poor crisis management policy at best.

ICRISAT at Hyderabad are searching for stress tolerant genes in drought resistant sorghum and millet that can survive drought situations in Africa so as to transfer them to less tolerant wheat and rice. Scientists at CIMMYT and CIAT developed a hand held sensor using light infra-red radiation which can tell farmers whether plants need more fertilizer or not; less fertilizer use means less N_2O produced. Surinder Sud (*Farm View*, Nov. 07, 2006) suggested that climate change can be largely mitigated through breeding new plant types. But action on this front brooks no delay.

The vested interests in the global warming theory are now as strong, rich and politically influential as the biggest multinationals. It is no coincidence, says Crichton that so many scientists sceptical of global warming are retired professors; they have no need to chase research grants and chair. Anticipating planning for climate changes is imperative if farmers of poor countries are to avert forecast declines in yields of World's most important food crops (Verchot). Climate ready crops need to be developed that can withstand environmental changes and extremes (Ziegler). CIMMYT is using molecular biology techniques to find 'hot spots' in corn DNA that could make plants more able to tolerate drought. In IWMI (International Water Management Institute) Sri Lanka has devised a simple drip irrigation system to deliver scarce water to crops (cost ca Rs. 200). Climate change may bring new opportunities (e.g. new crop options), but also will pose new risks and challenges for farmers and land managers. Specifically:

- invasive insect, disease and weed pests are likely to benefit most from climate change, leading to increased pesticide and herbicide use;
- reduction in biodiversity are likely, because climate change will tend to favour aggressive invasives at the expense of endangered species that are poor at migrating and adapting to change;
- the fabric of our forests will be changed forever , with maple, beech and birch being gradually replaced by oak, hickory and pine;
- Several agriculture sectors that currently dominate the rural economy will be at risk, most notably the fragile dairy industry (dairy cow milk production is highly sensitive to heat stress).

The point to ponder is - with all this hullabaloo on global warming (and mullah freely available,are the Indian polity and agricultural master planners at ICAR focusing on integrating the problems that our agriculture may face in a few decades from now? When will we act in our own interest instead of catering to the interest of the multinationals/rich countries by following them or their back-up NGO/Foundation-supported dictats? The present day pest-oriented losses are likely to escalate beyond redemption if we lag behind. Will the concerned administrative authorities wake up to this stark reality?

Chitreshwar Sen
On behalf of the Editorial Board

Letters

Nematode Awareness Day

The newsletter is very good with nice presentation. Hearty congratulations for arranging Nematode Day. Please send me every time. I will try to send one paper for publication in the journal. If any symposium is there then do let me know. Please let me know whether you publish review articles also in journal. Keep in touch.

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I am really happy to know AAPP is one step forward compared to other universities. My hearty congratulations to all the team members and I wish success in this endeavour. A programme like Nematode Awareness Day is very unique and this will help nematology science to flourish in near future. Farmers will come to know about nematode problems.

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Taxonomy and biodiversity

I am sorry to respond late. I went through the attached newsletter and undoubtedly it is informative. But in ZSI, we are more concerned with taxonomy and biodiversity. Hope that this aspect will be included along with plant protection.

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Congratulations

Thanks for sending me copies of newsletter of Association for Advancement in Plant Protection. Congratulations on writing such a brilliant write up in excellent language in the Editorials. The effort and the strides made by the Executive Committee and the Editorial Board to bring out this type of quality newsletter are praiseworthy and I wish for its glorious progress.

S. K. Mukhopadhyay, Emeritus Professor, Visva-Bharati, Santiniketan.

Views

Biotech 'GM seeds' buccaneers destroy India's rice economy –
The India Government is firmly under control of buccaneers of biotechnology and spurious life sciences multinational corporations. The target now is rice. India being centre of origin of rice, having a wide diversity of rice genes, it is shocking to note the cavalier attitude of GOI to the country's non-GM status for rice. GM rice research, especially field trials exposes our rice farmers to contamination including transgenic contamination of wild species and rice seed stock. Losing control over our local rice seeds may well mean losing our right to food and nutrition.

In granting permission for field trials GOI has failed to protect people's interest. The Supreme Court (SC) in an interim order had directed that an inter-ministerial GEAC be formed and all applications for field trials be routed through it. This was obviously not a *'carte blanche'* for field trials. Yet the 67th meeting of GEAC (22.05.06) sanctioned 91 GM products for multilocational trials. This forced SC to issue an interim order to direct the GEAC to withold such approvals till further directions. While Bt-rice trials have been approved in 10 out of India's 25 States, much more have been slipped in.

One might recall that India had 1,20,000 varieties of rice seeds of which no more than 50 are available - and this is detailed in Claude Alvarez's *'The Great Gene Robbery'* way back in 1986 wherein USA is shown to have launched a war on Indian rice and food security. The war has now been taken to new heights by Monsanto-Mahyco nexus. Like rice, about Bt-brinjal, the limited field trials proposed is one of the most ill-conceived and they should be enjoined pending a thorough assessment (Robert Mann, Univ. of Auckland, NZ).

