Biosciences for Farming in Africa: Media Fellowship Programme

Second Workshop Report
Round 1 – Nigeria

Front cover photo: Regional Plant Breeding Manager Dr Delphine Amah demonstrates tissue cultured banana plantlets to B4FA media fellows at the International Institute for Tropical Agriculture at Ibadan, Sept 2012 – photo by Bernie Jones

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1. Fellowship advertisement and application form

Professional Development Opportunity

B4FA Media Fellowship – Nigeria

Application for participation

The Cambridge, UK-run ***Biosciences for Farming in Africa (B4FA)*** project, funded by the philanthropic John Templeton Foundation, is offering a Pan-African Professional Development programme over a six month period to media professionals (including journalists, editors, broadcasters and producers) in our focus countries in sub-Saharan Africa, including Nigeria.

What is the programme about?

The theme of the Fellowship is to promote better understanding and dialogue on developments in agriculture and biosciences throughout Africa with specific emphasis on activities and research in our focus countries.

Subjects to be covered during the Fellowship include: the history of plant breeding and agricultural techniques, basic plant genetics, modern plant breeding and biotechnology for agriculture, the role of international and African industry (eg seed producers), regulatory frameworks and future opportunities and applications.

What will the Fellowship programme involve?

- Dynamic 4 day training course in each focus country
- Mentored field trips to regional scientific locations and projects of interest
- Supportive professional dialogue and mentoring from leading scientists, journalists and policy makers
- Opportunities for international travel and conference attendance for high achieving participants
- Opportunities for future paid mentoring
- Commitment to use learned skills and knowledge in the production of media pieces and facilitation to publish and produce relevant media pieces

What will participants get out of it?

- The Fellowship is unpaid. However, Fellows will receive expenses and per diems for training courses and field trips.
- The Fellowship will not infringe upon your responsibilities to current employment.
- Certificates will be provided on successful completion of courses and the Fellowship.
- Greater appreciation and understanding of current issues in genetics, agriculture, and the scientific work being carried out in Africa to help address these.
- Opportunities to hone reporting skills to bring important local stories to the attention of readers and listeners.
- Interaction with local and international experts.
- Benefit from mentoring by experienced African and international journalists.

If you wish to be considered for one of these Fellowships, please complete the form below in as much detail as possible, and submit it to nigeria@b4fa.org by 30 June 2012 together with all supporting material.

We will accept written material in Microsoft Word or PDF format, and audio material in mp3 format. If you wish to submit video material, please check with us first regarding the size and format of your file. If you are in employment in a media organisation, we strongly encourage you to submit a letter of support from your editor, producer, managing editor etc.

We will be carrying out face-to-face interviews in Abuja after shortlisting in late July and early August. Proposed training dates for this year are September 24th – 27th. Please ensure you will be available on these dates before applying.

More details of the project and Fellowship can be found at b4fa.org

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B4FA Media Fellowship – Nigeria
Application Form

	Details	**Answers**
1.	Name of applicant	
2.	Address of applicant	
3.	Date of birth	
4.	Gender	male/female
5.	Office and/or mobile telephone number (please indicate preferred contact)	
6.	Email address	
7.	Name of media organisation for which you work (if any)	
8.	Job title (Reporter, editor, freelance etc)	
9.	Please describe you role, and how long you have worked in it for	
10.	Media qualifications	
11.	Previous media experience (jobs, traineeships etc)	
12.	Previous training courses taken (especially any science/ agricultural reporting courses)	

13.	List your current areas of interest in reporting	
14.	Please describe why you are interested in this Media Fellowship	
15.	Please describe why you believe you are a strong candidate for this Media Fellowship	
16.	Do you have the approval of your editor/producer etc to participate in this Fellowship for 6 months? Are you attaching a letter of support?	Approval: yes/no/not applicable Name and position of approver: Letter attached: yes/no
17.	Examples of previous work: *All these pieces must be your own work – pieces found to have been copied will result in the disqualification of the candidate.*	Please submit up to 3 short pieces (up to 500 words each for print, up to 3 minutes for audio/video) which you have produced in the last two years on an agricultural, scientific or technical issue. Please give a date and where the piece was printed or broadcast in each case. If you have NOT produced any agric, scientific or technical pieces in the last two years, please send us up to 2 examples of what you consider your best reporting on other issues, AND please write or record a NEW piece of up to 500 words or 3 minutes on an issue to do with agricultural, plant breeding or biotechnology currently in your country. Titles of pieces submitted: 1. 2. 3.
18.	Please list any experience you have of either farming or scientific research (if any) – eg former work, family engagement in these activity, experience from childhood etc	
19.	Commitment	If successful, are you able to commit to attending the mandatory training course and engaging with the Fellowship opportunities over the six month period? Yes/no

Please submit to nigeria@b4fa.org by 30 June 2012

2. Interview findings and candidates selected

In Nigeria we interviewed 43 print and broadcast journalists. Although few had had exposure to science or to scientists, science journalism in Nigeria is beginning to be better understood as a discipline.
We were perhaps fortunate in our cross-section of applicants that many were from regional or rural bases, as well as from Abuja (since both our B4FA staff were based there). Although Lagos is a centre for journalism (especially print) in the country, we had very few applicants from there.

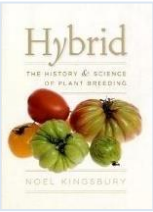
An explanation that we were given for this phenomenon was that Lagos journalists were "trained out" – given the importance of Nigeria as a power in West Africa, many organisations are keen to organise events and training courses with members of the media. But few ever go beyond the commercial capital, Lagos, when they do so. Lagos journalists are therefore not only overwhelmed by training opportunities, but also become very discerning in what they apply for – often looking for the greatest pecuniary benefit to themselves from the training before making their choice.

Conversely, few training opportunities came the way of rural and regional journalists, so there was a very enthusiastic and dedicated group of applicants for our programme. Prospective fellows selected from the interview round were:

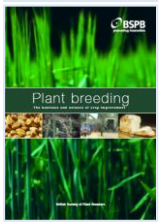
1.	**Abdullah El-Kurebe**	Vanguard Newspaper,
2.	**Abdul Rasheed M. Kuraye**	Nigeria Television Authority, Katsina
3.	**Adejoke Odunayo Akanmu**	The Guardian, Abuja
4.	**Anolu Vincent. O**	Daily Independent, Owerri, Imo State
5.	**Augustina Armstrong O**	Choice FM, Lagos
6.	**Baraka Bashir**	Freedom Radio, Kano
7.	**Bassey Ita**	Akwa Ibom
8.	**Bilikisu Ado Zango**	Radio Kano
9.	**Binta Lawan Umar**	Freedom Radio, Jigawa
10.	**Cokey Ugoma Mary**	Voice of Nigeria
11.	**Elizabeth Achagh Torlewase**	Harvest FM, FRCN Makurdi
12.	**Eyo Charles David**	Daily Trust Newspaper, Calabar
13.	**Hasana Salisu Abubakar**	Freedom Radio, Kano
14.	**Joseph Kingston**	Pillar Newspaper, Calabar
15.	**Kole Dawodu**	News Agency of Nigeria Abuja
16.	**Lawan Isa Bagwai**	Radio Kano, Kano
17.	**Mohammed Kandi**	Peoples Daily, Abuja
18.	**Onche Odeh**	Daily Independent, Lagos
19.	**Orsar Hembadoon Rosa**	The Voice Newspaper, Makurdi
20.	**Saminu Alhassan Usman**	Freedom Radio, Jigawa
21.	**Stella A. Egberende**	The Epitome, Asaba, Delta Sate
22.	**Ugonabo Loretta**	Aso Radio, Abuja

3. Pre-course reading material

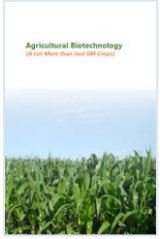
Material distributed on USB stick and physically (book) before training workshops took place.



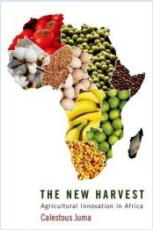
Noel Kingsbury: Hybrid – the history and science of plant breeding (Book)



British Society of Plant Breeders – Handbook on Plant breeding



ISAAA guide to Agricultural Biotechnology



Calestous Juma: The New Harvest – Agricultural Innovation in Africa

4. Workshop Programme

Initial Dialogue and Training Workshop on Plant Breeding, Genetics and Biosciences for Farming in Africa

PROGRAMME

24 – 27 September 2012
International Institute of Tropical Agriculture, Ibadan

Please arrive at the IITA guest house on Sunday 23rd September. Overnight accommodation has been arranged.

Day 1 – Monday 24 September 2012

0900 **Welcome and Introductions**
Bernie Jones; Course Leader

SESSION 1 - Background
Julia Vitullo-Martin – facilitator

1000 **Plant Breeding and Agriculture**
Wayne Powell; University of Aberystwyth, UK

Discussion – *tea/coffee*

1200 **Science Journalism**
Diran Onifade; World Federation of Science Journalists

1300 **Lunch**

1400 **Principle of Genetics**
Charles Amadi; National Root Crops Research Institute, Umudike

Discussion – *tea/coffee*

SESSION 2 – Practical Science
Julia Vitullo Martin – facilitator

1600 **Practical Experiment – DNA extraction**
Bernie Jones

1730 **Video Presentation: TED – Ben Goldacre – "Battling Bad Science"**

Dinner

Day 2 – Tuesday 25 September 2012

Breakfast

SESSION 3 – Biotech for Agriculture I

Diran Onifade – facilitator

0900 **Biotech, Genetics and Plant Improvement**
Jasper Rees; Agricultural Research Council of South Africa

Discussion – *tea/coffee*

1030 **Local case-study 1**
Inuwa S Usman; Ahmadu Bello University, Zaria

1100 **Local case-study 2**
Emmanuel Okogbenin; National Root Crops Research Institute, Umudike

1130 **Local case-study 3**
Maimuna Abdulmalik; Ahmadu Bello University, Zaria

Discussion

Brief on post-dinner "game"
Bernie Jones

1230 **Lunch**

SESSION 4 – Professional Journalism I

Alexander Abutu Augustine – facilitator

1330 **First journalism piece - background**
Preparation and discussion of story ideas, angles, sources, interview Questions. Feedback on pre-course work – *tea/coffee*

SESSION 5 – Biotech for Agriculture II

Julia Vitullo-Martin – facilitator

1530 **Genetic Modification**
Jim Dunwell; University of Reading, UK

Discussion

1730 **Local case study 4**
Muhammad Lawan Umar; Ahmadu Bello University, Zaria

1800 **Local case study 5**
Mohammed N Ishaq; National Root Crops Research Institute, Umudike

Discussion

Day 2 – continued

1900 Dinner

2030 Post-dinner game: "Genes on air"
Role playing talk shows on GM and biotech issues
Bernie Jones - facilitator

Day 3 – Wednesday 26 September 2012

Breakfast

SESSION 6 – Professional Journalism II
DIran Onifade – facilitator

0830 First journalism piece - production
Production and feedback on first piece

Tea/coffee

SESSION 7 – Regulatory and Commercial considerations
Diran Onifade – facilitator

1030 Agricultural biotechnology
Christian Fatokun; International Institute for Tropical Agriculture, Ibadan

1115 Agricultural biotechnology and industry
Daniel Otunge, African Agricultural Technology Foundation, Nairobi

Discussion

1230 Lunch

FIELD TRIP

1330 International Institute of Tropical Agriculture, Ibadan

SESSION 8 – Professional Journalism III
Alex Abutu – facilitator

1630 Second journalism piece - background
Preparation and discussion of story ideas, angles, sources, interview
Questions. Feedback on pre-course work – *tea/coffee*

Dinner

Day 4 – Thursday 27 September 2012

Breakfast

SESSION 9 – Professional Journalism IV

Julia Vitullo Martin – facilitator

0830 Second journalism piece - production
Production and feedback on second piece – *tea/coffee*

SESSION 10 – Biotechnology and the future for African agriculture

Bernie Jones; Course Leader

1030 Prize-giving and closing
Next steps and establishment of follow-up network
Opportunities for participation in future courses
Announcement of prize-winners for best articles produced

1100 Official Close

(*Lunch)*

5. List of participants and biographies

B4FA Media Fellows

Abdallah El-Kurebe Vanguard Newspaper,
07085259999 www.elkurebe@gmail.com

Abdallah el-Kurebe is 47 years old. He is from a farming community in Kurebe village of Niger state (an agrarian state),Nigeria.He has been in the Journalism profession for 23 years reporting on various subjects for Hotline, National Echoes, Horizon, Just and PeopleMonthly news magazines as well as This Weekend, The Companion and Newspage newspapers. He presently reports for Vanguard newspaper as Sokoto state Correspondent and freelance for TheROAD and National Trail newspapers. He is married with children.

AbdulRasheed M. Kuraye Nigeria Television Authority, Katsina
08035077110 abdulrashidmohammed73@yahoo.com
abdulmalikmohammed160@yahoo.com

Abdulrashid Mohammed is from Kuraye Town, Charanchi, Katsina State, Nigeria. Graduating from the Federal Polytechnic Kaduna with a National Diploma in mass communication and a HND Mass Communication, he has worked as Assistant Information Officer and Supervisory Councillor in the Chanranchi Local Government and Katsina State correspondent for Leadership Newspaper. He is currently working with NTA Katsina.

Adejoke Odunayo Akanmu The Guardian, Abuja
08030657907 jokeluvsu@yahoo.com

Hailing from Ogbomoso North Local Government, Adejoke attended Bowen University, obtained a BSc Mass Communication in 2007. She did her National Youth Service at Akwa Ibom State Newspaper, Uyo Akwa Ibom State, before joining Guardian Newspaper Abuja Bureau in March 2010, where she is serving as Agriculture Correspondent.

Augustina Armstrong O Choice FM, Lagos
08090507976 tyna4u2me@yahoo.com

Baraka Bashir Freedom Radio, Kano
08037022649 barbash4gh@yahoo.com

Bassey Ita The Sensor Newspaper, Akwa Ibom
08094436789 bbtreasure3@yahoo.com

Bilikisu Ado Zango Kano Radio Corporation
08035191628 bilbazlove@yahoo.co.uk

Binta Lawan Umar Freedom Radio, Jigawa
08032320219 bintumar1@yahoo.com

Cokey Ugonma Mary Voice of Nigeria
08034048771 ugonmacokey@yahoo.com.

Ugonma Cokey is a Chief News Producer with Voice of Nigeria - Nigeria's sole external broadcast station. She has worked with Voice of Nigeria for 18 years in different capacities, including as reporter, editor, producer and presenter. But currently she is the head of the online unit and edits and supervises the unit. She however started her career in print journalism before moving to television and radio. She report mainly on agric, climate change, environment and development related issues. Ugonma Cokey is an UNFCCC fellow and UNFCCC+COM fellow, a 2011 winner of the UNFCCC/CDM Africa Radio journalist contest and winner of the 2010 Farm Radio International script writing competition on healthy community and Best Commentary Writer News Directorate, 2002.

Elizabeth Achagh Torkwase Harvest FM, FRCN Makurdi
08033930020 betsycheerful@yahoo.com

Eyo Charles David Daily Trust Newspaper, Calabar
08023515659 eyopeace@yahoo.com, eyotrust@gmail.com

Eyo Charles was born in Ijebu Ode in Ogun State but is from Akwa Ibom State. He speaks Yoruba, Efik, Ibibio, English and some Hausa. His higher education was at the Nigerian Institute of Commerce, Ketu followed by a two year programmes with the Writing School, Sussex, UK and the Business Training Institute, Manchester (Lagos study centres). He continues to pursue academic programmes with the International Institute of Journalism, affiliated to the University of Maiduguri. He started his journalism career in 1988 with Development Outlook Magazine, in Lagos, and has since worked for New World Magazine (Lagos), New Kingdom Trumpet (Calabar), Todaysports newspaper (Lagos), and Union newspaper (Uyo). He is currently with Media Trust Ltd publishers of the Daily Trust, Sunday Trust, and Weekly Trust. Eyo Charles has travelled extensively in West Africa, visiting Senegal, Cape Verde, Gambia, Cameroon, Ivory Coast, Togo, Benin Republic and Ghana. He is passionate about music , writing and travelling. He is married with children

Hasana Salisu Abubakar Freedom Radio, Kano
08033782797 salisuabubakarh@yahoo.co.uk

Joseph Kingston Pillar Newspaper, Calabar
08063920488 Kingstonj54@gmail.com

Akinwunmi Kole Dawodu News Agency of Nigeria Abuja
08032858584

Lawan Isa Bagwai Radio Kano, Kano
08028338879 lawanbagwai@gmail.com.

Lawan Isa Bagwai was born in Kano State. He studied mass communication. He has been in broadcast journalism for several years and he is presently the head of the agricultural desk of the Kano State Radio Corporation. He has attended several workshops and conferences.

Mohammed Kandi Peoples Daily, Abuja
08061307241

Born to the family of the late Alhaji Muhammad Saidu Kandi Mohammed Kandi is an indigene of Lapai Local Government Area of Niger State, Nigeria. He graduated from the famous Kaduna Polytechnic, Kaduna State, with Higher National Diploma (HND) in Mass Communication. He has worked as a professional journalist at Vision FM and now with Peoples Media Limited, publisher of Peoples Daily Newspaper for four years.

Muawiya Bala Idris Triumph Newspaper, Katsina
08024980558 balamuawuya@yahoo.com
08039789712 bimonab@yahoo.com

Mu'awuya Bala Idris was born in Kano State. A graduate of Bayero University Kano and holds a Bachelor degree in Linguistics (Hausa Language) he also holds a Diploma and Higher National Diploma in Journalism from International Institute of Journalism (IIJ) and Hassan Usman Katsina Polytechnic respectively. A seasoned Newspaper reporter since 1993, he is currently a correspondent of Triumph newspaper in Katsina.

Onche Odeh Daily Independent, Lagos
07083014946 odehbishop@yahoo.com

Orsar Hembadoon Rosa The Voice Newspaper, Makurdi
07036934517 rosadoonorsar@gmail.com

Orsar Hembadoon Rosa graduated from the Benue State University Makurdi, in the Department of Mass Communication in 2008 with BSc Hons Mass Communication. Thereafter, she went into mainstream journalism practice. She is currently working with Benue Printing and Publishing Corporation (BPPC), Makurdim, publishers of The Voice newspaper, in the Editorial Department as a reporter. She is the State agriculture correspondent.

Stella A. Egberenede The Epitome, Asaba, Delta Sate
08033230737 editorepitome@yahoo.com

Stella Egberenede was born in Lagos but her family hail from Ughelli North Local Government Area of Delta State. She is the eldest in a family of seven. She holds a diploma in Mass Communication (1988) and a degree in English (2006). Stella publishes the Epitome Newsmagazine and Newspaper and the headquarters of her office is in Asaba, Delta State. She lives in Asaba with her husband and daughter.

Ugonabo Loretta Aso Radio, Abuja
08034643160

B4FA Experts, Presenters & Mentors

Alexander Augustine Abutu Africa Science, Technology and Innovation News
alexyabutu@gmail.com

Alex edits environment and agriculture stories for Daily Trust, one of Nigeria's national daily papers, and works for the News Agency of Nigeria covering science and related issues. A graduate of Benue State University with a degree in Mass Communication, Alex authored the most discussed story ever published by the Science for Development Network (SciDev.Net) and was honoured in London as one of the" journalists that changed the world".

Charles Amadi National Root Crops Research Institute, Umudike
okeyamadi2003@yahoo.com

Charles Okechukwu Amadi is a plant breeder and geneticist with the National Root Crops Research Institute (NRCRI) Umudike. He obtained his Doctorate degree (PhD) from the prestigious Michael Okpara University of Agriculture Umudike in 2005. He has contributed to the breeding, registration and dissemination of many potatoes varieties grown in Nigeria. He has authored over 120 scientific works including books, journal articles, conference proceedings and annual reports. He has presented many conference papers, acted as a consultant and resource person at many workshops, and is a member of many professional bodies including the Genetic Society of Nigeria. He has attended many short courses in Nigeria and abroad including international courses on Agrobiodiversity, biotechnology, plant breeding and seed sector development, and Seed Potato Technology at CDI Wageningen Netherlands. He is presently an Assistant Director and Coordinator of the Ginger Programme of NRCRI Umudike. Charles is happily married with five children.

Christian Fatokun International Institute for tropical Agriculture, Ibadan
C.Fatokun@cgiar.org

Christian Fatokun is a plant breeder/molecular geneticist. He was a lecturer in plant breeding and genetics in the Department of Agronomy, University of Ibadan prior to joining IITA as a cowpea breeder/molecular geneticist. He represented IITA in the team that drafted the biosafety guidelines for Nigeria which eventually became the Biosafety Bill and is also a member of the steering committee of an international body, the Public Research and Regulation Initiative (PRRI).

Dr. Fatokun's research focus is on genetic improvement of cowpea for resistance to insect pests and in more recent times on developing cowpea with drought tolerance. He coordinated a number of projects at IITA which include the Cowpea Project for Africa (PRONAF), that promoted improved technologies that enhance the crop's productivity in some countries; Nigeria Agriculture and Biotechnology Project which promoted public awareness of biotechnology while also building human and infrastructural capacity for biotechnology and biosafety in the country; Tropical Legumes II (TLII) project with focus on the development and dissemination of cowpea lines with better adaptation to the drought prone areas of sub-Saharan Africa.

Dr. Fatokun obtained his PhD degree in agronomy specializing in plant breeding and genetics from the University of Ibadan. He was visiting scientist at Kyoto University, Japan and University of Minnesota in the USA. He has supervised several students at the BSc and MSc degree levels and no less that a dozen at the PhD level while at the University of Ibadan and IITA.

Daniel Otunge African Agricultural Technology Foundation, Nairobi
d.otunge@aatf-africa.org

Daniel Otunge, a Kenyan, is a development communication expert with over 10 years' experience. He holds a Master of Arts degree in Philosophy, a Postgraduate Diploma in Mass Communications, and a Bachelor of Arts degree in Sociology from the University of Nairobi. Daniel is waiting to graduate with an MA in Development Communication from the University of Nairobi. Prior to joining AATF, Daniel was the head of Communication and Advocacy at the African Seed Trade Association (AFSTA) where he helped establish and manage the communication department responsible for corporate communication, membership relations, events management, strategic communication, logistics and biotechnology outreach programme targeting seed companies and national seed trade associations in Africa. Before joining AFSTA, Daniel worked for about six years as Communication Officer with the International Service for the Acquisition of Agri-biotech Applications (ISAAA AfriCenter). Daniel also teaches mass communication and development communication at St Paul's University, Limuru, Kenya, as an adjunct lecturer. As Regional Coordinator of the Open Forum for Agricultural Biotechnology

(OFAB), Daniel is responsible for effective and efficient coordination and management of OFAB activities in Africa.

Diran Onifade World Federation of Science Journalists & AfricaSTI
diranx@msn.com

Emmanuel Okugbenin National Root Crops Research Institute, Umudike
eokogbenin@yahoo.com

Inuwa S Usman Ahmadu Bello University, Zaria
inuwasu@gmail.com

Jim Dunwell University of Reading, UK
j.m.dunwell@reading.ac.uk

After graduating in Botany from Oxford University, Jim Dunwell worked for 16 years at the John Innes Institute in Norwich where he obtained a PhD in Plant Physiology. His research interests included the production of haploid plants and the development of in vitro regeneration techniques for a range of crop plants. He then spent 10 years in the commercial sector at ICI Seeds, later Zeneca Plant Sciences, at the Jealott's Hill Research Station, where he was responsible for an international programme on the development and exploitation of transgenic crops. With the support of a BBSRC Industrial Fellowship, he moved in 1996 to the University of Reading where he is Professor of Plant Biotechnology and has research interests in plant breeding, gene expression and protein evolution. He recently served on the UK Food Standards Agency Advisory Committee on Novel Foods and Processes, and the Royal Society Working Group on biological mechanisms for enhancing food-crop production. He am now a member of the Defra Advisory Committee for Releases to the Environment, the group that advises the UK government on the growing of GM crops.

Julia Vitullo Martin Journalist
jvm@belnord.org

Julia Vitullo-Martin (PhD, University of Chicago) is a New York-based independent journalist who is a Senior Fellow at Columbia University's Center for Urban Real Estate and Director of the Center for Urban Innovation at the Regional Plan Association. Her work focuses on development issues such as comparative economic analysis, planning and zoning, waterfront development, public housing, environmental review, and historic preservation and design. Her current project, The Future of Urban Food, looks at the functions and benefits of food in local economies.
Vitullo-Martin has been widely published in a variety of newspapers and magazines, including the Wall Street Journal, the New York Times, the New York Review of Books, the New York Post, the New York Daily News, Monocle, Forbes, and Fortune, as well as academic journals. She has authored and edited three books, including Breaking Away: The Future of Cities (Century Foundation Press, 1996). She served as co-director of the Templeton-Cambridge Journalism Fellowships at the University of Cambridge from 2033 through 2011.

Maimuna Abdulmalik Ahmadu Bello University, Zaria
inuwasu@gmail.com

Mohammed N Ishaq National Root Crops Research Institute, Umudike
mnishaq2003@yahoo.com

Muhammad Lawan Umar Ahmadu Bello University, Zaria
inuwasu@gmail.com

Wayne Powell University of Aberystwyth, UK
wap@aber.ac.uk

Wayne Powell trained in plant breeding and cytogenetics at the University College Wales, Aberystwyth (H. Rees, FRS) and in quantitative genetics (Birmingham school Biometrical Genetics, J. L. Jinks FRS). His earlier work laid the foundations for the use of doubled haploids and cross prediction in plant breeding. He was awarded the Broekhuizen Prize in 1990 for outstanding contribution to European cereal science and obtained his DSc (Plant genetic manipulation) in 1993 (Birmingham university). His personal research interests are at the interface of plant genetics, genome science, plant breeding and conservation of genetic resources with a strong emphasis on the delivery of 'public good' outcomes. He has published over 250-refereed scientific journal papers that have attracted 9,300 citations, with an H index of 50, a further 120 book chapters and conference proceedings and presented numerous invited papers at international meetings and successfully supervised 20 PhD students and numerous visiting workers. His professional career has spanned academia, the public sector and commerce (Dupont).He is currently Professor and Director of the Institute of Biological, Environmental and Rural Sciences (IBERS) at Aberystwyth University. Formed in 2008 by merging the Institutes of Biological and Rural Sciences of the University with the Institute of Grassland and Environmental Research (IGER) to form one of the largest groups of academics and support staff in the UK focussing on plant and land based sciences, with more than 350 staff, 1,200 undergraduates and a complex range of stakeholders. In his current role he has lead and managed a significant organisational and cultural change programme to create a fully integrated Institute that embraces mission diversity: education, research and enterprise. This has involved attracting more than £80 million of investment to support new faculty appointments, capital infrastructure and national capability to underpin world class research.

B4FA Staff

Bernie Jones B4FA
bernie@b4fa.org

Based in Strasbourg, France, Bernie Jones specialises in the international development and science policy and communications area. He has been Interim Executive Director for the InterAcademy Panel and the InterAcademy Medical Panel, International Director of Shaw Trust – a UK disability charity, Head of International Policy at the Royal Society, and Executive Director, European Academies Science Advisory Council. He has also worked in the commercial arena, spending 8 years working in a variety of roles at British Airways plc. Bernie is a graduate of the Universities of Edinburgh and Cambridge in the UK, with degrees in Cognitive Science, Computer Science and Experimental Psychology.

Ojochide Atojoko-Omovbude B4FA Nigeria
chidatojoko@yahoo.com

Chide studied law at the University of Ibadan and was called to the Nigerian Bar as a Solicitor and Advocate of the Supreme Court of Nigeria. She is a prolific writer and has published articles and a book on Law in Nigeria. She is a multi-linguist, speaks the three major Nigerian languages and has a diploma in French. She is also a Chartered Secretary and a Chartered Mediator.

Eve Watts B4FA
eve@b4fa.org

Eve Watts is based in Kampala, Uganda, and has worked in Africa for the past 10 years in a variety of projects including both human development and agricultural private enterprise. Her main focus has been on governance, policy development, agriculture and social development. She holds a Bachelor of Social Work and a Doctor Juris from Murdoch University.

6. Training course and Field Trip highlights

The training workshop took place within the International Institute for Tropical Agriculture (IITA) in Ibadan over a four day period, and included a number of games/simulations, a practical exercise (DNA extraction), and a field trip to the IITA facilities.

Participation

Nearly all of the fellows selected at interview and experts invited to participate attended the workshop – those who did not generally had problems with transportation. Then logistical problems in travelling around Nigeria should never be underestimated.

Unfortunately, Dr Jasper Rees of the Agricultural Research Council of South Africa was unable to attend, at the last minute. His section of the training was quite a critical one, bridging from basic genetics and breeding techniques to higher technology options, including marker assisted selection, gene banks, hybrid seeds and tissue culture. We filled this gap in our training schedule with an impromptu joint journalism/technical exercise, by getting small teams of media fellows to interview domestic and an international experts on key issues such as gene banks, hybrids and tissue culture, which worked well.

Fellows

It was clear early on that although few fellows had participated in such an intensive training course, they were all dedicated and hard workers.

Unlike Ghana, the agricultural side of our presentations were more familiar (though there was still little appreciation of the history of breeding and crops, and how agriculture arose). An issue that emerged was that although agriculture is widespread in Nigeria, it has received very little interest and attention since the oil boom, both from politicians and – seemingly – civil society. “Everybody has a farm” we were told, “but nobody grows anything”. It became clear that a subset of our fellows were determined to try to change that, and raise the importance and profile of modern agriculture in the country.

There was a great deal of confusion in biosciences and modern breeding techniques, and many fellows still confused hybrid seeds, GM, and other technologies such as tissue culture!

Innovation

Consistent feedback throughout the course was that our journalists rarely got to participate in courses like the one we had designed. The amount of time spent interactively, to try to forge understanding, combined with the practical exercises and mentoring designed to achieve the same outcome, were clearly very unusual in terms of both training courses and interactions with scientists and technical experts that they had experienced before.

The DNA extraction in particular was received with great enthusiasm, and was the first time most of the fellows had ever done any hands-on science. We did have to take extra care however, to explain that the alcohol used in the extraction should be seen as a laboratory reagent rather than as a drink, to reassure the journalists of Islamic faith that they could carry out the experiment without any concern.

Local scientific participation

The local scientists who participated reacted very positively. Few had ever had the opportunity to interact with journalists (a role usually reserved for the politically-appointed Institute Directors). Many research institutes were also located away from the Nigerian cities that are media centres, further isolating the scientists. The scientists, although they did also act as mentors, seemed as enthusiastic about the games and the practicals as the journalists themselves, and several asked to take away copies of worksheets and procedures

Field trip

For the field trip, the group toured the IITA laboratories on-site on the Ibadan campus, visiting an aflatoxin project, seed bank, tissue culture facility and molecular biology laboratory.

Though it was challenging carrying our the tour with a single large group, fellows used their time productively to carry out a large number of interviews with the scientists. For many it was also the first time most of them had ever seen a laboratory, thus further breaking down the barriers between them and the scientific community.

Journalism exercises

We asked fellows to produce one or two journalistic pieces for mentoring and judging. Some pieces were very basic, reflecting local rural journalism standards in some cases, but often also pointing to a language issue, since many journalists present did their reporting and broadcasting in a local language rather than in English. Many pieces however were of high quality and with highly original content. Several of the journalists who participated were also publishing pieces deriving from the material we were covering during the workshop itself.

Continuity

One of the most appreciated facets of the programme was the follow-up phase. Fellows were very pleased that the workshop was not, like so many others, a one-off event, and felt there was high value in remaining part of the fellowship and benefitting from further engagement and future opportunities.

7. In-course journalistic pieces produced

Journalism exercises – in course pieces produced by media fellows.

Plant breeding and the ordinary Nigerian farmer

By Abdallah el-Kurebe

"...We all know that Africa is endowed with vast fertile soils, favourable climates, vast water basins and perennial rivers that could be utilized for irrigation farming and lead to the Green Revolution, and mitigate the adverse effects of climate change...I propose that our slogan should be: 'Feeding Africa through New Technologies: Let Us Act Now." - President Bingu wa Mutharika of Malawi addressing the Assembly of African Union in 2010.

Breeding is the process of developing new crop varieties that have better performance. This process has created a very wide gap between ancestral crops or wild plants and the modern varieties that we now have.

On annual basis, crop varieties are developed and in Nigeria this year, five new varieties of maize, three new varieties of sorghum and two new varieties of cowpea have been developed. But the challenges for the ordinary Nigerian farmer are accessibility and the technical know-how on adaptability of biotechnology against his traditional method of farming.

Nigerian agricultural policies over the years have been modeled only to suit the very few 'political farmers' against the real, peasant farmers that are found in the rural areas.

More central on the policies of the nation's Agriculture is the provision of fertilizer and farm implements - mainly, tractors, which are also out of the reach of an ordinary farmer.

While fertilizer and tractors have been out of the reach of Nigerian peasant farmer, in terms of affordability, the introduction of plant breeding by government to enable rural farmers to migrate from ancestral crops to hybridization, has been absent.

Late Burkinabe President, Blaise Campaore observed that "New technologies, especially biotechnology could provide African countries with additional tools for improving the welfare of farmers," but meaningful steps have not been taken by governments to ensure the prominence of biotechnology in food production.

Although high-yielding varieties have been provided, there has been no full-swing programmes that could enable farmers to 'wholly' buy into genetic modification.

Again, although improved varieties of sugar cane, upland rice, maize, tomatoes, etc have been introduced to the farmers, nothing or little is known about them. The mega crops here have displaced the local ones, but not much is known about them.

Growing these improved varieties has been a task for Nigerian peasant farmer because enlightenment programmes by government about the varieties has not been there.

Feeding future populations is dependent upon doubling the productivity of the neglected crops that are grown but the political will of the nation’s leaders has not been there.

The lack of political will on one hand and lack of knowledge by the ordinary farmer on the other have resulted in reversely poor agricultural productivity. Today, in Nigeria for example, a ton of maize is produced from a hectare of land against five to six tons produced on the same portion of land in some African countries like Zimbabwe.

Against the backdrop that Africa and the Sahel were centres of origin of food production; the continent has failed to in becoming part of the most productive in agriculture in the modern world.

Unfortunately, Nigeria which is seen as one of Africa's agriculturally powerful nation was recently ranked by the 2012 Global Food Security Index of the Economist Intelligence Unit as the 80th nation among 105 other nations with 34.8% of lower middle income of $1,006 – 3,9975 per capita of income. The assessment was based on the countries' food affordability, availability and quality.

If Africa must come up in food production against its ever-growing population, the nations must take up on biotechnology, more seriously.

Food security and climate change

By Tina Armstrong

Audio file of radio news piece

Why Nigeria may miss out on the Green Revolution

By Onche Odeh

News type: News/Features article

Outline

Story to look at the Norman Boulaugh's Green Revolution which Nigeria and other countries in sub-sahara Africa missed out on vis-à-vis the country's current placement on the Food security index

- Focus will be to localise some of the experts' view/explanations on the reasons for the huge miss out, lessons learnt, and how Nigeria could key into the next Green Revolution.
- Voices of the farmers, consumers, experts and policy makers to be projected

Experts to be interviewed:

- Plant Geneticists (to look at how the genetic makeup of current crops could be tweaked for better performance)
- Farmers (To know if they are well acquainted with the concept and context of the [past and Imminent Green Revolution)
- Consumers (to feel their fears, optimism or whatever)
- Plant and animal breeders to ascertain how

Story ideas on B4FA training for journalists

Agric Experts Debunk Wrong Notion On Hybridasation

By Eyo Charles

News :

It is believed that the process of hybridisation can harm or kill animals and humans, but agric experts have debunked this.

How Kano Groundnut Pyramids Can Flourish Again

By Eyo Charles

Features:

This will aim to enlighten the public about the encouraging works of researchers and groundnut farmers which have resulted in the discovery of process to bolster the production of the grain.

ABU research institute releases five varieties of crops

Joseph Kingston, Calabar

A research fellow of the Institute for Agricultural Research of the Ahmadu Bello University, Zaria, Dr Inuwa S, Usman has disclosed that four new crops varieties have been developed by the institute through research from their old species.

Dr Usman made the disclosure Tuesday during the Bio-Sciences for Farming in Africa (B4FA) training workshop for Journalists held at the International Institute for Tropical Agriculture, IITA Ibadan, he said the new crops have long been handed over to the Registration and Release Committee of the Federal Ministry of Agriculture according to laid down regulations and that there have since been formally approved and released.

He maintained that the new varieties include: " five of maize, three of sorghum, three of cowpeas, and one of groundnut. Same-nut 24[of groundnut] has been released, same-maize 32, 33, 34, 35, 36 and 37 have also been released. Two of the same-maize 32,33 are the extra early mature breed which mature in 75 days and can tolerate drought, diseases and have quality protein. QPM has two essential amino acids.

"The same-maize 36 and 37 are also QPM. The same-maize 34 and 35 are early maturing breed. They mature in 95 days, besides, there are drought tolerant and have high yield,'' he stressed.

Dr Usman said the growing population has made it challenging for political leaders to consider food sufficiency as a priority stating that the time has come to pay increasing attention to research efforts to produce more of crop varieties that can address the food sufficiency needs of the growing population.

END

Agric experts give recipe for food sufficiency, employment

Joseph Kingston, Calabar

Plant breeding and genetics experts, under the aegis of Biosciences for Farming in Africa (B4fa) have agreed that Nigeria could attain food security and bridge unemployment gap if farming based on biotechnological advancements is made a priority.

Making this known during the Bio-Sciences for Farming in Africa (B4FA) training workshop for Journalists held at the International Institute for Tropical Agriculture, IITA Ibadan, Wayne Powell of the University of Aberystwyth, United Kingdom, described agriculture as the foundation of all civilization and capable of providing employment opportunities.

He emphasized on the imperative of breeding new varieties of crops which could boost higher-yields, resist pest diseases and drought, and which adapt to different environment and growing conditions.

He disclosed that, on Agriculture, Nigeria ranks the 80th in the world out of 105 farming countries sampled based on food availability, affordability as well as equitable distribution of food.He therefore challenged African leaders to make agriculture a priority sector to boost their economies

Powell pointed out that access to seed, infrastructural advancement and good leadership are catalysts to food security the world over.

“Agriculture was the bedrock of civilization and is at the centre of every society. Since there was enough food in those days, scientists, explorers and inventors were able to concentrate in making civilization work and of great benefit to man.

“Records show that when Green revolution initiative was introduced, it saved a

million people from starvation, and this succeeded because the initiators involved the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, modernization of management techniques, distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers.

“Today the world population has grown by about nine billion people with hunger and unemployment. Biotechnological farming could save the world from unemployment through creation if millions of jobs, and without this, there would continue to exist famine, severe malnutrition and unemployment”, he submitted.

END

STORY IDEA: Issues in Cassava Production in Nigeria

From Abdallah el-Kurebe

Following Nigeria's interest in the production of Cassava on large scale basis, the need to address the challenges facing African cassava farmers is imperative.

In view of the fact that it is the basic food for 500 million people in the tropics and that Nigeria is one of the three countries that account for two-thirds of the continent's total production, all obstacles standing in the way of cassava farmers, as identified by researchers, must be addressed.

I would to treat my piece taking cognizance of Nigeria's position on the GFSI.

PITCH: Using new Crop varieties to achieve Food Security

By Ugonma Cokey

Why: The Food security index, Nigeria's nutrition status and the Millennium Development Goals

Interviewees:

- NRCRI (EXPERTS)
- Farmers Association members
- Funders of some crops e.g Harvest Plus.
- Nutritionists.
- Policy makers.

Aim:

- To make researchers and policy makers see the need for the crops to get to the farmers' and the grassroots.
- Enable the farmers understand researchers, the new crop varieties and its advantages.(Vitamin A, protein etc) Adapting to challenges of Climate Change
- Allay fears on the new varieties.

Sugarcane cultivation in Katsina State

Abdulrasheed Kuraye, NTA Katsina

Sugarcane, which is used in sugar production, is one of the most common commodities found in the northern parts of Nigeria and in Katsina State in particular.

The state has a sugar factory in Danja council area where efforts have been made in the past 15 years to establish and begin processing sugarcane for sugar production.

Despite this however, the factory has continued to lie fallow, after millions have been spent by government to make it begin operation.

This is in addition to the high cost of sugar and import-dependent nature of the country's economy of sugar.

It is against this that my report would try to dwell on the prevailing problem of Nigeria's dependence on imported sugar, the inability to begin sugar production at the factory in Katsina, and recommendations on what should be done by stakeholders to reduce dependence on imported sugar.

Global Food Security Index: Nigeria ranks below Ghana, Cameroon

By Mohammed Kandi

Nigeria, Africa's acclaimed biggest giant with supposedly one of the most robust economies on the continent has again failed to prove its worth in agriculture and global food ranking, coming beneath its close neighbours, Ghana and Cameroon.

In the current Global Food Security Index (GFSI) conducted by world powers across some globally acceptable standards, Nigeria occupies 80th position out of 105 countries of the world that have been evaluated while its Ghanaian and Cameroonian counterparts ranked 68th and 74th respectively.

The Global Food Security Index mull over the core issues of affordability, availability, and quality across a set of 105 countries. The index is a dynamic quantitative and qualitative scoring model, constructed from 25 unique indicators, that measures these drivers of food security across both developing and developed countries.

Apparently, the methodology and sources used for this index conceived that most countries of the sub-Saharan Africa like Nigeria could not meet up with a range of criteria such as the nutritional standards, presence of food safety net programs, access to finance for farmers as well as diet diversification.

Other parameters include prevention of undernourishment, proportion of population under global line, volatility of agricultural production and agricultural import tariffs, from which these number of variables, are categorized under the strengths and challenges of all these countries as they struggle to meet the requirements of Global Food Security.

For countries that lie within sub-Saharan of Africa, however, Nigeria's strengths, according to information made available on the index, was embedded in prevention of undernourishment (98.2%), and on volatility of agricultural production (86.8%) while its agricultural import tariffs stood at 78.1%.

But, Nigeria can be said to be facing more challenges going by the ranking. It areas of constraint comprised 0% in presence of food safety net programs as in public expenditure on agricultural rural development. Not the GDP, which stood at 3% or its proportion of population under global line (9.6%) are encouraging. The challenges are just too colossal to mention.

One would have expected that an oil-rich country with manifolds of socio-economic potentials and favourable weather conditions like Nigeria would excel much more than those that grapple with their economy. The shocking statistics placed Ghana's strength in prevention of undernourishment at 100%; its food safety 75.6% and agricultural import tariff, 75%.

Nevertheless, Ghana's weaknesses are evident in its 4.5% GDP per capita; 12.5% public expenditure on agricultural rural development, and 20% protein quality as well as 24% diet diversification. Ghana's challenges don't end with these but it occupies a higher position than Nigeria.

Also, Cameroon, which bounded north-east of Nigeria has a higher status on the recent Global Food Security Index, standing at 74th position, even as it only area of strength lies in volatility of agricultural production with 95.5%. However, the country is not without some copious limitations.

On measures required for Nigeria to move forward, however, Plant Breeding and Agriculture expert, University of Aberystwyth in the UK, Wayne Powell, advised Nigeria to optimize its myriad opportunities and take the lead in development of Africa's research, science and technology.

His words: "I think there is a big opportunity in Nigeria given the resources that it has in terms of climate, access to water, and given the importance of agriculture to employment in Africa."

Similarly, Dr. Inuwa Usman of Nigeria's Amadu Bello University, Zaria, attributed the country's challenges to lack of encouragement and emphasis on research finding on the part of successive governments.

He added that unlike Europe and America where governments subsidise completely and insures agriculture for the farmers, there was total removal of such in Nigeria, especially during Olusegun Obasanjo led government.

Meanwhile, the US tops the ranking list with 0% challenge but scored 100% in most of its area of strengths. Denmark followed with 0% weakness and however prevailed in 19 different quarters. Norway ranks 3rd, while France and Netherland came up at 4th and 5th respectively, with 0% dispute areas for each of the countries.

Biotechnology and Nigeria's Socio-economic Development: A Brief Comparative Study of South Africa and Nigeria

By Abdallah el-Kurebe

"Failure necessitates agitations for improvement" – Anonymous

In all spheres of socio-economic development of Nigeria, there have been traces of failure, which have given rise for calls for drastic measures to be taken in order to improve on the country's present status of a failing economy. Nigeria is at the bottom of other African countries in terms of socio-economic development, today.