People of India will be paying Monsanto and the likes (Asgrow, Pioneer, Hi-Bred etc.) with their lives and property. (For more information log on to the URL: www.globalresearch.ca/index)

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Shifts in paradigm or revolutionary breaks in weed science – Suggestions for a more dynamic targeting in weed control may be spelled out as follows :

- *Stop ploughing for growing crops* - Is it possible to grow crops without land preparation or tillage practices? Normally crops are grown by several ploughings to make good tilth by land preparation. The revolutionary breaks or shifts in paradigm are that present day weed scientists are advocating a U-turn from this concept. The new idea is to practice no-tillage for growing crops. One of the International stalwarts to advocate zero tillage is Masanovu-Fukuoka, the author of the book *One Straw Revolution.* Presently 27% of the total cultivated land in the world has been successfully put under zero tillage. Our present slogan is "Stop the plough and save the soil degradation". Our soil resources have suffered from loss of organic matter over past 100 years. Many of them has lost upto one half of their native organic matter content. The major contribution to this trend in soil organic matter loss is the tilling of soil with plough, disc and cultivator in preparing the land. If we are to counter the effects of soil degradation caused by excessive tillage of the soil we must find and adopt new methods for annual cropping. One of the prospective methods is the practice of Zero Tillage Resource Conservation Technology.
- *Site-specific weed management* - Another new paradigm in weed management is the site-specific weed management in Precision farming. The primary approach is the weed detection sensor mounted on spraying equipments. The sensor can distinguish targeted weeds from the crop and information thus generated is passed to control system that turns the sprayer on or off accordingly.
- *Remote sensing, GIS and GPS in weed management* - Remote sensing technique can be used to distinguish a particular weed species on range land or wild vast range area. Joint use of Geographic Information System (GIS), Global Positioning System (GPS) and Remote Sensing (RS) provides a powerful tool for detecting, mapping and monitoring spread of weeds over inaccessible areas. Digitisation of computer-analysed video images permit the area estimate of weed population.

Sisir K. Mukhopadhyay, Emeritus Professor, Visva-Bharati, Santiniketan.

Mango malformation – a menace to productivity

Malformation disease of mango prevalent in the northern India causes 50-80% annual loss in yield. In recent years the disease has also been introduced into coastal states of the country including West Bengal, with planting materials. Its pathogen, a physiological race of *Fusarium moniliforme* var. *subglutinans* (*F. mangiferae*) which is highly mutable and adaptive has established itself well in the new agroclimatic conditions and spreading fast among local cultivars. The disease symptoms manifest on inflorescence (floral malformation), shoots (vegetative malformation) and young seedlings (bunchy top). The pathogen survives and multiplies over dead, necrotic malformed panicles or shoots particularly after rainy season. From there it is carried to healthy developing buds by eriophyid (*Aceria mangiferae*) or mycophagous (*Tyrolichus casei*) mites and then it enters the host through injuries inflicted by the mites. Autumn and spring flushes are most vulnerable for the pathogenic invasion and symptom manifestation. Plants in nurseries and at juvenile stages show more susceptibility. The disease incidence on regular bearers is more when compared with the alternate bearing cultivars . Number of malformed shoots or panicles during onset of flowering season greatly influences the incidence of floral malformation in the forthcoming crop season. The pathogen during its constant presence in host cells, brings about various metabolic imbalances. Thus, depletion of auxin, zinc ions and nitrogen content also affects normal development of the plant. Against this background information, an integrated management strategy has been developed. It recommends to remove malformed plant parts one feet below from the point of attachment twice once after harvesting of fruits (before onset of rainy season) and next in October before flower bud initiation. The emerging buds of autumn and spring flushes should have prophylactic sprayings with copper fungicide (0.2%) and an acaricide (dimethoate 0.05%). To replenish the hormonal and micronutrient deficiencies, sprayings of napthylacetic acid (200 ppm) before flower bud initiation (October-November) and chelated zinc sulphate (40 ppm) at developing stage of panicles (January-February) have been recommended. Intensive control measures should be taken for 5-25 years age group of plants. In orchards, a mixed population of regular and alternate bearing cultivars should be maintained avoiding mono block cultivation.

For raising healthy nurseries, scion shoots are sprayed with Captan (0.2%) thrice i.e. immediately after defoliation of scion shoots, 24h and 7 days after grafting. The grafted plants then are shifted to polyhouse (temperature 25-31^{0}C, RH >85%) for further growth. At the non-availability of polyhouse, grafting may be done during spring flush and nurseries should be maintained far away from infected orchards under adequate sunlight. A computerized decision support system for predicting outbreak of malformation in any state of India and suggestions for appropriate control measures is available at www.dkchakrabarti.com.