Among the 105 countries assessed by the Global Food Security Index, GFSI of the Economist Intelligence Unit, Nigeria became the 80th with 34.8 based on the indices of Affordability, Availability and Quality and Safety.

Areas in which the country was rated as weak having scored less than 25 include public expenditure on agricultural research and development where it scored 0.0; presence of food safety net programmes, 0.0; gross domestic product per capita, 3.0; proportion of population under global poverty line, 9.6; food consumption as a share of household expenditure, 9.6 and protein quality, 12.8.

This is abysmally low compared to South Africa which was ranked as the 40th (61.7) and which only weakness is in gross domestic product per capita of 18.8. The country recorded 72.8 for sufficiency of supply; political stability risk, 66.7; proportion of population under global poverty line, 66.5; agricultural infrastructure, 61.1; volatility of agricultural production, 55.8 and access to financing for farmers, 50.0; public expenditure on agricultural research and development, 50.0; diet diversification, 43.9; protein quality, 41.4 and micronutrient availability, 38.0.

South Africa was ranked 38th (61.1) on Affordability, 33rd (63.6) on Availability and 52nd (57.9) on Quality and Safety. But Nigeria, the hitherto Africa's agricultural giant in the 70s, ranked 103th (15.4) on Affordability, 50th (51.5) on Availability and 84th (37.2) on Quality and Safety.

Conversely, while Nigeria scored favourably only in two areas of Volatility of agricultural production and micronutrient availability, South Africa scored in 14 areas, including food safety, sufficiency of supply, protein quality, access to financing for farmers, nutritional standards, agricultural infrastructure and diet diversification, among others.

It is imperative therefore for Nigeria to embrace the modern food production techniques that have come in the form of Agricultural Biotechnology and which, in Africa, are being introduced by Biosciences for Farming in Africa, B4FA. This technology is aimed at improving crop and livestock through biotechnology tools that include conventional plant breeding, tissue culture and micro-propagation, molecular breeding or marker assisted selection, genetic engineering and genetically modified (GM) crops and Molecular Diagnostic Tools according to scientists.

A leading nation that led in Agricultural production in the seventies but now ranked as one of the lowest in food production, Nigeria must have to double the productivity of nutritious crops like yam, maize, beans, etc through plant breeding, to be able to feed future populations.

According to Dr. Inuwa Shehu Usman of the Institute of Agricultural Research of Ahmadu Bello University, Zaria the result of Nigeria's ranking is from the tidal wave of population growth against the low agricultural productivity. "While we have our population expanding, we have less agricultural production. The productivity of our farmers is very low. There is the need for us to look at modern technologies that are capable of bringing about multiple food production and that are where Biotechnology comes in."

In order to tackle the current problem that placed the country 80th among 105, Dr. Usman emphasized the urgent need for concerted efforts on Research and Development. "We need to improve on our performance by reducing the down line between research and development. We also need to respond to this urgently in order to be able to meet up with the nutritional requirements of the country."

With biotechnology, what would be achieved in 15 years could be achieved in five years, especially where farmers are able to access the technologies.

The potentials of these new crop varieties call for the need to develop these improved varieties and hybrids because; it is unacceptable that, while Zimbabwe produces 11 tons per hectare of farmland, Nigeria produces only two tons.

Soya Beans :An Economic Crop

Bilkisu Ado Zango

SCRIPT of Radio Feature

Soya beans is a leguminous specie which is grown in many parts of the world. It is among the major industrial and food crops that is grown continentally. In Nigeria, the crop has been successfully grown in many states by the use of low agricultural input.

The cultivation of soyabeans in the country has expanded as a result of its nutritive and economic importance as well as diverse domestic use.

Soya beans is rich in protein than any of the common vegetable or animal feed sources in the country

It contains 40% of protein, 85& of unsaturated and cholesterol- free oil

In Kano state the market for Soyabeans is growing fast with opportunities for improved income for the farmers, many companies that produce it now rush for it.

Farmers in the state have now become aware of the potentials of the crop and are growing it in large scale basis.

The Head of Women in Agriculture Unit of the Extension Department of Kano State Development agency (KNARDA), Malama Halima Bello sheds more light on the importance and use of Soya beans;

According to her, If there is any technology that farmers has to accept and adopt, it has to be useful to him , it has to be of economic importance, something that will fetch him money, something that he knows he is going to make money,

In case of the soya beans, among the recipies that were taught to us is Awara soya beans cheese and baby food, yoghurt, and using Soya beans flour for food fortification.

Ministry of Agric campaigned for Awara in Kano state.

We use to take a market day to demonstrate magigi, the mobile bus

Many women build houses with Awara many of them go to Mecca with Awara money,

When we come back to baby food the baby food is very rich, if you cannot afford first class protein that is why you see if you go to rural areas now, you hardly see this malnourished children ,every corner take the soya beans product, they either take it in form of pap, tuwo, the cheese alone you can make up to ten recipes, you can do the scrambled egg,omlette,fried,dip into egg,

It is now widely used as livestock feeds, bio-fuel ,and petroleum based lubricant among others.

Africa has complex problems that plague Agriculture and people's lives hence, the need to partner with relevant stakeholders within the continent and beyond to reduce producer/consumer risks as well as enhance crop quality and productivity in order to generate wealth from Agriculture.

Therefore, ensure households food security because the size of household and their income significantly influence consumption level of Soyabeans products.

However, government and non-governmental organizations working on food security need to provide assistance to the people create programs on improved income generation in their local communities,

Analysis: The Silver Lining In Nigeria's Quest For Food Security

By Bassey Ita

Although substantial attention may have been paid to the health sector of the polity perhaps for its consequential role as pivot upon which long life and longevity rest, but life itself does not sustain on health care and personnel hygiene alone but to a greater extent on food intake and diet. Noel Kingsbury, a European Horticulturist quite rightly agree with this conviction in his book ''Hybrid''

Interestingly, the Federal Government of Nigeria under the leadership of Dr Goodluck Jonathan is equally paying substantial attention to the agricultural sector to buttress the reality of food security for the teeming population of Nigerians. Concretely, the administration's agricultural transformation agenda which has already began highlighting certain variables that project a boost of the long forgotten agricultural sector of the economy, can certainly be said to be a sure vehicle that drives home the food security needs of Nigerians.

Obviously, the objective of articulating policies that improve on crop breed and yield among others, for crops that Nigeria has comparative advantage as revealed for instance by the government's initiative to produce certain of Cassava species for its Cassava bread programme, lends credence to the reality aforementioned.

Furthermore, one appreciates stakeholders' concern especially of the public sector, to prop up research efforts that give impetus to the crop improvement techniques.

It would not go unnoticed that the public sector has so far put in over 40 percent participation in the funding of the research programmes on food security, a development researchers confirmed is a good start for the government projections in the agricultural sector.

Interestingly too, the development has dispelled doubts much as it has slowed down critical debates as to whether or not success will be achieved of the programme given the failures of the past.

At a recent Media Fellowship organized by Biosciences for Farming in Africa,B4FA, an international organization with vested interest in promoting modern agricultural development techniques in Africa, experts who include Researchers and other professionals could not wait to appreciate ongoing efforts by stakeholders in the public sector to key into the government food security initiative.

A research fellow with the National Roots Crops Research Institute,Umudike,Mr Emmanuel Okogbenin confirmed that apart from the 40 percent participation by the public sector in funding the ongoing programme, there has been increasing institutional collaboration with the research bodies to enhance biotechnology in Nigeria for the expected food security in the country.

According to him, both the Federal Government and relevant stakeholders in the public sector are into a synergy to put an end to food crisis in the country.

This development he emphasized, has propelled the procurement of equipment including laboratories, necessary for successful research, as well as counterpart funding and other measures through which

the large scale production of those crops that the country has comparative advantage can be made perfect.

Mrs Abdul Malik and Dr Inuwa Usman, both of the Institute of Agricultural Research, of the Ahmadu Bello University, Zaria toed the line of Mr Okogbenin as they agreed that the increasing activity in the agricultural sector in the country is a pointer towards achieving food security by the present administration.

All of these showings as well as yet another step to enact enabling legislation that enhance easy production of new crop species through modern day techniques such as biotechnology; in line with its long run projection to end importation of certain food crops into the country, proves the Federal Government has already shown that there is a silver lining to arrest the prowling hunger in the land and ensure food security.

END

Agriculture and malnutrition in Nigeria

Ugonma Cokey

INTRO to TV report:

A joint report issued by the UN Food and Agriculture Organisation (FAO) and the Organisation for Economic Co-operation and Development (OECD) says global food supplies will be threatened by lower production and high prices over the next 10 years.

According to the report, prices for agriculture products were projected to remain the same or lower than current levels in the next decade, but expected to average 10 per cent to 30 per cent more than the lower prices of the previous 10 years.

In this special report correspondent Ugonma Cokey looks at this report and malnutrition in Nigeria.

Tape: Cue in:

Cue out:

Saved as:

Duration:

REPORT SCRIPT

The Rome-based FAO estimates that agricultural production needed to increase by 60 per cent over the next 40 years to meet the rising demand for food.

Besides the global population increase, the report found that other factors also emphasised the need for more agricultural production.

To overcome some of these challenges, the report called for better and more ecologically-sound farming practices; creating the right commercial environment to encourage private-sector investments; and laws to ensure tenure rights for those working in agriculture, such as small-scale farmers in developing countries.

In other to ensure increased food production, availability of it and nutritional content, the Nigerian government initiated the Transformation Agenda in agriculture aimed at Nigeria's Agricultural Transformational Action.

This plan, called ATA, is aims to add 20 Million MT of food to the domestic food supply.

It focuses on agriculture as a business, not a development program; it focuses on developing agricultural value chains that can allow farmers to make money from what they produce, through greater value addition.

But does more agricultural production translate to addressing hunger and malnutrition? Professor Ignatius Onimavo is a professor of nutrition and the National President Nutrition Society of Nigeria, he says it is not automatic, and explains why?

Tape: cue in: In the past…

Cue out:...agriculture coming together.

Nigeria's ranks 158th out of 182 countries in the Human Development Index, with life expectancy of 48 years; risk of maternal death of 1 in 18; and under-five mortality rate of 186 per 1,000 live births.

UNICEF reports show that 43 per cent of under-five children in Nigeria are stunted. This is high when compared to 39 per cent for all developing countries; this stunting prevalence puts it as the 32nd-highest out of 136 countries.

Although the overall prevalence of stunting and underweight has been decreasing over the past two decades, progress in Nigeria may not be sufficient to meet MDG's goal of halving 1990 rates of child underweight by 2015.

It is to reduce this prevalence that Nigeria has made history with the formal launch of 3 varieties of beta-carotene cassava for multiplication among farmers across the country. This is the first time in Africa where pro-Vitamin A cassava varieties have been developed and released.

The 3 varieties that compare favourably in pro Vitamin A, came out of more intense selection and conventional breeding work from 20 varieties earlier identified.

What is the implication of this? Mr Larry Umunna is the Country Director, Global Alliance for improved nutrition he says this will help reach the vulnerable population.

Tape: Cue in: What this means…

Cue out:…is very significant

Does the launch of these Cassava varieties mean that Nigeria's food and nutrition issues have found a permanent solution? The country Manager of Harvest Plus funders of the released variety say there is need for scaling up and awareness creation on the new product:

Tape: cue in: This is what…

Cue out:…bodies and agencies.

But what is the reaction to farmers to this development?

Tape: Cue in:

Cue out:

Nigeria says it is already working to ensure that the stem cuttings of the pro Vitamin A varieties are multiplied in 10 local governments of four pilot states, namely, Oyo, Benue, Imo, Akwa Ibom and Abia States. The target is to reach 50,000 farm families by 2013 in all these States. Nigeria is also working on Vitamin A maize variety which it will launch soon, as well as working on other variety of crops, but how far will this go in reducing Malnutrition and increasing food production? Time will tell.

Ugonma Cokey reporting.

Groundnut Pyramids: The lost pride of the North

Baraka Bashir, Freedom Radio, Kano.

Prior to Nigeria's independence in 1960, groundnut pyramids was a success story of agricultural revolution in the northern part of the country

Though it suffered a serious setback following the disappearance of the famous pyramid in Kano, groundnut farming is the oldest kind of practice in this part of the country. This setback led to the subsequent closure of confectionary factories that used it as major raw material for the production of biscuits, chocolate and other confectionaries.

The then magnificent buildings of the high pyramids have now been replaced with buildings and some commercial activities in the onetime venerable produce.

But one might wander what is it that we failed to do that killed the production of the once pride of the north. Curious minds have had unanswerable thoughts lingering in their minds as a result. Might it be lack of patronage or poor policy on the part of the government?

You don't have to think harder about the genesis of the unfortunate set back. Mallam Habu, an old farmer says, "Then you were been waited for and pampered to bring your produce. But since the advent of the oil boom, farmers sifted their farming style to variety that people needed more in the market, governments stopped patronizing their produce and that was the beginning of the untold story of the once pyramid and major source of income.

A learned person might also think if the like variety or seed of then groundnut was have is no more, also an issue in the production of groundnut, differ which makes the markets unfavorable, this leads me to the quest of such answers of my untold stories of the pyramid

I talked to Dr Maimuna Abdulmalik an expert at the university of Zaria says The collapse of the groundnut sector effected farmers as most this farmers are poor and the government has little or no support in that aspect ,the support financial and the improve seed to make happen was neither available.

In the era of the groundnut pyramid after the discovery of oil ,a misfortune befall the groundnut farmers with a deadly disease that destroyed their harvest which contributed in the end of the pyramid seeing government intervention was merely a mirage.

It was recently that Minister of Agriculture and Rural Development, Dr. Akinwumi Ayodeji Adesina said, that at an international gathering of agricultural researchers and policy makers in Patancheru in India that Nigeria would rebound as a leading groundnuts producer in the world.

According to the global food security index Nigeria is rated the 80th and among the top countries that produce protein food crops.

And the third in the production of groundnut after India and China, yet not as an exchange revenue avenue for the nation and Groundnut has remained as an important crop for resource-poor farmers in Nigeria.

A professor plant biotechnology Dr Jim Dunwell said Nigeria has massive tradition of producing such crops that serves as foreign exchange revenue in the past considering the change of agricultural priority and believe it is not sensitive for Nigerians to export cowpeas and other such crop from other countries while as they can produce such in their country.

He believes that Nigerian have skill full people and institute doing great work it is possible to improve the scientific knowledge, and for that to happen there could exploit or use international contact, may be if skills are available to make sure those skills are brought back to Nigeria so that Nigerian scientific community could go further with all the knowledge acquired to applied the skills and improving farming especially regarding those that deals with foreign revenue exchange.

Biotech, the new way for boosting crop production – Dr Okogbenin

By Orsar Hembadoon Rosa

In a quest to improve crop production in Nigeria, agricultural scientists have devised ways of improving yields called Biotechnology so as to put smile on the faces of farmers, especially those who may want to engage in commercial agriculture.

According to an expert, Dr. Emmanuel Okogbenin of the National Root Crops Research Institute, Umudike, Abia State, Biotechnology is a combination of various fields of applied life sciences ranging from molecular biology, biochemistry, genetics, etc.

Dr Okogbenin made this known in an interview with The Voice during a media fellowship and training for journalists organized by organization called Biosciences for Farming in Africa (B4fa) at the conference hall of International Institute for Tropical Agriculture (IITA) in Ibadan recently.

He said that the best alternative for improvement of agriculture which will avert food insecurity and environmental calamity is biotechnology, explaining that Biotechnology can improve yields through tissue culture which can be used to introduce important germ plasm, as well as molecular which he said are some of the tools used to finding genes that lead to high yields.

Explaining the cost implication, Dr Okogbenin said the molecular marker is expensive but its application is cheaper, adding that the development process is fast declining in cost.

“It was initially expensive but with the dynamism in advances in biotechnology, economic resources are rapidly being developed”, he said.

He also disclosed that biotechnology tools has better precision and the rate of progress made using biotech tools in breeding is much faster and better results are attained.

He stressed that the general public needs to be sensitized about the usefulness and benefits of biotechnology, saying biotechnology is not all about genetic modification.

Why biotechnology should be priority in Nigeria

Joseph Kingston, Calabar

It is no longer news that Nigeria ranks 80th, out of 105 index countries globally, in terms of availability, affordability and quality/safety of food. This is indeed startling considering the fact that Nigeria has the largest population in Africa with more than N150 million, and with millions of mouth to feed.

Analysis indicate that despite the world's focus on increased food production, the country seems to be satisfied with its exploits in oil exploration and as such pays very little effort to bridging the yawning gap between the poverty/hunger stricken masses and those riveting in oil opulence.

Data from Global Food Security index shows the country in a very bad and disgraceful shape.

This shocking data may have propelled experts, researchers and professional institutions to seek a solution to the avoidable effects of food insufficiency. They, at various fora, have been calling on the federal government to remove its focus and concentration from oil, which they reasoned could dry up one day, but unfortunately, this call is yet to be heeded by both the federal and state governments.

This situation is not only bad but ridiculous particularly on the background of our history as agriculture-driven economy in the past, with our groundnut pyramids in the North, cocoa in the West and palm oil in the East which were exported to other countries.

The questions that are therefore being asked are: Why were the past agricultural strides not sustained and improved upon, and how can the country move from its present ranking with its attendant negative implications, to a more practically secured position?

It was this question that experts from the Bioscience for Farming in Africa (B4fa) sought to answer during its media fellowship which was held at the International Institute of Tropical Agriculture, Ibadan, from Monday, September 25 to Thursday, 28, 2012

Both local and international researchers had pointed at the imperative of applying a scientific method technically referred to as Biotechnology as panacea to solving our poor agricultural standing. This, they reasoned, would consequently translate to food sufficisency and security.

Speakers at the event were Wayne Powel of University of Aberystwth, United Kingdom, Jim Dunwell of Univeristy of Reading, United Kingdom, Charles Amadi of National Root Crops Research Institute, Umudike, Inuwa Usman of Institute for Agricultural Research of the Ahmadu Bello University, Zaria amongst others.

In his remarks, Wayne Powell noted that plant breeding for improved varieties of crops could boost higher-yields, resist pest diseases and drought. He said access to good seed by farmers is important and that these seed are got form a biotechnology process called hybridization.

He described high-yielding seeds as fundamental to Agric, and basis for oil deposits and that it could help in production of the universally supported biofuel.

Powel stressed that many crops have undergone major scientific changes with traits which distinguishes them from their old parents, adding that knowledge about genetic and application of technology is crucial for improved farming in Africa.

On his part, Jim Dunwell emphasized on the need for a proper understanding of genetic make up of crops (genotype), their Deoxy Rebose Nucleic Acid (DNA), noting that with a tissue culture phenomenon, crops could be multiplied rapidly within a short time.

He explained that plant biotechnology involves taking a desired gene from a plant and infusing or adding it with an already existing commercial variety of crops so as to produce completely new varieties which could increase yield.

Dunwell believed strongly too that with right application, Genetic Modification (GM) crops could turn around the fortunes of any country since it has ability to protect crops against pest and insects all by itself.

According to him, advantages of GM crops include higher yields, high oil, modified starch, modified protein, modification of flavour/sweetness and post-harvest tolerance amongst others.

He reiterated that some of the benefits of application of this method include reduction of pre-emergent sprays, absence of tillage system and that it ease agronomy.

On the assessment of the method in Nigeria, Dr Inuwa Usman said biotechnology is gradually making in-roads into the country, and that with the application of the technology some new crops have long been handed over to the Registration and Release Committee of the Federal Ministry of Agriculture according to laid down regulations and that there have since been formally approved and released.

Usman said the new varieties include: “five of maize, three of sorghum, three of cowpeas, and one of groundnut. Same-nut 24[of groundnut] has been released, same-maize 32, 33,34, 35, 36 and 37 have also been released. Two of the same-maize 32,33 are the extra early mature breed which mature in 75 days and can tolerate drought, diseases and have quality protein.QPM has two essential amino acids.

He further noted that the growing population has made it challenging for political leaders to consider food sufficiency as a priority, stating that the time has come to pay increasing attention to research efforts to produce more crop varieties that can address the food sufficiency needs of the growing population.

With these revelations about biotechnology, one would therefore submit that a time has indeed come for a turn-around in Nigeria’s approach to agriculture. If developed countries such as United Kingdom and United States are exploring the benefits of Biotechnology, Nigeria, as a third world country, cannot afford to lag behind.

It is against this backdrop that it has become mandatory for Nigeria’s leadership, from both the federal and state, to embrace this global phenomenon by speedily employing the services of international and local experts in the biotechnology field to bring to bear on our agriculture, the good things which this phenomenon offers.

When this is done, unemployed graduates shall no more roam our streets. This is because, apart from making the country to be food sufficient, agriculture has the capacity to employ millions of Nigeria's youths who are believed to be leaders, tomorrow.

END

Hybrid rice – hope for rice farmers in Benue state

By Elizabeth Achagh T

Rice farmers in Benue state have been counting their losses following recent flooding experienced in some parts of the state.

Some of the areas including, Makurdi, Apa, Buruku, Agatu, Otukpo, Taraku, Tarka and Gwer West have been known to be one of the highest producers of rice.

The challenge of flooding have come to be one of the biggest challenges of rice producers in the state in recent times as most of the farmers fear the viability of rice production as witnessed in the past may be on the decline as more farmlands are being submerged on a daily basis.

Speaking on this development however, a resource person from the University of Aberstwyth, UK, Wayne powel, said flood resistant hybrid rice have been developed in the uk to help surmount this challenge.

Dr Powel stated this at a four-day Dialogue and Training Workshop on Plant Breeding, Genetics and Biosciences for farming in Africa at the International Institute for Tropical agriculture, Ibadan organised for over 20 Nigerian reporters.

According to him the snorkel rice species have been hybridised to rapidly shoot up and grow withstanding flooding and increasing yield.

He therefore called on farmers in the state and other rice producing areas in the country to avail themselves of the opportunity to increase rice production in the country with a view to achieving the expected food security in the country.