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GE Crop Stats of India

Highlights

India is in the look out for a 2nd green revolution and the Prime Minister, Dr. Manmohan Singh stressed that the farmers should benefit from research in agricultural production (May 29, checkbiotech.org.). The tool referred to was obviously biotechnology in general and genetic engineering in particular. Under such a proactive policy of GOI the Public Sector enterprises that took up GE crop development included IARI, New Delhi; IIHR, Bangalore; NBRI, Lucknow; NCPGR, New Delhi; NRCWS (Weed Science), Jabalpur; CRRI, Cuttack; DRR (Rice Research), Hyderabad; CPRI, Simla; SBI (Sugarcane), Coimbatore. The Universities involved were primarily, University of Delhi, JNU, ND, Madras University, Chennai; Osmania, Hyderabad; Madurai-Kamaraj, TNAU, Coimbatore; UAS, Bangalore and Dharwad etc. The private sector enterprises include Mahyco-Monsanto Biotech, Mumbai; MetaHelix, Bangalore; Avestagen, Bangalore; Dow Agrosciences, Bangalore; Sungrow Seeds Ltd, ND and several others.

Crops and traits involved include 23 crops and 67 GE traits respectively and are in different stages of development. Autonomous Institutes are developing 8 traits and private sector 20 traits.

- ***Cotton:*** Forty approved Bt varieties in 4.5 m acres (2006-07)); 20 varieties of Cry 1Ac and 2 gene stacked varieties with Cry 1 Ac + Cry 1 Ab will be commercialized in 2007.
- ***Rice:*** GE varieties being developed for pest tolerance included tolerance to *Galanthus nivalis*-lectin gna (Osmania University); bacterial blight and pest resistance (Cry 1Ac, gna) (DRR), pathogen resistance (chitinase) and pest resistance (Cry 1Ac, Cry 1Ab, Cry 1Aa), (IARI); pathogen resistance (chitinase, glucanase) and drought resistance (Osmania ; MKU & Mahyco for pest resistance (Cry 1 Ac). A GE variety of basmati rice with stacked genes for BLB and another for post-harvest damage by coleopteran pests are under development. Local varieties golden rice that contains genes for β-carotene in the grain is being developed at the CRRI, DRR and TNAU.
- ***Millets:*** MMB is developing GE maize for herbicide tolerance and a variety of sorghum for pest tolerance.
- ***Pulses:*** ICRISAT involved in pest tolerant chickpea and pigeon pea with Cry 1Ab and trypsin inhibitor gene.
- ***Oilseeds:*** ICRISAT is growing ground nut varieties against Indian peanut clump virus.

Mustard is receiving attention for stress resistance (IARI: CodA, osmotin), herbicide tolerance (UDSC & NRCWS : bar, barnase, barstar) and β-carotene content (TERI).

- ***Vegetables:*** GE potato with Cry1Ab (CPRI), high protein (NCPGR; JNU: Ama-1); tomato for fungal resistance (NCPGR, JNU): oxalate decarboxylase and for pest tolerance (MMB, cry 1Ac); others include cauliflower (MMB, Sungrow Seeds-Cry 1Ac), cabbage (Sungrow Seeds, Cry 1Ac) and okra for virus resistance (IHRI, MKU). Pest tolerant GE Brinjal (MMB) is under large scale field trial.
- ***Sugarcane:*** Resistance to fungal red rot (SBI).

(**Source:** http://www.fbae.org, www.fbaeblog.org, July 27, 2006)

Pesticide Industry

- Syngenta obtains first registration approval for its fungicide Revus in Europe (Austria) and Asia (S. Korea) (October, 2006).\
- BASF has launched a farm applied liquid fungicide seed treatment Charter PB (triticonazole) in the US to control *Fusarium* and other seed-borne diseases in wheat and barley (October, 2006).
- FMC and Dow Agrosciences have entered into a long term supply agreement, whereby both companies market pre-mixes based on cloransulan-methyl and sulfentrazone for weed control in soybeans.
- Syngenta's Agrisure RW has received approval from EPA for use against corn rootworm.
- United Phosphorus is to acquire DuPont's bensulfuran-Me product portfolio which includes Londax, a leading rice herbicide. It has also acquired the global propanil herbicide business of Dow Agrosciences.
- BASF has sold its global terbufos insecticide business to AMVAC Chemical Corpn - worth £ 20 million in 2005 (Nov. 2006).
- Cheminova has acquired from Bayer Crop Science the European license for pyrethroid insecticide anathrin and global rights to the organo-PO_4 insecticide phosalone (Dec., 2006).
- Makhteshime Agan is to increase the share of raw materials it gets from China and will reduce its dependence on European supplies in order to cut costs (Dec., 2006).
- DuPont cuts 1500 jobs from its crop protection and nutrition business and will increase its investment in seeds.