Dr Wayne described plant breeding and genetics as the only panacea to attaining global food security and economic sustainability and urged African leaders to embrace these concepts to address low productivity in the continent

Making the wonders of cowpea work for Nigeria

By Bilkisu Ado Zango

The 2012 food security index ranks Nigeria 80th out of the 105 countries assessed Nigeria ranks 103 (15.4%) in the affordability ranking, 49th (51.5%) in availability and 84th (37.2%) in quality and safety.

The statistics clearly shows that to attain the transformational agenda of the present administration of President Goodluck Jonathan, a lot has to be done to boost production of cowpea to meet demand for the population not to talk of commercialization in the global market.

Cowpea is the most important legume in Africa, it is consumed by over 60 million people every day as such, it accounts for half (58%) of what is produced worldwide with the National Deficit of over 500,000 tons.

The leguminous plant is very rich in protein, which is lacking in many diets can be found in almost every nook and cranny of our local communities.

According to Muhammad Lawan Umar of the department of plant science, institute of agricultural science ABU, Zaria explained that, initially, some factors hindered local farmers from production of cowpea including drought, which is causes up to 80% of yield loss for grains, poor quality grains which reduces income of farmers as well as estimated revenue loss of 4000kg.

Today, the advancement of science and technology in our lives has gone a long way in transforming the agricultural sector.

With the paradigm shift, the Maruca resistant Cowpea was introduced and the outcome increased farmers' yield up to 20 times. It also improved the quality of the grains and reduced cost of production, thereby causing income generation.

Biotechnology is now used to overcome issues that traditional farmers fears faced by farmers. It helps in producing resistant, fast yielding varieties and in combating malnutrition and hunger.

For Nigeria to maintain the status of "Giant of Africa," there is the growing need to create awareness for farmers in rural communities and to partner with relevant stakeholders including plant breeders and researchers of Cowpea to achieve food security by 2050.

Hope Rising For School Feeding Programme

From Loretta Ugonabo

Food systems today are under severe increasing strains from population pressures, high input prices, changing consumer patterns, climate change, among other causes of food deficiency among children.

The discovery and subsequent release of new grains and cassava varieties has raised hope that the school feeding programme of government which was introduced in 2006 would not be in vain.

The school feeding programme was introduced by the federal government to address vitamin and protein deficiencies among children under the ages of 12. The programme requires that each child in primary school would be fed once with high vitamin rich food but according to a report this was not possible in many states since he programme begun.

Due to the failure of the programme and other factors led to the world ranking of Nigeria as 80th in global food security index out of 105 countries that were sampled.

But hope for the revival of the programme may have come with the release of the Vitamin A cassava variety by the National Root Crop Research institute and improved cowpea variety by the institute for Agricultural Research ABU Zaria.

Dr. Emmanuel Okogbenin, a researcher from the National Root Crops Research Institute, Umudike in Anambra state said that the idea of new release of cassava varieties was to add value to cassava, improve food component for the poor and improve the status of children.

However according to a researcher, Mr. Charles Amadi also from the National Root Crops Research institute, Umudike, cowpea also known as beans when added to food given to children would increase the protein content of meal consumed by them, thereby limiting them from acquiring diseases associated with protein deficiency.

New grains and cassava varieties recently released would help address food deficiencies among children, revamp the school feeding programme and boost our food security index.

Sugarcane as value chain in Nigeria

Lawan Isa Bagwai

Radio news piece – outine

The need for farmers to be adequately informed on the need to embark on sugarcane production in commercial quantity has been stressed.

This is part of the presentation of papers at the ongoing B4FA training for journalists holding at IITA Ibadan.

A lecturer in Institute for Agricultural Research (IAR) of Ahmadu Bello University, Zaria Dr. Inuwa Usman said "such a move would be advantageous to farmers in view of the prospects in such a venture.

This according to him, sugarcane is propagated vegetatively by cloning and has rapid growth due to disease free seedlings.

In terms of the Biotechnology advantage Dr. Usman said "sugarcane can make bioethanol production more profitable and environmental friendly.

As regards to issues of green revolution and food security, the farmers would stand a better chance to meet global challenge.

Experts hinge Nigeria's agricultural future on good quality seeds management

By Onche Odeh

Agricultural experts have said Nigeria must understand and deploy appropriate methods of managing good quality seeds for it to get the best of its huge agricultural potential.

This, suggestion buttressed by the Head of Department (H.O.D), Plant Sciences at Ahmadu Bello University, Zaria, Kaduna State, North Western Nigeria, Dr. Inuwa Usman, and Coordinator, Open Forum on Agricultural Biotechnology (OFAB) in Africa, Mr. Daniel Otunge, is coming on the heels of revelations that only 15 per cent of crop farmers in the country have access to seeds of improved crop varieties.

Speaking in an interview, Usman noted that most farmers in the country (about 85 per cent of them) rely on seeds that have been saved from previous yields, a situation he said may not guarantee sustained good outputs from the farms.

"Most farmers in Nigeria would prefer to plant seeds they have saved either by smoking in their barn or through other traditional means," Usman disclosed.

He cited lack of confidence on industrially packaged seeds, accessibility to seeds market and lack of awareness as some of the reasons the farmers in Nigeria are stuck with the old tradition of seeds management.

Usman said, "Farmers in Nigeria fear that the packaged seeds that are sold in Nigerian market would always fail in the farm because of previous experiences, hence they would always rely on what they can trust, which is the seeds from their barn."

Usman's views reinforces the findings in a recent survey by the National Agricultural Seeds Council of Nigeria that one in every two seeds purchased from the seeds market in Nigeria may fail to deliver on performance in the farm.

Borrowing from the Kenyan model

Various institutes across Nigeria are developing improved seeds of improved crop varieties, but experts argue that the uptake by farmers have been very poor.

On how to enhance this, Otunge said Nigeria could look at what Kenya has done well in this regards and borrow a leaf from such.

He said, "Kenya has developed a very good seeds management that is primed on Distinctness, Uniformity and Stability (DUS) of the seeds performance in the farm."

According to him, "more than half (55 per cent) of farmers in Kenya currently have access to good quality seeds, especially of improved crop varieties."

"Nigeria needs to look at what the seeds companies are doing and ensure that they use their marketing and sales networks to ensure that quality seeds are delivered to farmers at the right time," Otunge added while making reference to how the companies are doing it in Kenya.

In a further suggestion, he said, "In Kenya, once new varieties of crops are introduced, seeds companies are invited to bid, but it has to be that one company bids for the seed of one variety only to avoid clustering on just one variety at the expense of others."

He said the Kenyan experience offers Nigeria the opportunity to also look at others used in other countries. In India for instance, the community seeds production is used to bridge supply deficit across far-flung and difficult to reach areas.

Agriculture in Nigeria has been faced with low productivity due to numerous challenges.

In a presentation to participants in the first Bioscience for Farming in Africa Fellowship project (B4FA), Researcher at the International Institute of Tropical Agriculture, Dr. Christian Fatokun, listed some of this to include Disease, drought, unimproved planting materials including seeds, reliance on traditional farming methods and materials, poor soil, low fertilizer usage among others.

These, the experts all agree could be resolved to a measurable extent by proper seed management.

Farmers Resistant To Biotechnology; Bane to Food Security

By Elizabeth Achagh T

The continued resistance to the application of biotechnologically produced plants by Nigerian farmers has been described as the greatest challenge to the hope of achieving food security in the country..

A resource person with the National Root Research Institute, Umudike, Dr Charles Amadi made the assertion while speaking to Radio Nigeria correspondent Elizabeth Achagh at a four-day Dialogue and Training workshop organised by Biosciences for farming in Africa media fellowship for agriculture reporters at the International Institute for Tropical Agriculture

Dr Amadi maintained that for Nigeria to attain food security, a pragmatic approach must be adopted .

He described the fear by farmers in the country on the safety of consumption of genetically modified crops as unfounded stating that the crops are safe for consumption and environmentally friendly.

On his part, Wayne Powell of the University of Aberystwyth, UK, described bio-technology as a panacea to the problem of insufficient and low quality food production in Nigeria and other African countries.

According to him hybrid and Genetically modified crops have been developed to withstand insect, drought and flood resistant for increased yield which would translate to increased food production, job creation and wealth creation and revenue generation.

He therefore urged farmers in the country, government agencies and other African leaders to embrace it for optimum results. .

Nigeria is importing 500,000 tons of cowpea into the country

Muawuya Bala Idris

A lecturer at the Department of Plant and Science, Ahmadu Bello University, Zaria, Mallam Mohammed Lawal stated this in an interview at the ongoing first media fellowship organized by the Nigeria B4FA holding in Ibadan.

Mohammed, who presented a research paper on the Development of BT, GEME Technology at the workshop, said the importation of cow peas was due to failure to produce enough of cow pea for the population of the country.

He said cow pea crops have suffered problems due to emergence of Maruca insects which destroy cow pea plants.

He said experts on cow peas improvement made in Dakar in 207 and later in Nairobi, plan to find a solution to the problem.

Mohammed said they finally concluded that the only strategy was through the technology tools.

According to him, since then, various workshops were carried out in Australia, adding that currently field test have commenced since 2009.

End.

Genebanks Provide Insuarance For Nigerian Farmers

By Binta Lawan Umar

Experts in agriculture have revealed that farmers in Nigeria could use the opportunity provided by the presence of genebanks in the country to preserve improved varieties of their crops.

This, according to them provides the requisite insurance for the farmers are often bothered about the problems of clean seeds and continuity for improved crops varieties.

The experts who spoke in separate interviews have said researchers in the country have enough genetic resources to help in crop variety preservation.

Genebanks provide safe storage to ensure that the varieties of crops that could ensure our food supply are secure and that they are easily available for use by farmers, plant breeders and researchers.

Dr. Emmanuel Okogbenin, a senior scientist and a molecular breeder with the National Root Crops Research Institute (NRCRI), Umudike, Abia State elaborates more on this.

He says “the seed bank preserves dried seeds by storing them at a very low temperature.”

“Spores and pteridophytes are conserved in seed banks, but other seedless plants, such as tubercrops cannot be preserved this way,” he explained.

Dr. Okogbenin also added that in an effort to conserve agricultural biodiversity, gene banks are used to store and conserve the plant genetic resources of major crop plants and their relatives.

Wayne Powell, a visiting Scientist from the University Of Aberywyth, United Kingdom talks about the other kind of Seedbanks as another form of crop varieties preservation, explaining that the variations between the two are just marginal.

He says “a seedbank stores seeds as a source for planting in case seed reserves elsewhere are destroyed,” adding that it is typically a gene bank.

“The seeds stored may be food crops, or those of rare species to protect biodiversity. The reasons for storing seeds may be varied. In the case of food crops, many useful plants that were developed over centuries are now no longer used for commercial agricultural production and are becoming rare. Storing seeds also guards against catastrophic events like natural disasters, outbreaks of disease, or war. Unlike seed libraries or seed swaps that encourage frequent reuse and sharing of seeds, seedbanks are not typically open to the public,” he says.

Muhammad Lawan Umar of the Department of plant science Ahmadu Bello University Zaria throws more light on some of the challenges faced in setting up a Genebank.

He says, “There are so many challenges faced in the process of seed banking like some stored specimens will definitely lose their viability.”

According to him, there is the need to improve data management, stressing the importance of a documentation process that shows the plant stored number of seeds stored and other information that should be made available to future farmer and of the expenses.

He also pointed out that the cost of seeds are quite high for most developing countries, noting also that there is need for stable power supply in Nigeria to make any agricultural innovation a reality.

Gene banks are facilities which preserve genetic materials. In plants, this could be by freezing cuts from the plant, or stocking the seeds. In animals, this is the freezing of sperm and eggs in zoological freezers until further need. With corals, fragments are taken which are stored in water tanks under controlled conditions.

While genebanks are important in safeguarding plant resources, complementary conservation approaches, such as on farm conservation is also vital to secure our future food supplies.

There are many gene banks all over the world, with the Svalbard Global Seed Vault being probably the most famous one.The largest seed bank in world is the International Rice Research Institute in Manila.

Report On Sugarcane

Abdul–Rashid Kuraye NTA, Katsina

Outline of TV piece

The plant researcher said "Application of micropropagation technique on sugarcane will improved the welfare of the farmers, revive sugar industries and boost the economy of the country at large.

A lecturer at the Institute for Agricultural Research (IAR) of Ahmadu Bello University in Zaria, Dr. Inuwa S. Usman stated this in four days media fellowship training at IITA, Ibadan.

He further said "new sugarcane varieties like BD 98.001, BD 98.002, BD 99.001 and BD 99.062 were developed by National Cereal Research Institute (NCRI), Badegi. He added that the new varieties were evaluated in different Agro-ecological zones in Nigeria.

Dr. Inuwa explained that multiplication of these cultivars to commercial scale is another challenge which may take six to seven years to propagate. Saying that during the period of years the farmers end up degraded and they will receive low performance materials for planting.

According to NTA news investigation revealed that, promotion of sugarcane farming can encourage foreign exchange earnings, high employment generation, linkages with major suppliers and support industrial customers.

Dr. Inuwa said mass production of sugarcane planting material through micro propagation will increase sugarcane production by 17% capacity with the total area of 64, 000 ha with 384, 000 tons.

Prize winners

Prizes were awarded to the following Fellows for the best pieces of journalism produced during the training workshop:

Abdallah El-Kurebe – Plant breeding and the ordinary Nigerian farmer
Joseph Kingston – Agric experts give recipe for food sufficiency, employment
Ugonma Cokey – Agriculture and malnutrition in Nigeria
Baraka Bashir – Groundnut Pyramids: the lost pride of the North

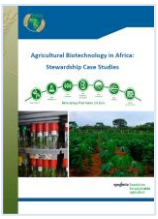
8. Material supplied to Fellows during training courses

Material distributed during courses on USB stick

AGRA: The African Seed Company Toolbox

AGRA: Seeds

Academy of Sciences of South Africa: Science-based improvement of rural/subsistence agriculture

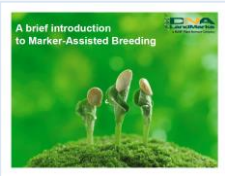


Syngenta/FARA: Agricultural Biotechnology in Africa – Stewardship Case-Studies

ASARECA Newsletter: The Agri-Forum

CABI Annual Report

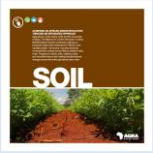
ATPS Policy Study: Why Informal Seed Sector is Important to Food Security



DNA Landmarks: A brief introduction to marker-assisted breeding

Oregon State University: Advanced Plant Breeding course

Collard & Mackill; IRRI: Marker-assisted breeding for Rice Improvement



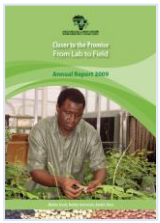
AGRA: Soil brochure

IITA: Annual Report 2011

ATDF Journal: Food Sovereignty edition

UN Commission on Sustainable Agriculture and Climate Change: Achieving Food Security in the face of Climate Change

IFPRI report: Agricultural R&D in the Developing World



AATF annual report 2009

AGRA: Markets brochure

ATDF Journal: Orphan Crops issue

Calestous Juma; Nature, Nov 2011: Preventing Hunger – Biotechnology is key

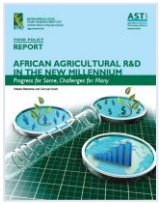
AGRA brochure: Africa's Green Revolution

Science Africa: Volume 17

National Academies of Sciences/National Research Council: Exploring sustainable solutions for improving global food supplies

Africa Technology Policy Studies Network: Annual Report 2010

William Kerr: Food Sovereignty – Old Protectionism



IFPRI Report: African Agricultural R&D in the New Millennium

FARA Report: Inventory of Innovative Farmer Advisory Services using ICT

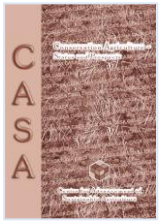
IITA: Research for Development Review

IFPRI Report: Country R&D Facts

Science Africa: Volume 15

AGRA Review 2011

AATF Annual Report 2010



Centre for the Advancement of Sustainable Agriculture: Conservation Agriculture – Status and Prospects

University of Arizona – lecture course on Early Farming

NCERT Course on Genetics and Heredity

Bjorn Lomborg; Project Syndicate: A Golden Rice Opportunity

ASSAf: GMOs for African Agriculture – Challenges & Opportunities

EuropaBio: Pocket Guide to GM Crops and Policies

ISAAA Biotech Crops Country Report 2012: Argentina

ISAAA Biotech Crops Country Report 2012: Bolivia

ISAAA Biotech Crops Country Report 2012: Brazil

ISAAA Biotech Crops Country Report 2012: Burkina Faso

ISAAA Biotech Crops Country Report 2012: Chile

ISAAA Biotech Crops Country Report 2012: China

ISAAA Biotech Crops Country Report 2012: Colombia

ISAAA Biotech Crops Country Report 2012: Honduras

ISAAA Biotech Crops Country Report 2012: India

ISAAA Biotech Crops Country Report 2012: Mexico

ISAAA Biotech Crops Country Report 2012: Myanmar

ISAAA Biotech Crops Country Report 2012: Pakistan

ISAAA Biotech Crops Country Report 2012: Paraguay

ISAAA Biotech Crops Country Report 2012: Philippines

ISAAA Biotech Crops Country Report 2012: South Africa

ISAAA Biotech Crops Country Report 2012: Uruguay

ISAAA Biotech Cotton – Annual update

ISAAA Biotech Maize – Annual update

ISAAA Biotech Canola – Annual update

ISAAA Biotech Soybean – Annual update

ISAAA Report on Global Status of Biotech/GM Crops

EMBO reports: “Stop worrying; start growing – Risk research on GM crops is a dead parrot”

COGEM: Biotech in the news – lessons from a quantitative analysis of news articles on biotech

Morris 2011: Modern Biotech – potential contribution & challenges for sutainable food production in sub-Saharan Africa.

Kikulwe et al 2011: Attitudes, perceptions and trust – insights from a consumer survey regarding GM banana in Uganda.

The Royal Society: Genetically modified plants for food use and human health – an update

The Royal Society: Responses to call for evidence on "Reaping the Benefits – towards sustainable intensification of global agriculture"

The Royal Society: Reaping the Benefits – towards sustainable intensification of global agriculture

Sense About Science: "Making Sense of GM"

Sense About Science: "I don't know what to believe" – making sense of science stories

ACME: A guide for African Science Media Officers

ACME: Handbook of Independent Journalism

In addition we placed copies of around 50 different plant breeding and biotech videos from internet sources onto the same USB drive as the documents, since bandwidth constraints in Africa would make it almost impossible for fellows to download and watch these themselves.

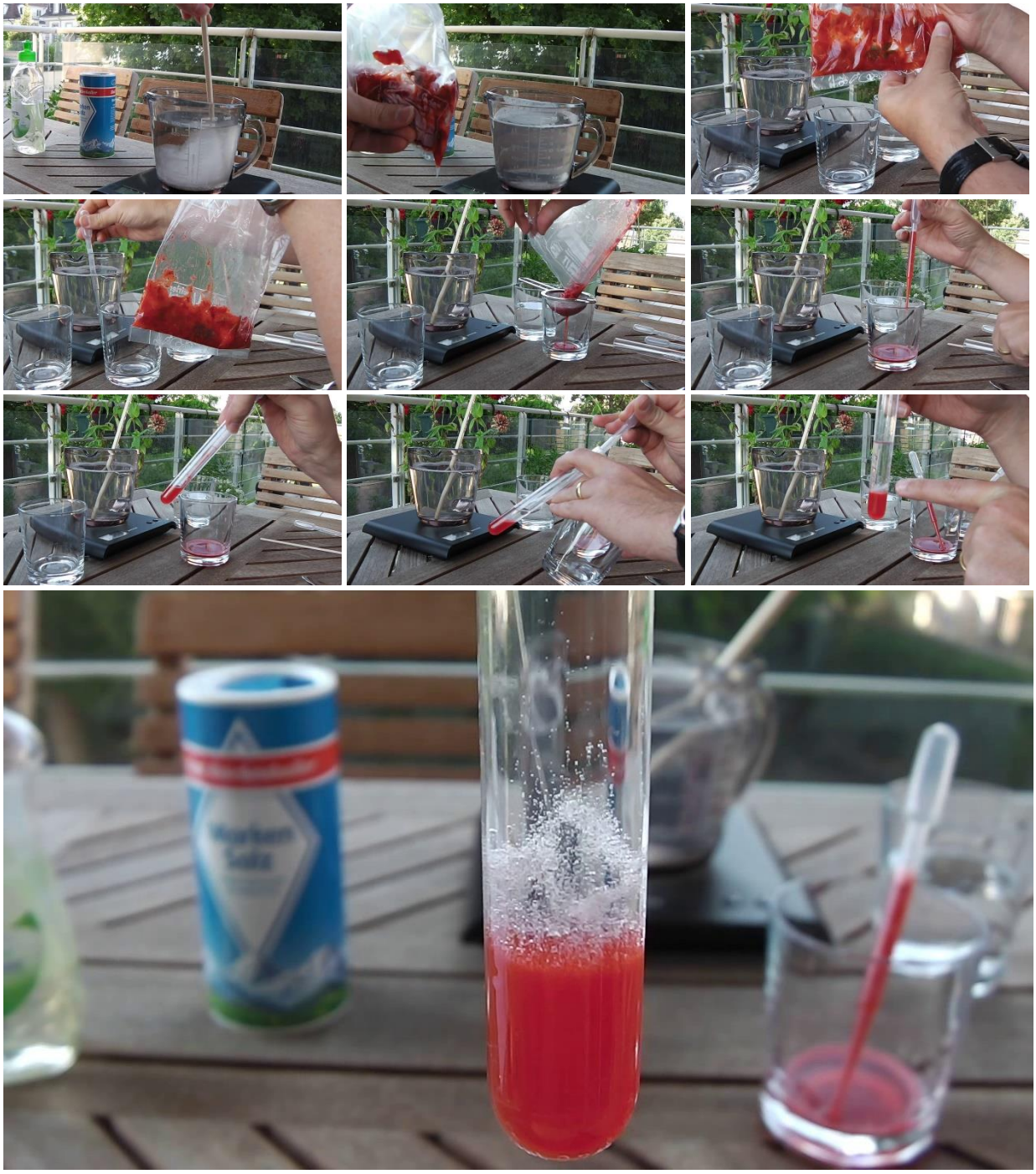
Likewise we included some basic free software (eg Adobe pdf reader, vlc media player) on the USB drive, since not all fellows had these available and would have found it difficult to download them locally.