GM business

- EU environment Ministers have voted for the 2nd time to refuse the European Commission's proposal to overturn illegal GM bans in Austria (Dec., 2006).
- BASF has launched a new brand identity Ag Celence for agriculture products that offer growers plant health benefits beyond crop protection (Nov., 2006)
- The USDA has deregulated Bayer Crop Sciences herbicide tolerant rice variety (LLRICE601) stating that it does not pose any environmental concerns and should no longer be regulated (Nov., 2006)
- Bayer's Crop Science has exclusively licensed the right to Senesco's proprietary gene technology for use in brassica oilseeds (Nov., 2006)

(**Source:** http://www.ecpa.be)

Rice: Following ban by EU of rice seeds from US contaminated with Bayer Crop Science GM Liberty-link 601 (LL601) trait (deregulated in USA alone) the commercial cultivation of Bt-rice in India could lead to similar restrictions imposed by EU, said the country's leading rice experts. India's rice export to EU totalled Rs. 507.31 crores in 2005-06. The Chinese Govt. is apprehensive of releasing Bt-rice for commercial cultivation. Iran has not released its Bt-rice for commercial cultivation. On Nov. 16, Rice Exporters Association of Thailand and the Vietnam Food Association have reached an agreement to keep GM rice out of cultivation (www.financialexpress.com, dated Dec.02, 2006).

On the other hand GM paddy ran into rough weather in TN as the State is planning to ban its trials altogether. Farmers of Ramanathapuram village near Coimbatore and Bharatiya Kisan Union uprooted and burnt the Bt-rice plots under test by Mahyco-Monsanto Consortium. In the meanwhile, following UP Govt, Chattisgarh State Govt. has ordered enquiry into Bt-rice trials close to Raipur (Nov. 24, 2006, Press release) at Purara Village a trial that occurred within a kilometer distance from the world's richest collection of rice germplasm available with Indira Gandhi Krishi Vidyalaya, the State Agricultural University.

On the flip side National Seed Industry Council of the Philippines released the first biotech rice variety NSIC Rc142 or Tubigan 7 claimed to be resistant to BLB (resistance derived from Xa 21 gene from IR BB 5-21) using DNA markers that makes the BLB resistance selection faster and more effective. This variety is clamed to be adapted to wet seeded as well as transplanted culture. However, it should be constantly monitored for rice blast disease. It has moderate resistance to sheath blight and a spectrum of resistance to insect green hopper (tungro vector), yellow stem borer and brown plant hopper (*Philippines Star,* Dec. 28, 2006).

Bt-Cotton: A genetically modified cotton, which makes up to 35% China's crop is damaging the environment despite its apparent present day success in controlling bollworm pest as the transgenic cotton was harming natural parasitic enemies and seemed to be encouraging other pests see (http://new.xinhuanet.com).

In India more than a month ago, about 125 farmers of Dharmpuri, a major cotton producing district of TN complained of Bt-cotton failure from seeds procured from Mahyco-Monsanto. The TN Agriculture Minister asked the company to pay compensation and on 28th January, Mahyco has given solatium to the farmers to the tune of Rs.9.86 to 88 ryots (http://www.nerwindpress.com).

GE Mustard: The Supreme Court of India (SC), concerned over risks of open field trials of GM seeds, shared the public concern over large scale on-going field trials of GE/GM seeds in India and their potential to corrupt traditional crops like rice, cotton, brinjal, tomato, cauliflowers, wheat and okra, while debating permission for continuance of GM mustard seeds DMH-11, being carried out by the Delhi University (DU) that contained non-permissible genetic-used-restriction technology (GURT). *Brassica* spp. including *juncea* present highly contaminatious sics. DMH-11 is also engineered to glufosinate, a Bayer's herbicide. According to Heinmann (Director, Centre for Integrated Research & Biosafety, University of Canterbury) the Barnase construct has the potential to act as GURT because the barnase plant and its pollen can restrict access to fertile plants. That is also the position held by Indian Protection of Plant Varieties and Farmer's Act 2001 which bans the registration of GURT. Incidentally, ProAgro, a private Seed Co. in India, obtained from Belgium a high yielding GE mustard based on barnase/barstar gene system back in 1966. After several backcrossing ProAgro was permitted field trials at 50 locations by RCGM with 7 entries of 3 test GE hybrids, co-ordinated by ICAR which submitted a report to GEAC. The varieties never saw the light of the day and ProAgro withdrew their application (www.fbae.blog,Dec. 01, 2006). Fate of DM-11 is awaited, hopefully with the same result. (http://www.hindu.com).

Brinjal: Monsanto-Mahyco tries to introduce its Bt-brinjal varieties under extensive and often clandestine field trials. They inserted Cry1Ac gene from *B. thuringiensis* for providing in-built pest control especially against fruit and shoot borer that causes losses to the extent of 50-70%. Indiscriminate use of pesticides to protect fruits from the pests is common leading often to destruction of beneficial insects and posing a hazard to consumers. During the development of Bt-brinjal since 2000, ICAR and RCGM (DBT) were monitoring multilocation field trials, given limited permission by GEAC. The varieties were bred by Mahyco in collaboration with 2 public sector Institutes–the TNAU, Coimbatore and UAS, Dharwad, though the ownership of EE-1 still rests with Mahyco. It is proposed to extend the partnership to IIVR, Varanasi, University of Philippines, Los Banos and BARI, Bangladesh. The genetically engineered brinjal contains a gene construct of Cry1 Ac from Monsanto which has a 26% stake in Mahyco-Monsanto Biotech. Mahyco has integrated EE-1 into 8 of its own brinjal hybrids (MHB 4, 9, 10, 80, 99, 11, 39, 111). The TNAU used brinjal hybrids Co.1, PLR-1, MDU-1 and KKM-1 while the UAS-D used Manjaro Gota, Udupi Gulla, Malapur local, Kudachi local, 112-GO hybrids and Rabkan local. The IARI has been developing a GM modified brinjal with Cry1 Ab for nearly a decade.

DBT norms have not been followed by the developers of Bt-brinjal, observed a CSA Committee. The Committee also noted that ICAR supervised trials under AICRP vegetable cultivation showed that there is not much hope for Bt-brinjal (gvramanjaneyulu@gmail.com).

In final analysis, it may be difficult for Mahyco to get approval for it's four Bt brinjal hybrids produced through *Agrobacterium* process of transformation. The varieties proposed are MHB-4Bt, MHB-9Bt, MHB-80Bt and MHBJ-99Bt claimed to be resistant to fruit and stem borer. (http://www.financialexpress.com).

Okra: The Secundarabad based CSA (Centre for Sustainable Agriculture) was first to detect the Bt-okra field trials by Mahyco in village Narukoduru and bring it to the notice of the Govt. The local farmers later uprooted the crop (Indian Express, Jan.12, 2006) claimed to be internally resistant to fruit and shoot borer (Earias sp.) through insertion of Bt gene Cry 1 Ac. Apparently, these trials are still being conducted on a back dated limited approval of DBT (2003-2004). (*The Hindu*, Jan.4, 2006).

The GEAC/DBT– approved and clandestine testing without the knowledge of authority or farmers is a practice whose tentacles spread over the length and breadth of our country. Unless immediate steps are taken, the food/seed security of the country may be compromised beyond its plastic limits.

News & Opinions

News

- *Air Pollution hits Indian rice harvest* - Researches in USA show that a combination of global warming and 'brown cloud' pollution made up of particulate matters and other pollutants from burning fossil fuels are significantly reducing rice yields in India *(Rice News,* 08.12.06).
- *Bt-toxin resistant bollworms* have appeared in China that will render the varieties obsolete in 6-10 years of introduction.
- *Genetically engineered crops rejected*- Resistance to genetically engineered crops continues by farmers, consumers and some Governments. All India Rice Exporters Association formally requested that the GOI to prohibit field trials of GE rice in basmati rice growing areas (http:// www.commondreams.org., 01.10.06).
- *Andean farmers fight with multinational Syngenta over GM potato*- Andean farmers launched an international protest starting 12.01.07 against biopiracy by Syngenta through introduction of terminator-enriched potato that today threatens their region's biodiversity, culture and food sovereignity. Such potatoes fail to sprout unless treated with a specific chemical. The farmers fear that pollen from modified plants could contaminate local varieties and prevent their tubers from sprouting. (*New Media Release*, Jan.28, 2007).

Syngenta view: Syngenta has adopted a policy not to use the so called terminator gene technology to prevent seed germination. Other techniques involving the control of activity of genes in plants could bring a variety of benefit to farmers and consumers boosting natural resistance during susceptible phases of growth, reducing losses after the crop have been harvested or help to avoid frost damage (http://www.syngenta.com).

- *Agriculture Minister versus BRRI*-The Agriculture Minister of Bangladesh stated that out of their 10,000 rice varieties only 200 odd are cultivated now. He advocated the conservation of genetic resources and biological diversity. On the other hand, scientists of BRRI intend to introduce golden rice, a genetically modified version of the BR-29 by 2010 having high yield and fortified with 17 times the amount of vitamin A. This is opposed in view of the results of the laboratory tests that show GM food results in allergic reaction, high white blood cell count, production of immature red cells, changed cell functioning of the pancreas and high death rates.
- *The AP Group agreed to have an out of court settlement with Mahyco-Monsanto Biotech Ltd.* in the Bt-cotton seed issue. Government, however, put the rider that there will be no compromise in the price front.
- *GM regulator on panel funded by biotech majors*- The Co-Chairman of the regulatory body for genetically modified crops, Charudatta Mayee, has triggered a conflict of interest debate by becoming a Director of an international network funded by biotech majors such as Monsanto, Bayer and DuPont. Mayee told that he did not attend the last two meetings of the Genetic Engineering Approval Committee (GEAC) because he was thinking in terms of quitting the regulatory body to avoid "unnecessary controversy" over his appointment to the International Service for the Acquisition of Agri-biotech Applications (ISAAA). Although ISAAA is dedicated to transferring biotechnology to developing countries, Mayee refutes the suggestion that his appointment to its Board of Directors on September 1 would get in the way of his regulatory job in India.