We also included some general information about the B4FA project as well as about our funder, the John Templeton Foundation.

Games and practical exercises

DNA extraction

To demonstrate what DNA looks like, illustrate the similarity of DNA across different types of organism, and to give a small insight into the scientific process, all media fellows had the opportunity to **extract DNA** from fruit by means of a simple experiment carried out during the training workshop. Fruits selected were largely African (mango, avocado, papaya), though because it gives such clear results we did also use strawberry when the fruit was available.



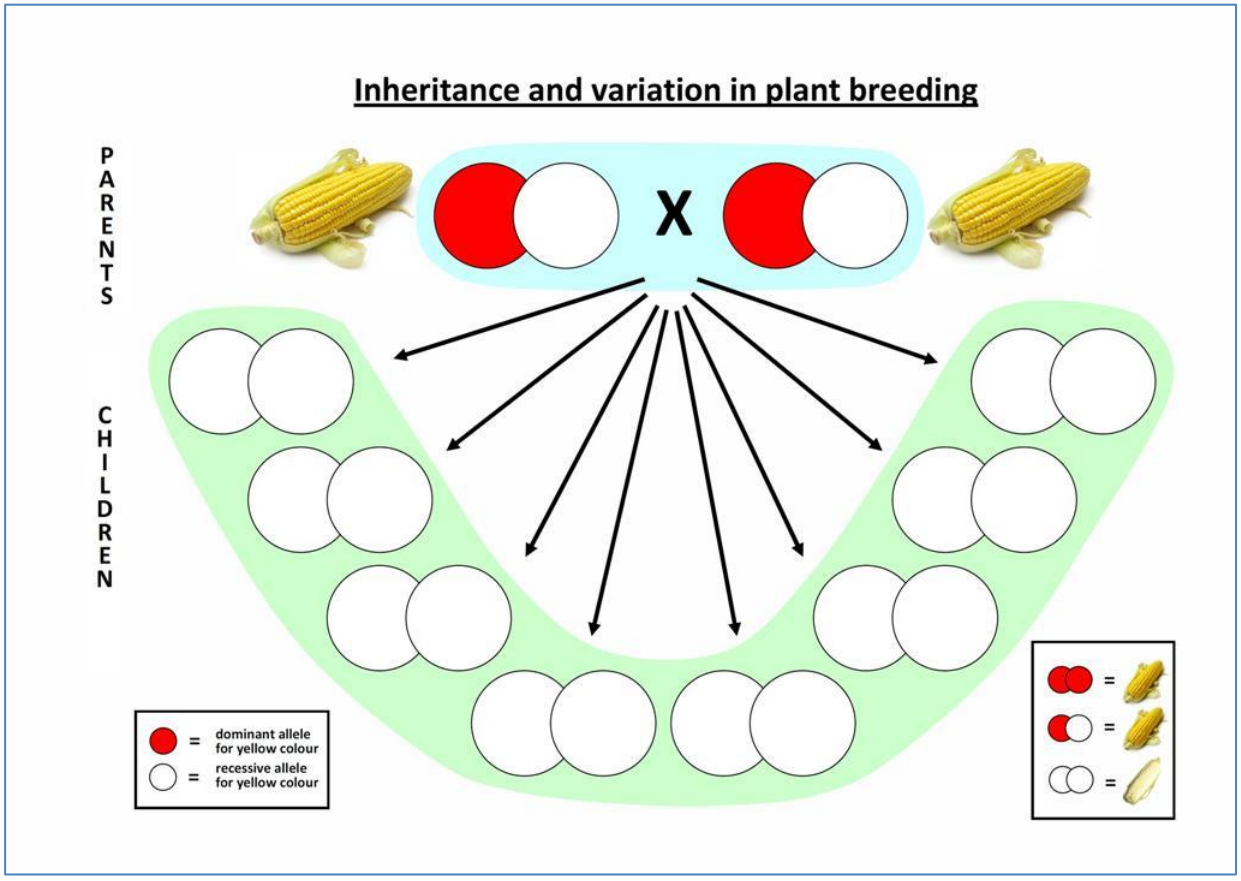
Following a simple experimental procedure (demonstrated beforehand through video – screenshots of which appear above) and mentored by B4FA staff and the research experts present, fellows prepared

their chosen fruit, mixed it with the communally-prepared extraction buffer, added the ethanol and finally were able to collect the DNA they had extracted and transfer it into glass vials which they were able to keep.

Inheritance

In order to demonstrate **genetic traits**, and to enable fellows to really understand how traits are **inherited through dominant and recessive** alleles in living organisms, they were given the opportunity to work through the inheritance of a single trait in this worksheet – the trait in this example was colour in corn, which happens to be determined by a single gene, controlling for the expression of beta-carotene.

Beginning with two heterogeneous "parents", fellows were able to simulate the possibility of "offspring" inheriting alleles of either trait from each parent by drawing counters from a bag and placing these on the blank circles of the "offspring" generation. The bags contained a large enough sample of equal numbers of **red and** white counters to ensure a near-random chance of either colour being drawn.

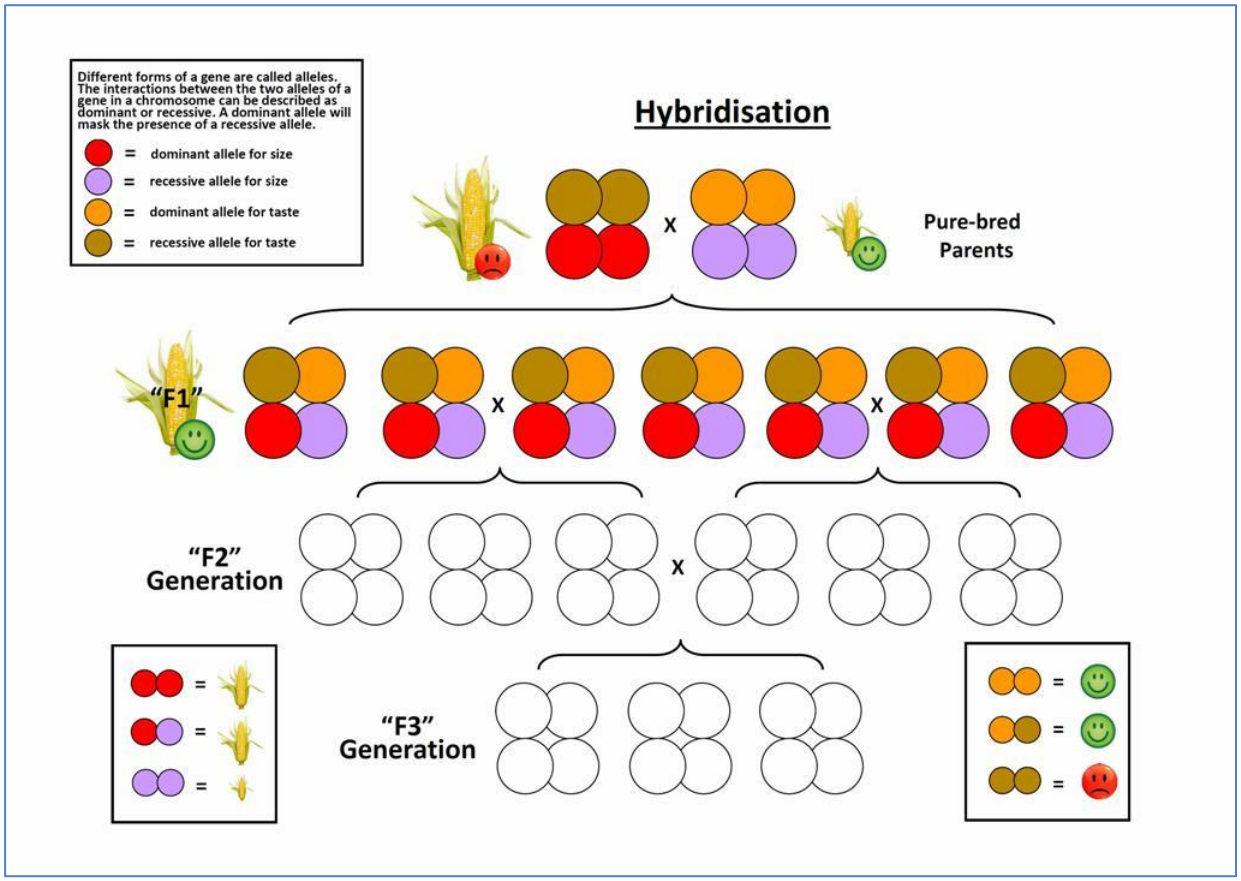


Once the worksheets had been populated with counters, fellows were asked to identify how the colour trait would be expressed in each of the "offspring" individuals, and tot up how many of each colour there were. With B4FA and local expert mentors, they were then encouraged to compare their results with their neighbours', the expected ratio of 3:1 (and results were also totalled across the whole group to see how this compared to that ratio). Discussion was also encouraged of how these results would seem to farmers and others who knew nothing of genetics, and might therefore be surprised to see that two yellow maize parents could have a white maize offspring.

Hybrid seed

In order to consolidate learning on how **dominant and recessive alleles are inherited**, and to demonstrate the genetic reasons **why saving and replanting seed from F1 hybrid plants** is not a good idea, fellows had the opportunity to work through the following F1 hybrid worksheet. Starting with the two purebred lines which are combined by breeders to produce the F1 hybrid seeds, the worksheets initially demonstrate how – through the genetics of inheritance – the F1 hybrid offspring end up with the dominant traits that breeders are trying to produce. The two traits used in this example were size and flavour, neither of which in reality is a simple trait controlled by just one gene.

The task for the fellows was then to simulate the characteristics of the F2 generation (the saved seed) that would result from crossing the F1 hybrids. Once again, the equal probability of each allele of the F2 generation inheriting either the dominant or recessive characteristic from the F1 generation was simulated by drawing counters at random from bags containing equal numbers of each choice (one bag for each trait).



Once the worksheets had been populated with counters, fellows were asked to identify how the size and flavour traits would be expressed in each of the F2 individuals, and tot up how many of each there were. With B4FA and local expert mentors, they were then encouraged to compare their results with their neighbours' and to reflect what this would mean to the crop productivity in the second year. Discussion was also encouraged of how these results would seem to farmers and others who knew nothing of genetics, and also to reflect on the fact that by saving seed, some of the resulting plants will, because of the genetics of inheritance, have neither of the two traits that their F1 parents uniformly possessed.

9. Conclusions and recommendations

The training workshop represented a good start to our fellowship programme.

The innovative elements of the B4FA fellowship were highly appreciated (the long term engagement, the focus on understanding, the practical exercises and technical and journalistic mentoring) and received positive feedback. The local communications manager for the African Agricultural Technology Foundation was also present throughout the training workshop, and subsequently adopted many of our approaches and tools in their own media engagement work.

The logistical complexity of the course was lower than the Ghana workshop, and it did flow more smoothly as a result, with more time for questions and for journalism exercises.

In terms of specific technical needs, the history of breeding and agriculture needed to be explained better. F1 hybrid seeds are probably the most highly relevant technology to the local agricultural situation, but are very poorly understood, and frequently confused with GM or (when seed has been saved against the best advice) regarded as “fake seed”.

Similar to Ghana, the section of the workshop programme that asked fellows to pretend to run a talkshow interviewing the scientists did not really work, as it was held too late in the evening and, since they took it very seriously, did not really have the “fun” element it had been designed to have. This element will be dropped from future workshops.

Having just a single fieldtrip, with a large group of fellows, was slightly limiting in terms of the diversity of what fellows saw as well as the access they had individually to scientists for interviews. Having multiple field trips, with smaller groups of fellows, will work better in future to maximise opportunity for interaction and learning

10. Presentations delivered in training course

Introduction

Dr Bernie Jones – B4FA Media Programme Director

Biosciences for Farming in Africa

Media Fellowship Programme
Nigeria

Welcome

Dr Bernie Jones
B4FA Project Director – Media

B4FA – The Project

- 3 years long
- Encourage dialogue and understanding
  - Biosciences
  - Farming
  - Africa

Funders

- John Templeton Foundation
  - focus on the big questions of human purpose and ultimate reality. The Foundation takes a particular interest in how major advances in genetics might serve to empower individuals, leading to spiritually beneficial social and cultural changes.
- Malaysia Commonwealth Studies Centre
  - focuses on affordable education, affordable healthcare, sustainable development, food security, mitigating climate change, the promotion of electoral democracy and good governance.

Sir John Templeton 1912 – 2008

- As a pioneer in both financial investment and philanthropy, the late Sir John Templeton spent a lifetime encouraging open-mindedness
- In 1999, *Money* magazine called him - "arguably the greatest global stock picker of the century"
- Sir John's passing was marked by *Nature*: Templeton was a deeply spiritual, although unorthodox, individual. He lived a life firmly rooted in the Christian traditions of modesty and charity. Yet he was also a great admirer of science....which led him to form his foundation in 1987

But First...

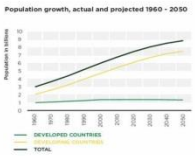
A welcome from the leader of our project...

Professor Sir Brian Heap FRS

Project Rationale

- Philanthropic objectives of our funders
- Global factors
  - Population growth
  - Climate change
  - Food security

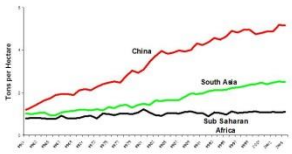
Population –> 9bn



Nothing new...

- Rev Thomas Malthus (1766 – 1834)
  - "An essay on the principle of population"
  - Populations checked by famine or disease
- But here we all are!

But look how different:



Africa

- High % of African GDP agriculturally based
- High % of Africans working in agric
- But green revolution "missed" Africa
- Unique disease/environmental challenges
- High % of farmers locked into subsistence
- Opportunity for economic and social development
- And US/Europe is part of the problem!

"Why don't farmers grow more?"

- Lack of inputs
- Poor planting material
- High costs of fertilizers
- Inappropriate technologies
- Poor land tenure
- Lack of water
- Poor extension services
- Variable and unreliable markets
- Poor infrastructure

But the mix varies from place to place

Gordon Conway (2010)

So what's happening?

- Many
  - Scientific Research Initiatives
  - Development Projects
- But
  - Little dialogue and public understanding
  - Much disinformation

Where does B4FA come in?

- Policy-makers' booklet of opinions by international thought leaders
- Series of Media Development Fellowships
- Series of studies on implementation, agricultural extension and demonstration
- Finding synergies

Course Expectations

- Introduction to plant breeding, genetics, and agricultural biotechnologies
- Networking and dialogue with African experts and practitioners
- Discussion of the regulatory and commercial aspects of biotech and crop improvement
- Practical sessions and field trips
- Reminder of fundamentals of science journalism
- Opportunities to practice journalistic techniques and skills in mentored environment

Follow-up

- After this training course?
  - Keep in touch: regular calls with local B4FA coordinators
  - Facebook discussion group
  - Networking events
  - Field trips (competitive)
  - Conference Bursaries (competitive)
  - Prizes (competitive)
  - Further training opportunities (competitive)

Our expectations of you?

- Engage in discussions
- Ask questions
- Participate in networking and other activities
- Write/broadcast more about the issues

- And let us know about it!

Housekeeping

- Format of each day
- Role of mentor/facilitators
- PLEASE no mobiles or emails in sessions
- Be on time – we cannot wait
- Attend all sessions

- Prizes

Practical Exercises

- 2 (at least) useable pieces from this course.
- 5 practical sessions on producing these
  - Preparatory
  - Pitch
  - Interviewing
  - Writing & Feedback

- But please any opportunity to interview the experts

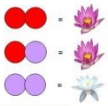
- We would also like to interview you!
- Some more activities to be introduced later

Introductions

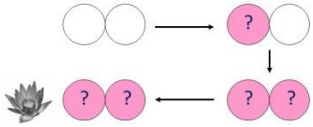
Over To You!

Genetics Simulation

- Inheritance of traits (colour)
- Dominant and recessive alleles



For every child (seed)…



The result

- How many of each type of "child" did you get?
- Did you expect that?
- Statistically, 25% could be expected of the recessive trait

- Same in humans: eye colour, blood group…

DNA Extraction

What you will do

- Some real science!

- Perform a experiment yourself here in the conference room to extract the DNA from fruit
  - You could use the same method on almost anything alive (including yourself) – but it works nicely with fruit, and hurts less!

Experimental steps

- First, make the extraction solution ("buffer")
- Second, prepare (mash) the fruit
- Third, add the buffer to the fruit
- Fourth, extract the DNA with alcohol

- Fifth, try to pick up some DNA to keep!

What you will need

a plastic cup
a test tube
a pipette
some fruit
a plastic bag
a strainer (to share)

Something to keep the DNA on/in (phial, card)

All clear?

There are some printed instructions on the tables (but we've made some changes)

Let's watch me trying it at home…

Making up the extraction solution (buffer)

Preparing the fruit

Adding the extraction buffer

Straining/filtering the solution

Extracting the DNA

Final result

Now
It's
Your
Turn!

Bad Science

Heard a lot about…

- Science
- Scientific method
- Evidence
- Publications
- Experts
- Statistics

Should you always believe?

- Things to watch out for:

Ben Goldacre

"Battling Bad Science"

From TED

Things to look out for…

So…

- What do journalists need to look out for?
- A copy of this video is on your USB sticks, in case it was too fast!

Briefing for "Interview Sessions"

- Day 2: Biotech for Agriculture 1
  - 3 teams of 2 interviewers
- Three topics:
  - Hybridisation
  - Tissue Culture
  - Genebanks and Seedbanks

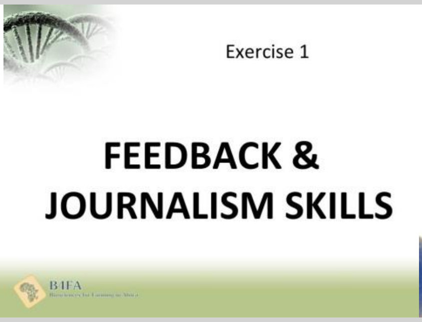
Biotech for Agric cont…

- Questions to ask…
  - What is the concept
  - Benefits
  - Risks/Problems
  - Examples
  - Etc…

Professional Journalism exercises

- 5 sessions – 2 articles
  - Pitching session – idea, arguments, sources, angle etc
  - Drafting and interview design – who, what?
  - Interview "speed dating" – including feedback
  - Final production
- Feedback & mentoring
- Please print out preparatory and final drafts
- Please remember to include your name

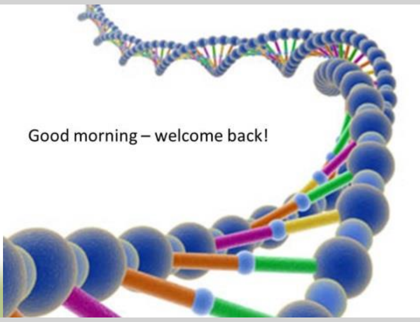
B4FA



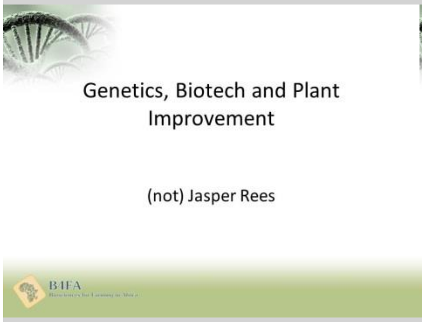
Exercise 1

FEEDBACK & JOURNALISM SKILLS

B4FA



Good morning – welcome back!



Genetics, Biotech and Plant Improvement

(not) Jasper Rees

B4FA

Recap

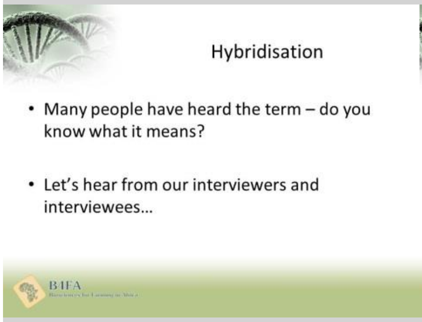
- Crop improvement got a long way before genetics was understood
- What genetics help us understand about crop improvement
- What genetics teaches us about how to improve crops

B4FA

The Need

- Conventional breeding only got us so far…
- Emerging diseases
- Lack of traits in landraces
- Ever more elaborate searches for new characteristics
- Difficulty of introgressing desired characteristics
- Time-consuming nature
- Human dimensions to the challenge – food security in the 19th and 20th centuries

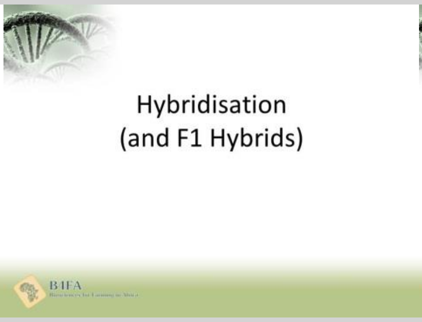
B4FA



Hybridisation

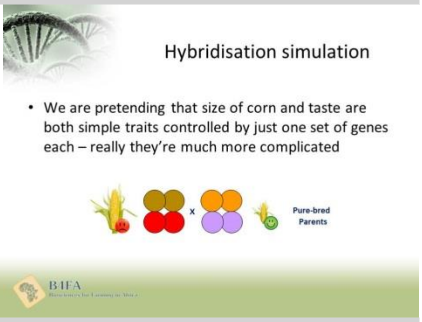
- Many people have heard the term – do you know what it means?
- Let's hear from our interviewers and interviewees…

B4FA



Hybridisation (and F1 Hybrids)

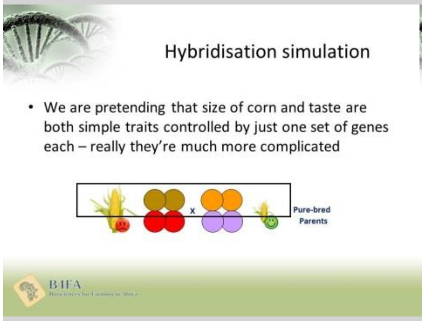
B4FA



Hybridisation simulation

- We are pretending that size of corn and taste are both simple traits controlled by just one set of genes each – really they're much more complicated

B4FA



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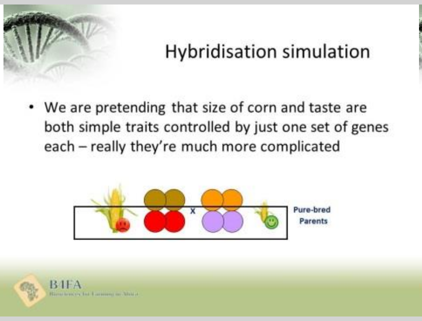

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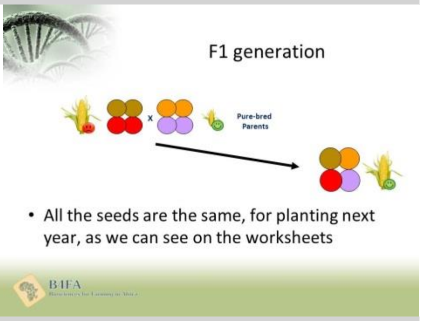
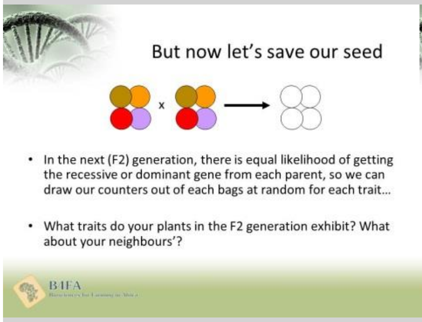
B4FA



F1 generation

- All the seeds are the same, for planting next year, as we can see on the worksheets

B4FA



But now let's save our seed

- In the next (F2) generation, there is equal likelihood of getting the recessive or dominant gene from each parent, so we can draw our counters out of each bags at random for each trait…
- What traits do your plants in the F2 generation exhibit? What about your neighbours'?

B4FA

Over to you!

B4FA

Consequences of hybridisation

- Bought seed vs seed saving
- (Lack of) Ability of individuals or government research institutions to produce in desired quantity and quality
- Uniformity of resulting plants assisted mechanisation, quality control and processing

B4FA

Plant breeding as a commercial enterprise

- This is how commercial seed companies arose, and subsequent combined with agrochemical suppliers
- Far from being a commercial tactic, having to buy new seed each year was a scientific imperative, "guaranteeing" yield and quality

Plant breeding as an applied science

- More and more difficult to get desired characteristics, traits and results
- Breeding moved away from hobbyists into the lab, as science itself evolved

Molecular biology

- What to do when the plants won't cross by themselves
- Tissue culture/Embryo rescue
- Similarity to assisted human reproduction?
- Let's hear from our interviewees…

Tissue Culture

What else can we do with genetics other than breed?

- DNA sequencing & computational biology
- Genetic testing/diagnosis
- Fingerprinting & plant breeders' rights
- Gene banks, seed banks
- Now for our final interview…

Seed Banks and Gene Banks

Millennium Seed Bank

Let's have a look at what Kew Gardens in the UK is trying to do in collaboration with partners around the world…

But what can you use a seed bank for?

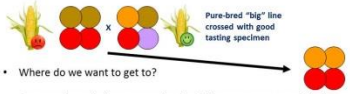
Let's look at….

Recap

- More "sophisticated" recent crop improvement is still trying to achieve same thing as farmers 500 years ago
- No fundamental difference to result, but new techniques let us address new and more immediate challenges
- Human consequence (fewer famines, better health, more obesity!, social and economic development of farming communities)
- But challenges are greater and greater, and new desired traits are more and more elusive
- Challenge of climate change, population, diseases

Breeding simulation

- Rather than our two true-bred lines for hybridisation, we start with a true-bred and a single "interesting" specimen



- Where do we want to get to?
- Can complete the first generation by picking counters out of the bags randomly
- What traits do your new plants have? What about your neighbours'?

Your next generation

- Now, as a breeder you have a choice. You can breed one of your best plants with itself, or cross-breed two of your best ones? Whichever you prefer!
- What do you get in the next generation? And your neighbours?

The third generation…

- Again – choose your best plant and breed it, or cross your two best ones?
- What do you get?

Were you successful?

- How can you tell your breeding programme has succeeded?
- Have you succeeded, failed, or do you need more time/generations?
- In reality, you'd need many more exemplars in each generation, and many more generations…

Backcrossing

- Also, chances are you'd need to get back all the good traits of your original true-bred line. So you'd have to back-cross. That would need even more generations…
- And don't forget that traditionally, you wouldn't have seen the genes, just the traits!

Time matters!

- Benefits of double cropping in Mexico to the green revolution
- Not all varieties can be "accelerated" like this though
- Yield lag and yield drag
- So imagine you could save time by "seeing" the genes like we could in the simulation…

Briefing for this evening

- Genes on Air – Talk Show game
  - 2 teams
  - 2 scenarios
  - 2 presenters
  - 2 experts
  - plus drinks at the bar

Exercise 2

The Pitch

New Technology

- There has always been a "new technology", from fire and the wheel onwards
- Perhaps unsurprisingly, human reactions have sometimes been similar…
- An interesting comparison from more recent history…

"Red Flag Laws"

- In the UK, the Locomotive Act 1865 set a speed limit of 4 mph (2mph in town) for self-propelled vehicles, and stipulated a crew of 3, one of whom needed to walk 60 yards ahead of each vehicle with a red flag to warn the general public and horse traffic
- Human walking speed is 4mph
- Justification: fear of accidents and prevention of damage to the highway
- Reality: evidence that road vehicles caused less damage to roads than horse drawn carriages.
- Laws were encouraged by those with interests in the railway and horse-drawn carriage industry!
- Emerging UK automobile industry advocated effectively for removal of the restrictive and non-sensical aspects of the earlier acts in the 1896 Act

More Red Flag Laws

- But: Pennsylvania enacted a Red Flag Law in 1896 requiring all motorists upon chance encounters with cattle or other livestock to
  1) immediately stop the vehicle
  2) immediately and as rapidly as possible… disassemble the automobile, and
  3) conceal the various components out of sight, behind nearby bushes
- This law was vetoed by the Governor!

Exercise 3

Rough Drafting & Interview Prep

jvm@belnord.org
bernie@b4fa.org
nigeria@b4fa.org

Exercise 4

Interview "Speed Dating"

Keynote Address

Exercise 5

Producing Pieces

Closing Session

Bernie Jones

Summary

- What we have covered
- Highlights
- Key issues and statements
  - No GMO on sale to public in Nigeria today
  - Several local crops being looked at
  - No risk proven
  - Appropriate use

Follow-up

- After this training course?
  - Keep in touch: regular calls with local B4FA coordinators
  - Facebook discussion group
  - Networking events
  - Field trips (competitive)
  - Conference Bursaries (competitive)
  - Prizes (competitive)
  - Further training opportunities (competitive)

Follow-up

- Our expectations of you?
  - Engage in discussions
  - Participate in networking and other activities
  - Write/broadcast more about the issues, and let us know about it

FACEBOOK

- Closed group

B4FA NIGERIA

- Bernie Jones
  (search for bernie@b4fa.org)

Prizes

For best pieces produced on the course

Awards

Certificates for our participants

Logistics

- Ensure we have your contact information
- Ensure you have a copy of course material "Nigeria course lectures"
- Ensure you connect to the facebook group

Feedback

- Forms distributed earlier
- Please hand in to Eve
- Let us know any comments and thoughts at any time
- We need to learn from you!

A final word from…

[redacted]

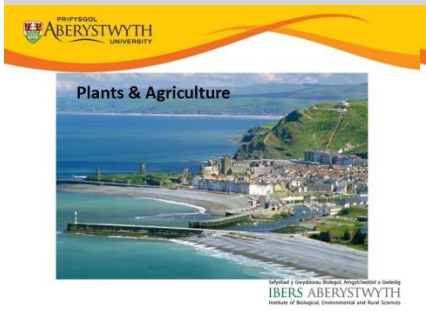
Thanks

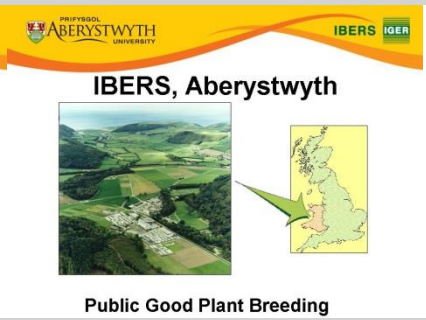
- To our presenters
- To our scientists
- To our local project staff
- To YOU!

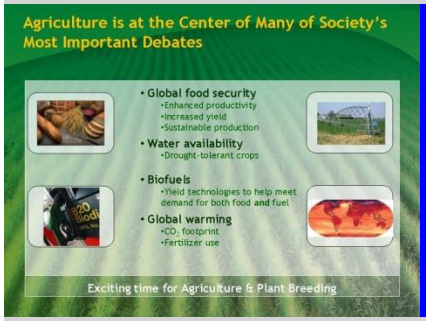
We look forward to seeing you all again soon!

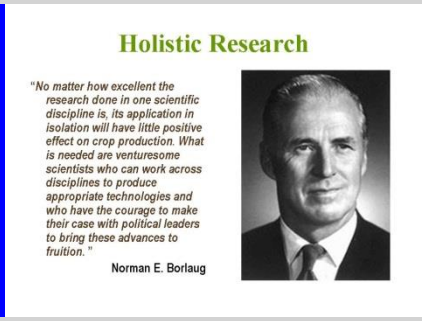
Plants and Agriculture

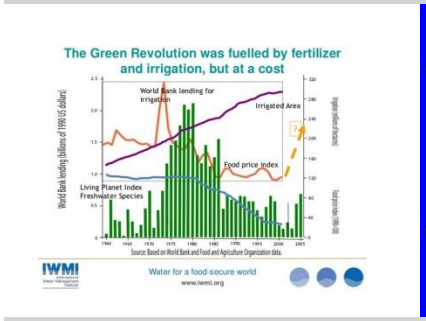
Professor Wayne Powell – University of Aberystwyth

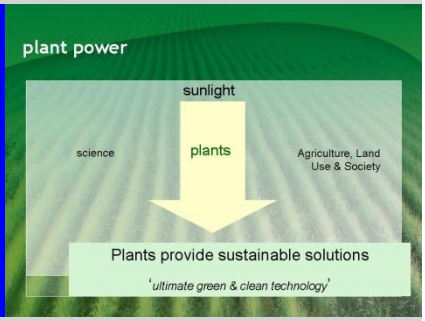


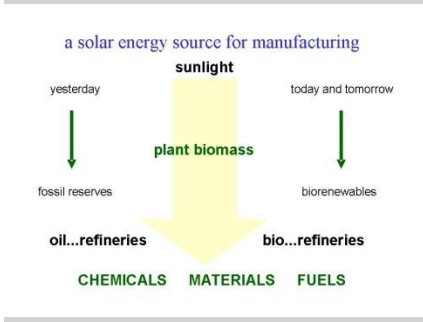


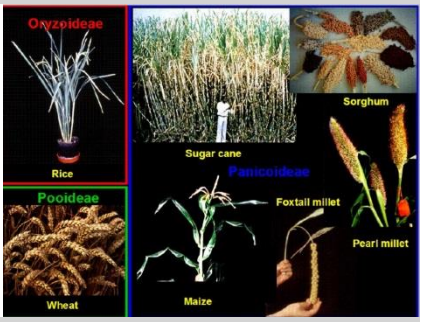


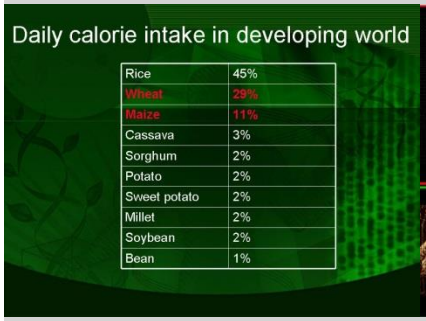




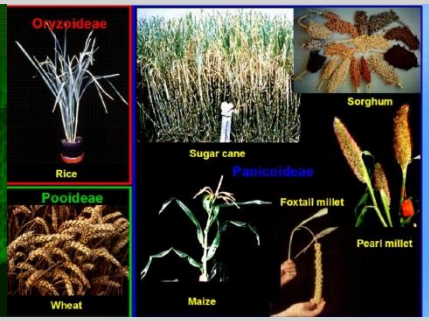








Rice	45%
Wheat	29%
Maize	11%
Cassava	3%
Sorghum	2%
Potato	2%
Sweet potato	2%
Millet	2%
Soybean	2%
Bean	1%



•DuPont Food security index
http://foodsecurity.eiu.com

•Father Green revolution: Norman Borlaug.

•Civilization founded on crops

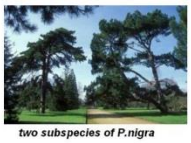
•Importance of diversity

Charles Darwin

Evolution is driven by natural selection

Darwin's mentor

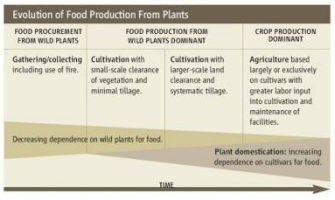
Henslow



two subspecies of P.nigra

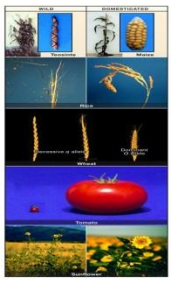
Great Teachers often feature in the development of Great People!

Fundamental role of Diversity & Selection



Reference: Michael Balter (2007) Seeking Agriculture's Ancient Roots, Science 316, 1830-1835

Selective breeding is a powerful tool

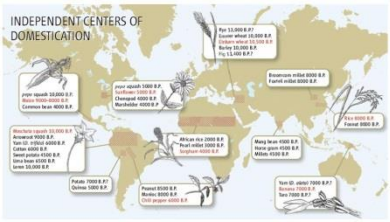


Domestication traits: traits that distinguish seed & fruit crops from their progenitors

Vavilov 1887-1943

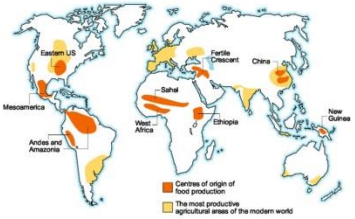
•Soviet botanist & geneticist
•Discovered and identified centres of origin/cultivated plants
•Criticised the non-Mendelian concepts of Lysenko
•Arrested in 1940, died of malnutrition in prison in 1943.

Crop origins and diversification: multiple births



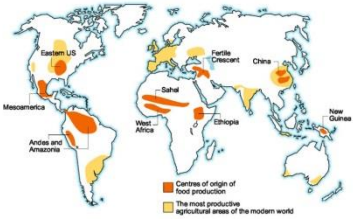
Science 316, 1830-1835

Little overlap between centres of origin & today's productive agriculture.



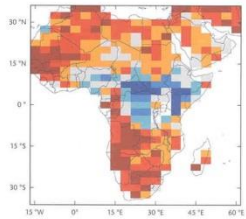
Nature Vol 418, 700-707

Why is this important?



Nature Vol 418, 700-707

Drought in Africa between now and 2090



Red, Orange = More prone to drought

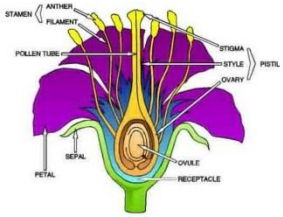
Blue = Wetter and less prone to drought

Hadley Centre, Met Office, UK

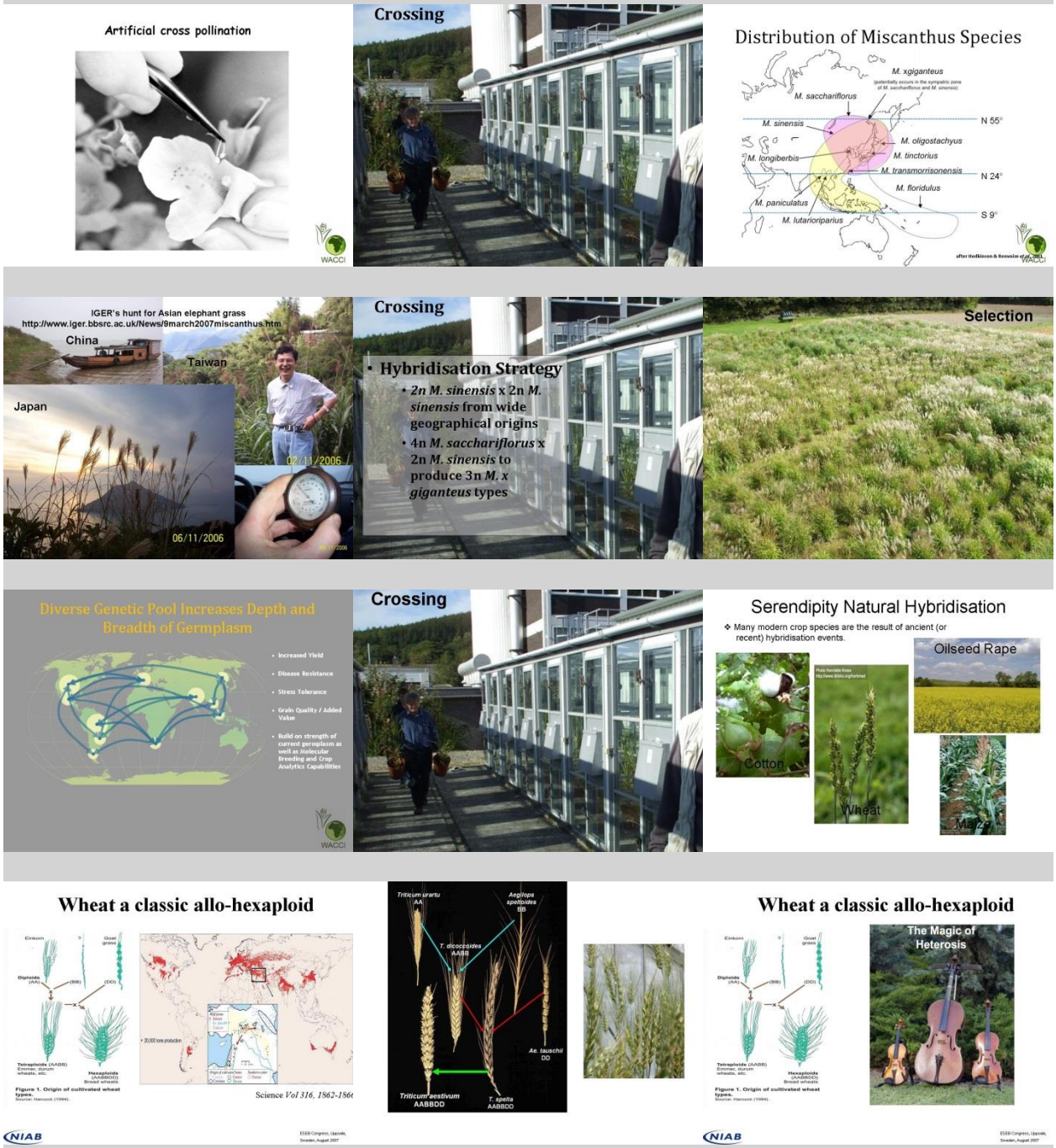
Crop Biodiversity

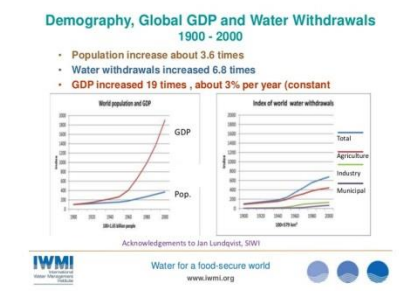
The Seed Vault at Svalbard
Global Crop Diversity Trust

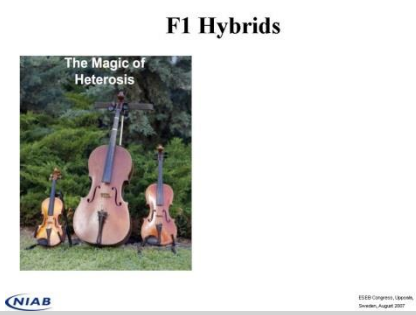
Sexual reproduction in plants

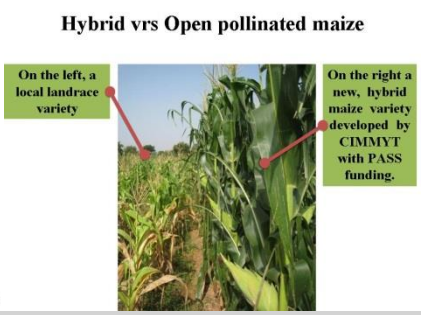


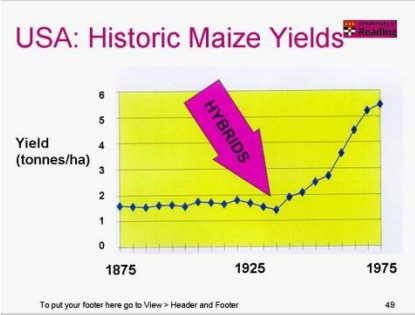
Maize


Artificial cross pollination
Crossing
Distribution of Miscanthus Species
M. xgiganteus
M. sacchariflorus
M. sinensis
M. longiberbis
M. oligostachyus
M. tinctorius
M. transmorrisonensis
M. floridulus
M. paniculatus
M. lutarioriparius
N 55°
N 24°
S 9°
IGER's hunt for Asian elephant grass
http://www.iger.bbsrc.ac.uk/News/9march2007miscanthus.htm
China
Taiwan
Japan
02/11/2006
06/11/2006
Crossing
• Hybridisation Strategy
• 2n M. sinensis x 2n M. sinensis from wide geographical origins
• 4n M. sacchariflorus x 2n M. sinensis to produce 3n M. x giganteus types
Selection
Diverse Genetic Pool Increases Depth and Breadth of Germplasm
• Increased Yield
• Disease Resistance
• Stress Tolerance
• Grain Quality / Added Value
• Build on strength of current germplasm as well as Molecular Breeding and Crop Analytics Capabilities
Crossing
Serendipity Natural Hybridisation
❖ Many modern crop species are the result of ancient (or recent) hybridisation events.
Oilseed Rape
Cotton
Wheat
Maize
Wheat a classic allo-hexaploid
Triticum urartu AA
Aegilops speltoides BB
T. dicoccoides AABB
Ae. tauschii DD
Triticum aestivum AABBDD
T. spelta AABBDD
Wheat a classic allo-hexaploid
The Magic of Heterosis
NIAB
The New Rice for Africa
• Organisation and importance of Diversity
• Selection is a powerful tool but need to understand & know what to select for.
• Importance engagement.
– Journalists to articulate and sell stories!
Breeding major technology platform for food, water & energy security
Time
New Opportunities for Agriculture

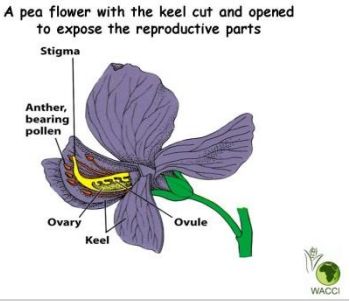

Demography, Global GDP and Water Withdrawals
1900 - 2000
Population increase about 3.6 times
Water withdrawals increased 6.8 times
GDP increased 19 times , about 3% per year (constant
GDP
Pop.
Total
Agriculture
Industry
Municipal
Acknowledgements to Jan Lundqvist, SIWI
IWMI
Water for a food-secure world
www.iwmi.org

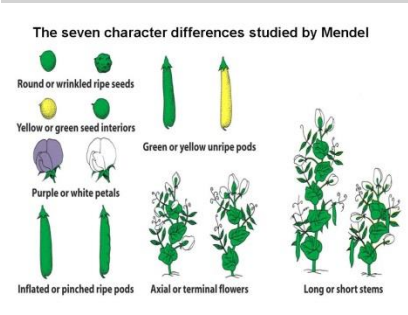

F1 Hybrids
The Magic of Heterosis
NIAB

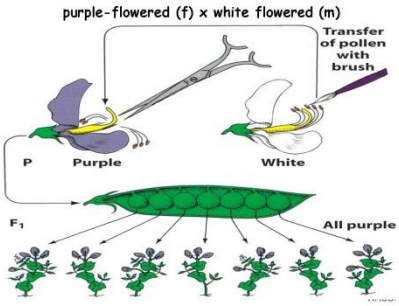

Hybrid vrs Open pollinated maize
On the left, a local landrace variety
On the right a new, hybrid maize variety developed by CIMMYT with PASS funding.