Simultaneously, Dr. Paintal, the promoter of DU's mustard DMH-11 is also the Chairman of the Review Committee set up by the GEAC for Bt-brinjal. He, therefore, oversees a body of regulation that he is himself subject to.

(Adapted from Manoj Mitta,Oct. 13,2006, http://timesofindia.indiatimes.com)

- *Who benefit from GM crops?* - The 2nd generation GM crops have failed to appear and the widely planted GE crops are the herbicide tolerant soy, maize, cotton,canola and Bt- maize and cotton. Herbicide tolerance allows such crops to be sprayed with heavy dosage of glyphosate (Roundup) without killing the crop. The only benefit is reduced use of farm labour as there is no yield increase (Friends of the Earth Europe). However, repeated use of glyphosate is creating weeds that are resistant to the chemical. The weeds develop resistance with surprising speed. Virus resistant potatoes are available through normal breeding but GE crops are being introduced having same properties but for precise shape and size and colour demanded by the chip industry.

Opinions

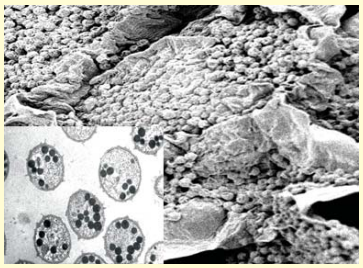
- *Prof. Dayuan Xue,* Nanjing, Institute of Environmental Sciences, China - Modern agricultural biotechnology has produced significant benefits for commercial companies but not for small farmers in China.
- *Hans Harren , DG,* International Centre of Insect Physiology & Ecology, Nairobi, Kenya - '...farmers are likely to be weaned from pesticides to be force fed biotech seeds. In other words, taken off one treadmill and set on a new one. The trend towards a quasi-monopolising of funding in agriculture development into a narrow set of technologies is dangerous and irresponsible. It is obvious that we are going to repeat the mistakes of the insecticide era even before it is behind us'. (http://members.tripod.com).
- *Felipe Osorio, Director*, Mahyco-Monsanto Biotech (India) Ltd.- Stated 'Cotton has seen a phenomenal production clothed in genetic success.' Are there any takers? (*GM Watch*, Oct. 4, 2006)

Pathogen Diagnostics

Club root of crucifers - a diagnostic challenge addressed

Club root caused by the obligate parasite, *Plasmodiophora brassicae*, is one of the most serious soil-borne diseases of crucifers throughout the World including India. It has been known on vegetable crucifers in Canada and was recently reported as being common on an important oil-yielding crop (Argentine canola, *Brassica napus*) in a western region of this country. During initial stages of club root, above ground symptoms may be absent making tools of presence of the pathogen in soil imperative. When present, foliar symptoms consist of stunting, yellowing, and wilting, along with other signs of a dysfunctional root system. Extensive galling, swelling, and distortion of the roots and hypocotyls are the main symptoms of the disease. Galled and clubbed roots are often invaded by secondary rot organisms such as soft rot bacteria; this results in the rapid decay of roots, further decline of infected plants, and release of additional inoculum into the soil.

Club root infects all of the cole crops, as well as many weeds in the mustard family. The fungus persists in soil as thick-walled resting spores that can remain viable for 10 years or longer. Infection is favoured by acid soils with adequate moisture, but infections do occur above pH 7.0. In the presence of host plant roots, these resting spores germinate by releasing swimming zoospores. Such zoospores infect and colonize root hairs. Later, a second type of zoospore appears that can infect the main roots. Infection and colonization by this second zoospore causes the galling and clubbing of roots. Additional resting spores are formed inside the galled roots and are released into the soil when roots decay. The fungus is dispersed from field to field by movement of infected plants, use of field-grown transplants, and movement of infested soil on machinery and surface water.



SEM of resting spores of *P. brassicae* on *B.napus* (inset - TEM)

Physiological specialisation is known in the pathogen and differential hosts have been extensively used to analyse its populations.