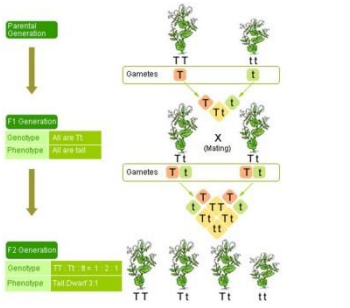

USA: Historic Maize Yields
Yield (tonnes/ha)
HYBRIDS
1875
1925
1975
To put your footer here go to View > Header and Footer
49

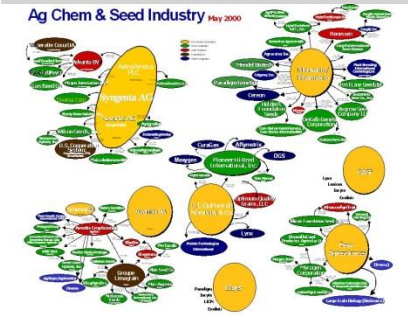

Gregor Johann Mendel,
(b. 22 July 1822; d. 6 January 1884)
Moravia, Austro-Hungarian Empire
Originator of the concept of the gene (autosomal inheritance)
Brno (Czech Rep.) Experiments, 1856-1870
Birthplace of Modern Genetic Analysis
Augustinian monastry garden, St. Thomas, Brünn, Austria

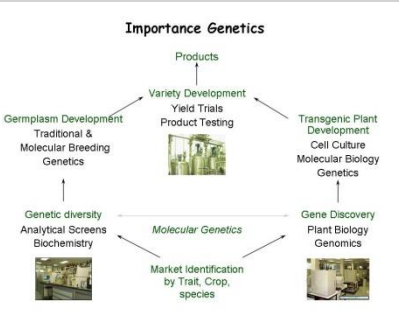

A pea flower with the keel cut and opened to expose the reproductive parts
Stigma
Anther, bearing pollen
Ovary
Keel
Ovule
WACCI

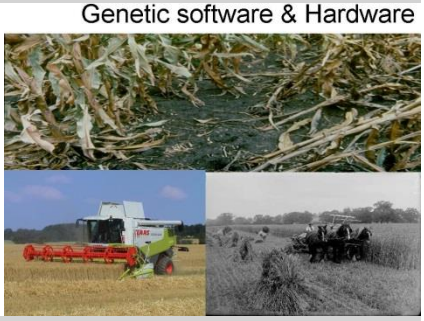

The seven character differences studied by Mendel
Round or wrinkled ripe seeds
Yellow or green seed interiors
Green or yellow unripe pods
Purple or white petals
Inflated or pinched ripe pods
Axial or terminal flowers
Long or short stems

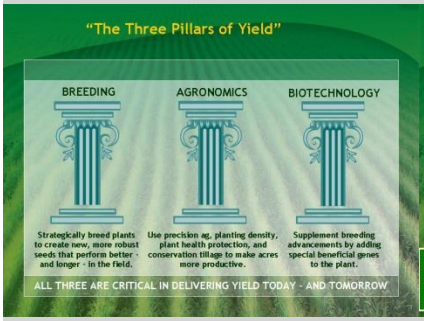

purple-flowered (f) x white flowered (m)
Transfer of pollen with brush
P
Purple
White
F1
All purple


Parental Generation
F1 Generation
F2 Generation
Gametes
X (Mating)


Ag Chem & Seed Industry May 2000
Syngenta AG

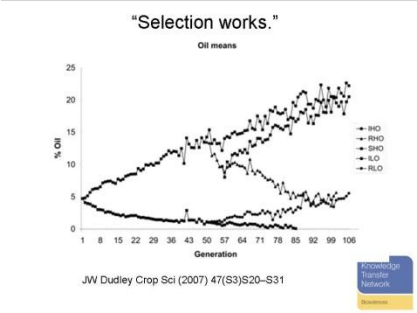

Importance Genetics
Products
Variety Development
Yield Trials
Product Testing
Germplasm Development
Traditional &
Molecular Breeding
Genetics
Transgenic Plant Development
Cell Culture
Molecular Biology
Genetics
Genetic diversity
Analytical Screens
Biochemistry
Molecular Genetics
Gene Discovery
Plant Biology
Genomics
Market Identification
by Trait, Crop,
species

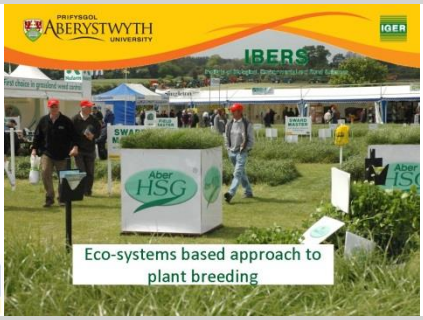

Genetic software & Hardware


"The Three Pillars of Yield"
BREEDING
AGRONOMICS
BIOTECHNOLOGY
Strategically breed plants to create new, more robust seeds that perform better - and longer - in the field.
Use precision ag, planting density, plant health protection, and conservation tillage to make acres more productive.
Supplement breeding advancements by adding special beneficial genes to the plant.
ALL THREE ARE CRITICAL IN DELIVERING YIELD TODAY - AND TOMORROW


Rasike Farm, Chililila WG. MBILI maize-soyabean intercrop providing 1215 kg maize and 545 kg soyabean per ha when conventional intercrops failed. These results indicate that MBILI is a means toward greater food security.
Wamalwa Farm, Siritanyi FFS, Kanduyi. Maize-groundnut intercrop providing 5330 kg maize and 1203 kg groundnut per ha. These results indicate that MBILI can produce significant food surpluses.

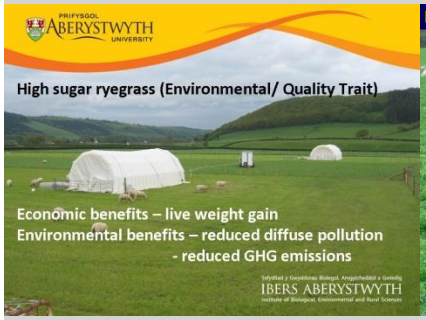

Feeding future populations means doubling the productivity of neglected but nutritious crops such as yams and green bananas

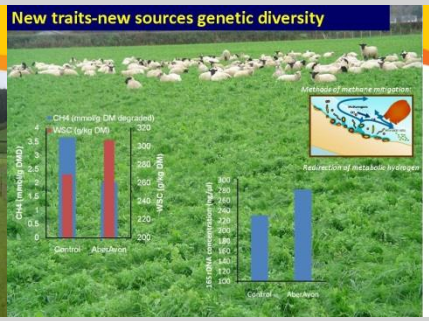


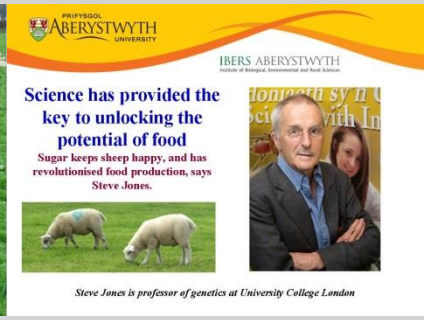


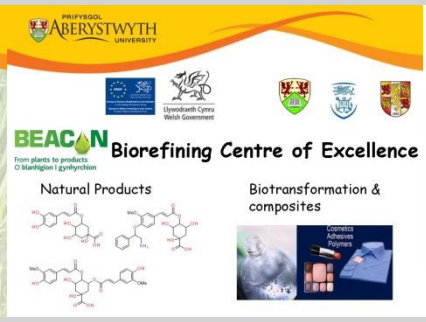
Grass crop domestication – increasing forage quality
(Mean WSC over 5 years data)

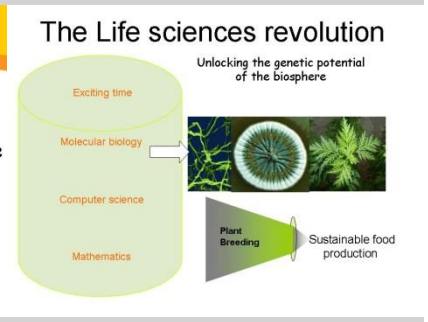
Cultivar	Mean Water Soluble Carbohydrate Content
S23	17.1%
AberDart	20.6%
AberAvon	20.6%
AberStar	21.5%
AberMagic	23.7%

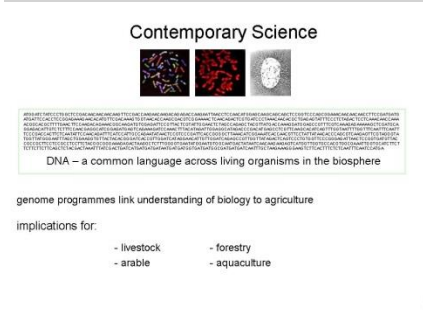


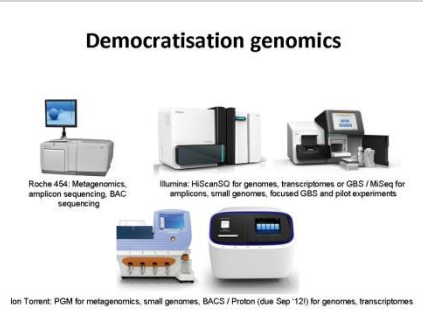


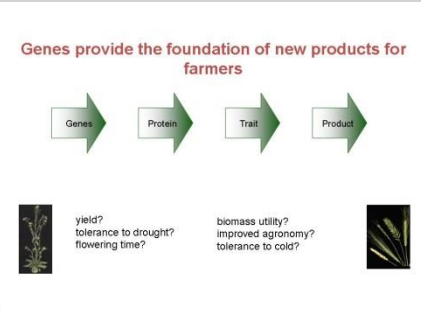


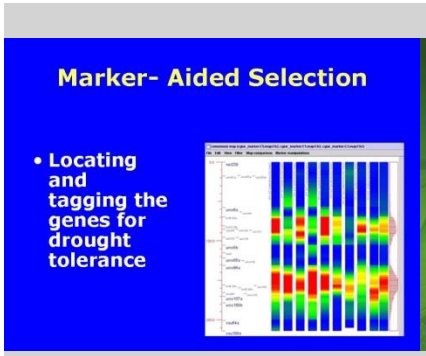


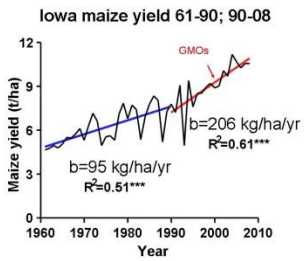


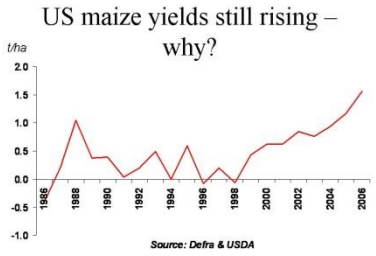






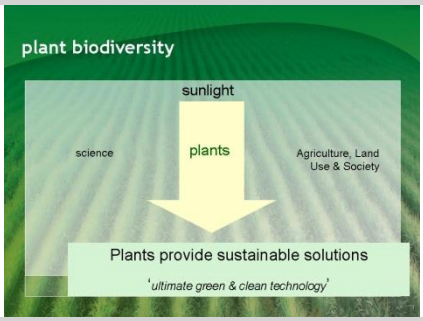


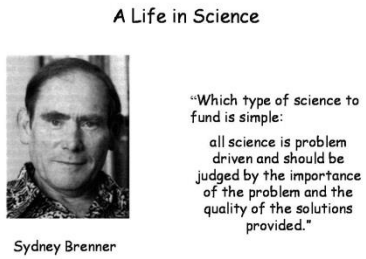

Iowa maize yield 61-90; 90-08
GMOs
b=206 kg/ha/yr
R²=0.61***
b=95 kg/ha/yr
R²=0.51***
Maize yield (t/ha)
Year

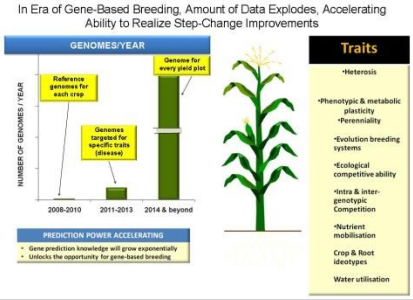

US maize yields still rising – why?
t/ha
Source: Defra & USDA

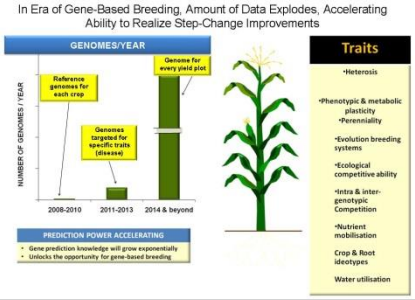

DIG FOR VICTORY
Scarcity
Security
The green revolution
Set Aside
Biofuels
Food Prices
Food Security
Subsidy and Surplus
Set aside, CAP changes


I WANT YOU TO USE BIODIESEL
Soil degradation
Estimated global water scarcity in 2050
Energy
Climate Change
Water (the new oil)
Food Security
Diet and Health


plant biodiversity
sunlight
science
plants
Agriculture, Land Use & Society
Plants provide sustainable solutions
'ultimate green & clean technology'


A Life in Science
"Which type of science to fund is simple:
all science is problem driven and should be judged by the importance of the problem and the quality of the solutions provided."
Sydney Brenner


In Era of Gene-Based Breeding, Amount of Data Explodes, Accelerating Ability to Realize Step-Change Improvements
GENOMES/YEAR
Traits
PREDICTION POWER ACCELERATING


In Era of Gene-Based Breeding, Amount of Data Explodes, Accelerating Ability to Realize Step-Change Improvements
GENOMES/YEAR
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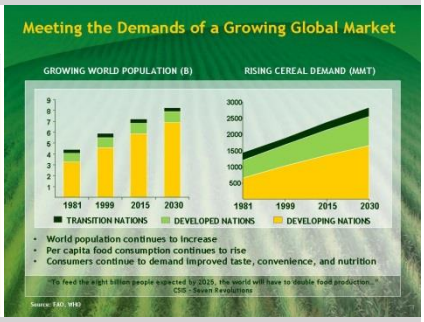
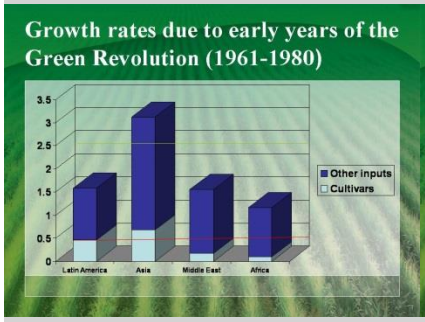
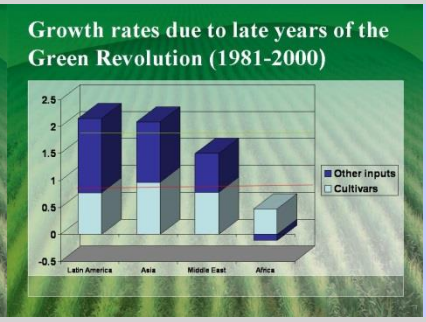
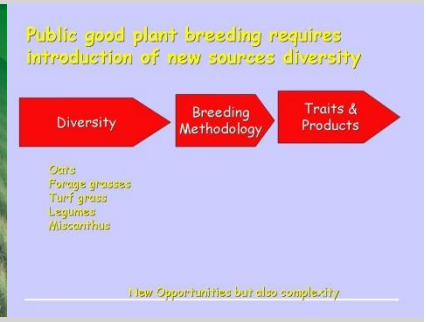
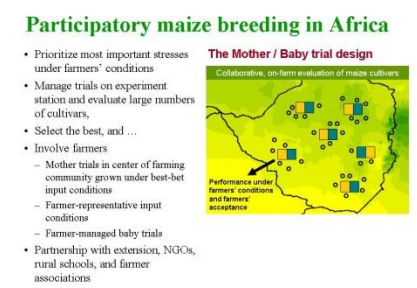
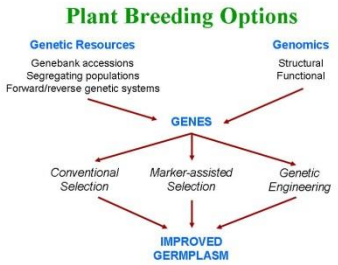

Meeting the Demands of a Growing Global Market
GROWING WORLD POPULATION (B)
RISING CEREAL DEMAND (MMT)
TRANSITION NATIONS
DEVELOPED NATIONS
DEVELOPING NATIONS
World population continues to increase
Per capita food consumption continues to rise
Consumers continue to demand improved taste, convenience, and nutrition


Growth rates due to early years of the Green Revolution (1961-1980)
Other inputs
Cultivars
Latin America
Asia
Middle East
Africa


Growth rates due to late years of the Green Revolution (1981-2000)
Other inputs
Cultivars
Latin America
Asia
Middle East
Africa

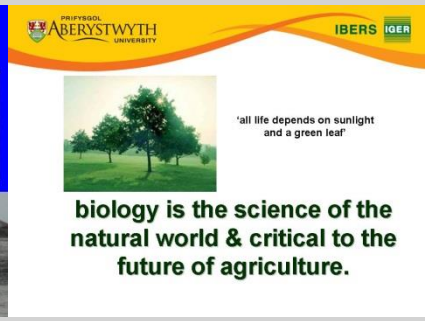

Public good plant breeding requires introduction of new sources diversity
Diversity
Breeding Methodology
Traits & Products
Oats
Forage grasses
Turf grass
Legumes
Miscanthus
New Opportunities but also complexity

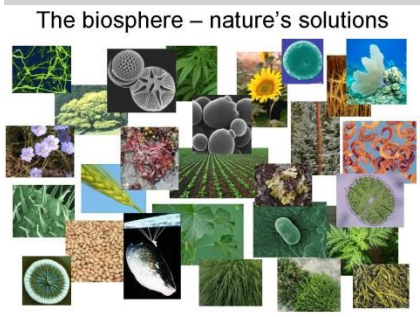

Participatory maize breeding in Africa
Prioritize most important stresses under farmers' conditions
Manage trials on experiment station and evaluate large numbers of cultivars,
Select the best, and …
Involve farmers
Mother trials in center of farming community grown under best-bet input conditions
Farmer-representative input conditions
Farmer-managed baby trials
Partnership with extension, NGOs, rural schools, and farmer associations
The Mother / Baby trial design
Collaborative, on-farm evaluation of maize cultivars
Performance under farmers' conditions and farmers' acceptance

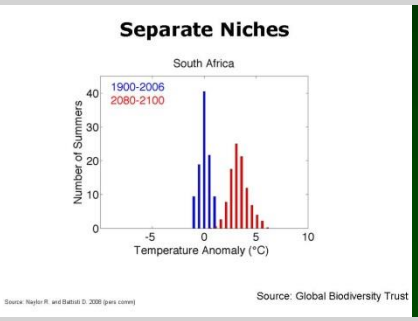

Plant Breeding Options
Genetic Resources
Genomics
Genebank accessions
Segregating populations
Forward/reverse genetic systems
Structural
Functional
GENES
Conventional Selection
Marker-assisted Selection
Genetic Engineering
IMPROVED GERMPLASM

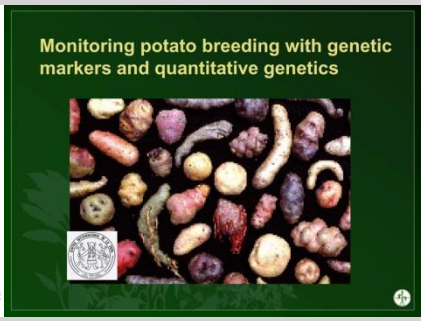

Crop Breeding Technology
CONVENTIONAL BREEDING
GENOMICS
GENETIC MODIFICATION

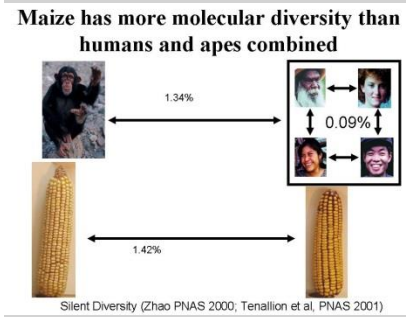

Ghana's Success Story
POVERTY RATE %
Rural Savannah
All rural
National
Rural forest
Urban
1991-92
1998-99
2005-06
Sources: Development Outreach, October, 08,Coulombe & Wodon, World Bank, Irish Hunger Report
MDG 1 achieved
Malnourished - 5.8m in 1993 to 2.7 m in 2003.
Declines in % underweight children and mortality
Strong agricultural growth since 80s
25% increase due to area expansion
Maize yield up by 36%, cassava by 50%
New maize, yam, rice and cassava varieties
A pest resistant cassava.
Strong growth in smallholder cocoa & pineapples
Market liberalisation
New rural infrastructure
All this is threatened by Climate Change
Higher temperatures
Greater & more intense rainfall
Greater droughts
River bank erosion
Rising sea levels
More intense cyclones
Salt water incursions


PRIFYSGOL ABERYSTWYTH UNIVERSITY
IBERS
IGER
'all life depends on sunlight and a green leaf'
biology is the science of the natural world & critical to the future of agriculture.