Once in the soil, there is no economical way to eliminate it. Rotation with non-host crops generally does not provide effective control; however, a 2-year rotation away from crucifer crops and into cereals may be helpful in some instances. Control measures include minimising the spread of the pathogen by using pathogen-free transplants. It is preferable to use transplants that are produced in soil-less rooting mixes in trays. However, if field-grown transplants must be used, they should be grown in fumigated plant beds. Infection in young plants can sometimes remain undetected at the time of transplanting. Movement of contaminated soil (on roots, farm implements, and machinery) from infested to non-infested fields should be restricted. Tail-water from contaminated fields to irrigate non-infested fields should not be used because the fungus can be transported in water.

Other methods like soil fumigation, application of fungicides and surfactants, and supplemental liming to increase soil pH may reduce disease pressure, but are not often sufficient to keep the crop healthy. Biological control measures such as using the fungal endophyte, *Heteroconium chaetospora* and bait crops like the leafy *Raphanus sativus* to suppress resting spore levels in the soil have not proved practical. *Brassica* races resistant to all races of this pathogen are currently not available. The best way to grow susceptible crops is to raise them in pathogen-free soils for which easy to use diagnostic tool is a prerequisite.

Soil bioassays, generally reliable, are labour intensive, time consuming , costly, & requires large amount of greenhouse space. So are other diagnostic tools tested including checking for root hair infection under microscope, observing spores stained with fluorochromes, and serological detection. PCR techniques have been applied extensively for the detection of fungal pathogens in plant and soil samples using 3 primers based on the DNA sequence of the pentyltransferase gene. But for improving reliability, most of these have to be subjected to a 2nd PCR amplification.

Drs. J P Tewari, Stephen Strelkov, and their associates working on club root of canola in Alberta, Canada have recently developed a one-step-PCR protocol to detect the pathogen in plant and soil samples. The primers TC1F and TC1R based on *P. brassicae* partial 18S ribosomal RNA (rRNA) gene sequence from Genebank yielded a 548 bp product in the optimised PCR. A 2nd pair of primers, TC2F and TC2R which amplified a fragment of 18S and internal transcribed spacer (ITS) 1 regions of the rDNA repeat, also was tested and produced a 519bp product. Neither set of primers amplified any DNA fragment from non-infected plant hosts, noninfested soil or common soil fungi and bacteria tested in this study. Quantities of 100 fg or less of total *P. brassicae* DNA or $1x10^3$ resting spores per gm soil could be detected consistently using these primers and PCR protocol, corresponding to an index of disease of 11% or lower when the soil was bioassayed. The protocol also permitted detection in symptomless root tissues 3 days after inoculation with the pathogen and this technique thus provided a reliable diagnosis for routine detection of *P. brassicae* in plant and soil materials in a specific and rapid manner (*Plant Disease*, 91(1):80-87, 2007)

(**Source**: J. P. Tewari, Ohio,USA.(For further information **E-mail:**JP.Tewari@ualberta.ca or stephen.strelkov@ualberta.ca)

Obituary

Henry M. Beachell, a plant breeder whose cultivation of a remarkably fecund new rice plant led to greatly increased yields of the crop in developing countries of Asia, died on Dec. 13 at his home in Pearland, Tex. He was 100. While working for the Institute in the 1960s, Mr. Beachell and others crossed rice plants from Taiwan and Indonesia to produce a new variety, which they named IR8. The gain for subsistence farmers was a significantly larger annual yield of rice, often amounting to two or three times that of other plants (*Jeremy Pierce, Published: December 28, 2006).*

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Spotlight

Buried treasure: the potato–

United Nations has declared the year 2008 as the International Year of the Potato (IYP).

In terms of sheer quantity the humble potato tuber is World's No. 4 food crop following maize, wheat and rice with production in 2005 of more than 323 mt having a total value over $ 40 billion.

In declaring 2008 the IYP, the UN General Assembly seeks to focus World attention on the role potato can play in defeating hunger and poverty. It has asked FAO to facilitate IYP implementation, in collaboration with Governments, UN Agencies, CGIAR centres and NGOs. FAO says, the increase in the potato production area in the developing World specially in India and China has outstripped that of all other food commodities, and by 2020 the demand of potato is expected to double that in 1993. The huge germplasm collection provides hopefully a vast gene pool for introducing greater resistance to biotic and abiotic stresses caused by pests of which the most serious is the late blight.

Modern potato vars. require frequent, shallow irrigation. Breeders are developing vars. having drought resistant properties and longer root systems. In Belize, an ongoing FAO project is helping farmers reduce losses of both stored seed potatoes and harvested potatoes which run to over 20% a year. Finally, developing clean, reliable seed potato, pest- and virus-resistant potato varieties, and IPM will have valuable benefits for the environment by drastically reducing the need for chemicals.

The Directors of Agriculture and Horticulture will do well to take note of the above and eliminate introduction of varieties like *'Atlantis'* (PepsiCo-Mahyco) lest our seeds are also contaminated beyond redemption.

(**Source:** www.fao.org., Nov. 2006)

Are biological control agents (BCA) the answer to a non-pesticide agriculture?–

'Non-pesticide' is only a part (and, possibly, a relatively small part) of what organic agriculture is all about. A review of the under-pinning principles of organic production will show that in general terms the use of BCAs is in reality no more acceptable than that of synthetic pesticides.

The position with respect to GMOs provides a parallel, although it is conceded that some limited use of BCAs is already accepted unlike the total ban on GMOs set out in both the EU Regulation and the National Standards. Any BCA proposed for use should be subjected to the most rigorous evaluation with respect to the environment, health and safety. That said the use of risk assessments will not in any way guarantee acceptance by the organic farming community. It is possible that copper-based fungicides would not have been allowed and it is conceivable that some presently prohibited products might have been allowed. This last is something of a nightmare scenario as far as practitioners and supporters are concerned although the removal of copper would be welcomed by many. The above is intended to illustrate the fact that BCAs have not and will not be embraced whole-heartedly by the organic sector but it has to be conceded that there may be a limited number of areas in which they could be of use.

A number of products have made it to the marketplace and some at least are being used by organic growers with the permission of their certifying bodies. It should also be remembered that the use of composts, compost teas and other biologically active materials is a major strand of the use of biology in the control of pests, diseases and fertility. The key difference is that such materials rely on a wide spectrum of organisms to achieve the desired effects as opposed to the very specific isolates that are to be found in the proprietary products that are available or are under development.

The use of such diversity clearly has much more in common with natural ecological systems. Many people had at one time a naïve and rather simplistic view of organic agriculture. The position is changing all the time and there is generally a greater understanding but we still have a long way to go. Companies and researchers are still coming up with single shot answers to questions that are complex by their nature. If we are dealing with biological systems then changing one small aspect can have knock on effects right through the system. This is something we forget at our peril.

(**Source**: Roger Hitchings, Head of Advisory Services, Elm Farm Research Centre, from internet).

Eenabavi village goes GM-free –

While an international Rice Conference in Delhi was discussing the inevitability of genetically modified rice in ensuring national food security in India, village Eenabavi in Warangal district declared itself GM-free on October 11, 2006. Supported by organizations like CROPS, Centre for World Solidarity and Centre for Sustainable Agriculture, this small village in the heartland of farmer suicides in Andhra Pradesh is in to its third year of chemical-free agriculture and is proving to the world that food security can indeed be secured without any chemical or GM solutions. All the farmers in the village took an oath to remain GM-Free and organic. Eenabavi is probably the first modern-day farming village that has gone completely organic, without the use of any chemical fertilizers or pesticides and without any GM seeds, to secure prosperity for each farming family in the village. This village which had gone down the intensive agriculture path, realized the folly of such agriculture around five years ago and decided to try out alternatives. Beginning with NPM (Non Pesticidal Management) of crops, the farmers then decided to give up chemical fertilizers too. Anjamma, a farmer, stated that there have been no decreases in productivity of crops like paddy in the village, even after the shift to organic farming. She pointed out that the cost of cultivation has come down to negligible levels, enhancing the net incomes of farmers. The farmers here grow a variety of crops without the use of chemicals including paddy, chilli, vegetables, cotton, tobacco, maize etc. The village is also experimenting with the System of Rice Intensification (SRI) and the results have been positive so far (*For more information, contact* :kavitha_kuruganti@csa-india.org).

India gets its own GM cotton–

Cotton plants genetically modified by scientists at the Indian Institute of Technology, Kharagpur, and an Indian company are set to become India's first homegrown GM crops approved for commercial release. The cotton, jointly developed by IIT Kharagpur and JK Agri Genetics in Hyderabad, is among GM crops approved recently by the government's GEAC, a top official said.

"This will be the first GM crop technology from India for commercial release," said Desh Deepak Verma, co-chairman of the GEAC. All genetically engineered varieties of cotton that have been under cultivation in India since 2000 are based on technology developed by the US biotechnology giant, Monsanto, and licensed or sublicensed to various seed companies in India. All GM cotton approved for cultivation in India contains genes from the bacteria, *Bacillus thuringiensis* (Bt) that allow the crops to protect themselves from pests.

"The technology was entirely generated here using Bt from India," said Soumitra Sen, Head of the Biotechnological Research and Extension Foundation at IIT Kharagpur. Sen and his colleagues have also been working on GM rice, brinjal and tomato. However, none of these plants are ready for commercial cultivation yet. "We're also working on a new generation of GM cotton that could resist a wider range of caterpillar pests than the first-generation Bt-cotton," Sen said.

Biotechnology industry analysts expect that the entry of indigenous varieties of GM cotton will reduce the market prices of these products. Activists evaluating the performance of GM cotton that has been under cultivation have claimed that while the yields of non-Bt cotton are marginally lower than Bt-cotton, the cost of cultivation of Bt-cotton is higher than that of non-Bt cotton.

(**Source**: G .S. Mudur, *The Telegraph,* 5th April, 2006).

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