The biosphere – nature's solutions

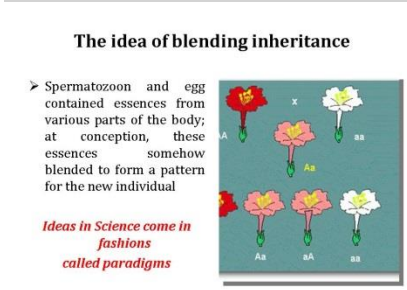

Separate Niches
South Africa
1900-2006
2080-2100
Number of Summers
Temperature Anomaly (°C)
Source: Global Biodiversity Trust

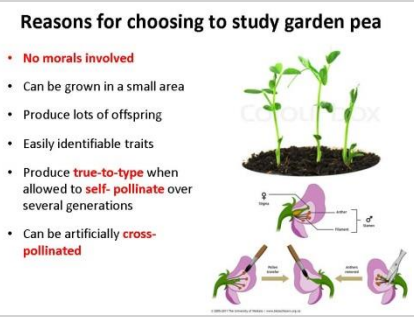

Monitoring potato breeding with genetic markers and quantitative genetics

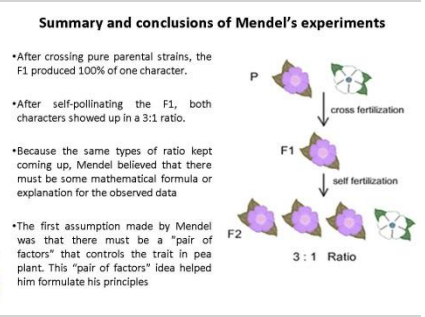

Maize has more molecular diversity than humans and apes combined
1.34%
0.09%
1.42%
Silent Diversity (Zhao PNAS 2000; Tenallion et al, PNAS 2001)


Selective Breeding is a Powerful Tool
Roslin Institute
Knowledge Transfer Network


Projected losses of food caused by the adverse effects of climate change (2080)


The idea of blending inheritance
Spermatozoon and egg contained essences from various parts of the body; at conception, these essences somehow blended to form a pattern for the new individual
Ideas in Science come in fashions called paradigms
x
aa
Aa
Aa
aA
aa


Reasons for choosing to study garden pea
No morals involved
Can be grown in a small area
Produce lots of offspring
Easily identifiable traits
Produce true-to-type when allowed to self- pollinate over several generations
Can be artificially cross-pollinated


Summary and conclusions of Mendel's experiments
After crossing pure parental strains, the F1 produced 100% of one character.
After self-pollinating the F1, both characters showed up in a 3:1 ratio.
Because the same types of ratio kept coming up, Mendel believed that there must be some mathematical formula or explanation for the observed data
The first assumption made by Mendel was that there must be a "pair of factors" that controls the trait in pea plant. This "pair of factors" idea helped him formulate his principles
P
cross fertilization
F1
self fertilization
F2
3 : 1 Ratio

Science Journalism Skills

Diran Onifade – World Federation of Science Journalists & AFRICASTI, Nigeria

Science and Agriculture Journalism

Diran Onifade

AFRICASTI

Breakthrough?

- 1987 Zaire MM1
- 1990 Kenya Kemron
- 1997 S/Africa Viroden

Breakthroughs?

Nigeria

- Chief Ojefu Odeh, Herbalist
- Dr Felix Amanya, Alternative Therapist
- Dr Jacob Abdullahi, Medical lab Technologist
- Dr Edmund Okworri, Medical Doctor
- Jeremiah Abalaka

Abalaka

- Born 4thDecember 1948
- 1972 medical graduate of the Ahmadu Bello University, Zaria, Northern Nigeria
- Obtained a post-graduate certificate in immunology from UCH, Ibadan

Who failed the public?

- Government?
- Quacks?
- Scientist?

Who failed the public?

The (unscientific)Media

Science and journalism

- The scientific method
- Scientific Consensus
- Good Research Practice
- Know the issues

WHO WANTS WHAT ?

Question Type	Outcome
Interrogation	Confession
Examination	Testing Knowledge
Survey	Research
Routine	Information
Interview	Seeking **news**

Beyond the definition

- Reporter interview for:

1. Information (facts and opinions)
2. Sound bites

Interviewing a scientist

- Scientists' reactions to journalists
- How to get the best from scientists
- Building a relationship
- How do you write the story for your reader to understand?
- Translating science-speak without dumbing down

Preparing for Interviews

Research

- The subject
- The context
- The interviewee

Test your tools

The Interview

- Assume the audience's place.
- The old reliable 5 Ws & H.
- Questions need to be short and clear.
- Ask one question at a time. No double barrelled questions.
- Be particular. No wide questions.
- No cliché questions.
- Avoid deferential phrases. Don't apologise for seeking answers.
- Construct questions skilfully in a way they don't produce 'yes' or 'no' answers.
- Follow up for clarity or for fallouts, genuine new angles and fresh developments emerging from answer.
- Probe the science.
- Report the science.

Why science? Why agric?

- Why does science appeal?
- Why should science and agric appeal to readers?

How to find a story

- Sources of information and inspiration
- Is it a story?
- What is the story – is it science, economics, society, politics?

Sources of information

- Where to get your facts and background from
  - Scientists
  - Organisations
  - NGOs
  - Government
  - Journals & other publications

Who do you trust?

- Not all sources are equally valid
- Science and "balance"
- Research vs opinion
- Published work
- Where and who by?
- Peer review

Interviewing a lobbyist

- Relationships with lobbyists
- How to get the truth from a lobbyist
- Investigative interviewing techniques

How do scientists react to the media?

- What do scientists think of us
- What can you do about that
- Building the relationship

How do journalists react to scientists?

- How do you typically react to scientists
- What can you do about that
- What can scientists do
- How can you help them achieve this

Selling it to your editor/producer

- Why should this be published?
- Selling the story to your editor
- Freelance Oportunities
  - Scidev.net
  - ScienceAfric
  - Africasti.com
  - Research Africa

Thank you

Fundamentals of Genetics

Dr Charles Amadi – National Root Crops Research Institute, Umudike, Nigeria

Principles of Genetics

Lecture Presented By Amadi Charles
National Root Crops Research Institute

INTRODUCTION

- **A cursory look at siblings immediately reveals similarities and differences amongst them and between them and their parents.**
- **Understanding the basis of these similarities and differences and how they are transmitted from one generation to another is within the purview of genetics.**

DEFINITION

Genetics

- **Genetics is the science of heredity, dealing with resemblances and differences of related organisms resulting from the interaction of their genes and the environment (Online dictionary).**

BASIC PRINCIPLES OF GENETICS

Gregor Mendel

Gregor Mendel (1822-1884)
Source: Wikipedia

- **Gregor Mendel, through a classical set of experiments was able to accurately describe the inheritance mechanism based on the assumptions of paired units and random transmission of the units from parents to offspring.**
- **For this reason He is called the Father of Genetics**

Some Basic Principles

- **Traits, or characteristics, are passed on from one generation of organisms to the next generation**
- **The traits of an organism are controlled by genes**
- **Organisms inherit genes in pairs, one gene from each parent**
- **Some genes are dominant, whereas other genes are recessive**
- **Dominant genes hide recessive genes when both are inherited by an organism**

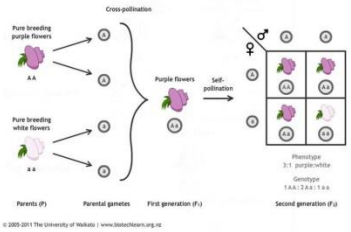


Table 14.1 The Results of Mendel's F_2 Crosses for Seven Characters in Pea Plants [true breeding: ♂self = ♀self]

Character	Dominant Trait	×	Recessive Trait	F_2 Generation Dominant:Recessive	Ratio
Flower color	Purple	×	White	705:224	3.15:1
Flower position	Axial	×	Terminal	651:207	3.14:1
Seed color	Yellow	×	Green	6022:2001	3.01:1
Seed shape	Round	×	Wrinkled	5474:1850	2.96:1
Pod shape	Inflated	×	Constricted	882:299	2.95:1
Pod color	Green	×	Yellow	428:152	2.82:1
Stem length	Tall	×	Dwarf	787:277	2.84:1

Mendelian Laws

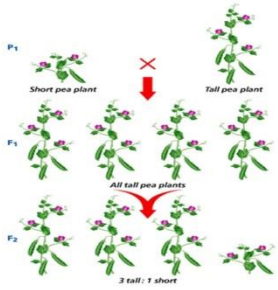
1. **The Law of Dominance**
2. **The Law of Segregation**
3. **The Law of Independent Assortment**

The Law of Dominance

- This law states that in a cross of parents that are pure for contrasting traits, only one form of the trait will appear in the next generation.
- Offspring that are hybrid for a trait will have only the dominant trait in the phenotype.
- The trait whose appearance is suppressed in the hybrid is said to be recessive.

The Law of Segregation

- **This law states that during the formation of gametes (eggs or sperm), the two alleles responsible for a trait separate from each other.**
- **Alleles for a trait are then "recombined" at fertilization, producing the genotype for the traits of the offspring.**
- **If we cross two tall hybrids with genotype Tt, we will get both tall and short plants in the ratio of 3 tall: 1 short plants.**



The Law of Independent Assortment

- **Alleles for *different* traits are distributed to sex cells (& offspring) independently of one another.**

Illustration of independent Assortment

Gametes	RG	Rg	rG	rg
RG	RRGG round	RRGg round	RrGG round	RrGg round
Rg	RRGg round	RRgg round	RrGg round	Rrgg round
rG	RrGG round	RrGg round	rrGG wrinkled	rrGr wrinkled
rg	RrGg round	Rrgg round	rrGg wrinkled	rrgg wrinkled

- **To illustrate independent assortment, let assume that the genotypes of our parents are**
- **RrGg x RrGg**
- **where**
  "R" = dominant allele for round seeds
  "r" = recessive allele for wrinkled seeds
  "G" = dominant allele for green pods
  "g" = recessive allele for yellow pods

Non Mendelian Inheritance

- Not all genetic observations can be explained and predicted based on Mendelian genetics.
- Other complex and distinct genetic phenomena may also occur eg
  - blood types,
  - skin colour,
  - height,
  - Lower colour
  - tuber yield etc.

Incomplete Dominance

- In some allele combinations, dominance does not exist. Instead, the two characteristics blend to form a new character in the offspring.
- For instance, snapdragon flowers display incomplete dominance in their color.
- There are two alleles for flower color: one for white and one for red. But when one allele for red is present with one allele for white, the color of the snapdragons is pink.

Illustration of Incomplete dominance

Gametes	W (white)
R (Red)	RW (Pink) New characteristic

Codominance

- With codominance, a cross between organisms with two different phenotypes produces offspring with a third phenotype in which both of the parental traits appear together.
- For example a cross between Red and White Parent will give rise to an offspring that is red and white spotted.

Illustration of Codominance

- R = allele for red flowers
  W = allele for white flowers
- red x white ---> red & white spotted
  RR x WW ---> 100% RW

RR

WW	R	R
W	RW	RW
W	RW	RW

Multiple Alleles

- In certain cases, more than two alleles exist for a particular characteristic.
- Even though an individual has only two alleles, additional alleles may be present in the population.
- An example of multiple alleles occurs in blood type.

Human Blood Type

- In humans, blood groups are determined by a single gene with three possible alleles: A, B, or O.
- Red blood cells can contain two antigens, A and B.
- The presence or absence of these antigens results in four blood types: A, B, AB, and O.

Polygenic inheritance

- Polygenic characters are controlled by many genes at different locations on chromosomes.
- There is a gradual variation in the character from one extreme to the other
- An example of polygenic inheritance is human skin color.
- A person with many genes for dark skin will have very dark skin color, and a person with multiple genes for light skin will have very light skin color.

Gene linkage

- A chromosome has many thousands of genes.
- It is common for a large number of genes to be inherited together if they are located on the same chromosome.
- Genes that are inherited together are said to form a linkage group.
- Gene linkage can show how close two or more genes are to one another on a chromosome.
- The closer the genes are to each other, the higher the probability that they will be inherited together.

Sex linkage

- There are 23 pairs of chromosomes in human cells.
- One pair is the sex chromosomes. (The remaining 22 pairs of chromosomes are referred to as autosomes).
- The sex chromosomes determine the sex of humans.
- There are two types of sex chromosomes: the X chromosome and the Y chromosome.
- Females have two X chromosomes; males have one X and one Y chromosome.
- Typically, the female chromosome pattern is designated XX, while the male chromosome pattern is XY.
- Thus, the genotype of the human male would be 44 XY, while the genotype of the human female would be 44 XX (where 44 represents the autosomes).

Sex linked Characters

- In humans, the Y chromosome is much shorter than the X chromosome.
- Because of this shortened size, a number of sex-linked conditions occur.
- When a gene occurs on an X chromosome, the other gene of the pair probably occurs on the other X chromosome.
- Therefore, a female usually has two genes for a characteristic.
- In contrast, when a gene occurs on an X chromosome in a male, there is usually no other gene present on the short Y chromosome. Therefore, in the male, whatever gene is present on the X chromosome will be expressed.
- Examples of sex-linked conditions are Colour blindness and Hemophilia

The Cell

- The cell is the basic structural and functional unit of all known living organisms.
- It is the smallest unit of life that is classified as a living thing, and is often called the building block of life.
- Most plant and animal cells are between 1 and 100 µm and therefore are visible only under the microscope.

Diagram of Plant Cell

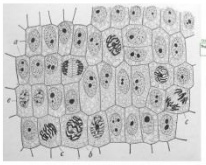


Diagram of Onion Cells. Source Wikipedia Cell(Biology)

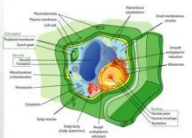
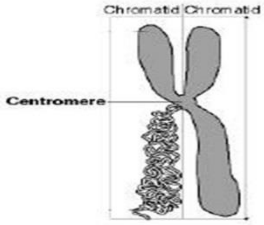


Diagram of a plant cell. Source: Wikipedia Cell (Biology)

Chromosome

- A chromosome is a long, stringy aggregate of gene that carries heredity information (DNA).
- A chromosome has many thousands of genes; there are an estimated 100,000 genes in the human genome.
- Inheritance involves the transfer of chromosomes from parent to offspring through meiosis and sexual reproduction.

Structure of Chromosome



Source: National Institutes of Health

Gene

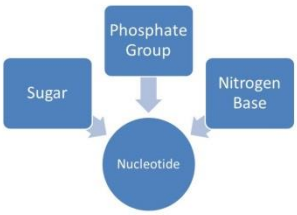
- Genes are segments of DNA located on chromosomes. Traits are passed from parents to offspring through gene. Genes contain the codes for the production of specific proteins.

Allele

- **An Allele is one of two or more alternative forms of a gene at corresponding sites (loci) on homologous chromosomes, which determine alternative characters in inheritance**

Deoxy Ribose Nucleic Acid (DNA)

- **Deoxy Ribose Nucleic acid (DNA) is the genetic material in most of the organisms.**
- **DNA is mainly found in the chromosomes in the nucleus.**
- **It consists of smaller molecules called nucleotides.**
- **Each nucleotide consists of a sugar, phosphate group and a nitrogenous base.**



Genotype

The genes present in an organism make up the genotype. That is the genetic makeup of an organism.

Genotype	**TT = homozygous(pure)**
	Tt = heterozygous(hybrid)
	tt = homozygous(pure)

Phenotype

- **The manifested characteristic or the physical appearance of an organism.**
- **Examples of phenotypes are**
  - **blue eyes**
  - **brown fur**
  - **striped fruit**
  - **yellow flowers**

Human Eye Colour

Electric blue eye

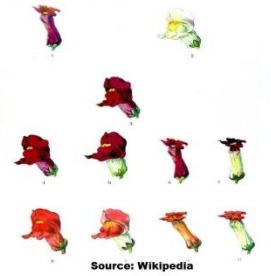
Steel Gray Eye

Green eye

Hazel Eye

Source Wikipedia from link www.obsidianbookshelf.com

Flower colours

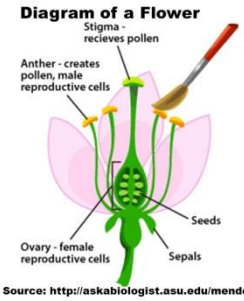


Source: Wikipedia

Sexual Reproduction

- The production of new living organisms by combining genetic information from two individuals of different types (sexes).
- In higher plants this usually involves:
  - Pollination (Transfer of pollen grains from the anther to the stigma of flower of a plant of the same type)
  - Fertilization (Mixing of the male and female gamete)
  - Embryogenesis (embryo formation).

Diagram of a Flower



Source: http://askabiologist.asu.edu/mendel-garden

Gametes

- **Gametes are the reproductive or sex cells produced in the sex organs of a plant or animal.**
- **The male sex cell (Male gamete) is known as sperm**
- **The female sex cell is known as egg**

Symbols for Gametes

Symbol for female gamete

Symbol for male gamete

Quantitative Genetics: Basics

- **They physical appearance of an individual, the phenotypic value (P) is the combined result**
  - **its genetic makeup, the genotype (G) and**
  - **the effects of the environment (E):**

P = G + E

Genotypic Variation

- **Additive effects**
- **Dominance effects**

- **Additive variation** represents the cumulative effect of individual loci, therefore the overall mean is equal to the summed contribution of these loci.
- **Dominance variation** represents interaction between *alleles*. If a trait is controlled by a dominant allele, then both homozygous and heterozygous individuals will display the same phenotypic value.

Environmental Effect

- **Effect due to environment**
- **Effects due to interaction between genes and environment**

- Interaction (I) between different genes can modify the observed phenotypes.
- This is called *epistasis*, or non-allelic interaction, distinguishing it from dominance.

$$P = A + D + E + I$$

- The total phenotypic variation (V) of a population is the sum of the variation in additive (A), dominance(D), gene-interaction (I), environmental (E)and gene-environment interaction (GE) effects:

$$V_P = V_A + V_D + V_I + V_E + V_{GE}$$

Why is this important?

- Being able to estimate how the total variance is partitioned between genetic and environmental effects is important to quantitative geneticists trying to improve a given trait.
- If the proportion of variation is mostly due to genetic effects (heritable), then selecting for individuals that possess the desired genetic value is a worthwhile investment.
- If however, the genetic variance is low (and therefore the environmental variation has more impact on phenotype), then a more strategic approach would be to optimize environmental conditions.

GENETICS GAMES OR SIMULATIONS

Introduction

- A search of the internet for " genetics games or simulations" using google search engine scored 25.6 million hits in 33 seconds.
- This underscores the emerging tendency to simulate the outcomes of genetic studies using computer technology.
- Many reasons have been adduced for the use of computer applications or programs to simulate the results of genetic studies.

Why use of computer applications or programs to simulate the results of genetic studies

- Many generations of genetic research can be carried out more quickly than with live organisms.
- It eliminates the drudgery associated with carrying out field experiments
- Organisms do not need to be created or destroyed
- Simulators allow the application of class lessons to real world situations.
- Complete crossing programs that are impossible in live organisms can be carried out rapidly at almost no cost.

Genetic Simulation Programs

- There are many computer simulation and animation programs available for genetic studies. Some of these include
  - "Hands On Genetics" programs
  - Drosophilab,
  - Classical genetics simulator,
  - EasyPop,
  - ModelMage,
  - PABSIM, etc.

Excercise

- We will practice simulation with Drosophilab a free program.
- www.drosophilab.com

Micropropagation of Sugarcane Case Study

Inuwa S Usman – Ahmadu Bello University, Zaria

Micropropagation and Secondary Metabolite Production Activities at Institute for Agricultural Research Zaria

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Department of Plant Science
Institute for Agricultural Research
Ahmadu Bello Unviversity
PMB 1044, Samaru
Zaria
E-mail: inuwasu@gmail.com
www.abu.edu.ng

Content

Activity 1	Micropropagation of Sugarcane a source of disease-free improved planting materials
Activity 2	Micropropagation of Pineapple a source of Disease-free Improved Planting Materials
Activity 3	Secondary Metabolite Production from Artemisia

Sugarcane (*Saccharum* spp.)

- one of the most important cash crops in the world
  - Vigorous growth
  - large biomass generation
  - C4 photosynthesis (effecient in carbon fixation)
  - storage of large amount of carbon as sucrose cellulose and hemicellulose
- Sugarcane a reliable crop for biomass, energy generation that can efficiently reduce greenhouse emission

Role of Sugar Industry in the Economy

The sugar industry makes an important contribution to the national economy, given its agricultural and industrial investments.

- **Foreign exchange earnings**
- **High employment generation**
- **Linkages with major suppliers, support industries and customers.**
- **A diverse industry combining the agricultural activities of sugar-cane cultivation with the industrial factory production of raw and refined sugar.**
- **Wide range of by-products such as syrups and specialised sugars, molasses (mostly for alcohol production), baggase (for generation of power) and filter press mart for fertilizer animal feed, to make paper or as fuel to generate energy.**
- **Payment of taxes**

Sugar Products

S/N	Consumer products	Industrial products	Other products
1.	White sugar	Bakers and biscuit manufacture	Tobacco curing
2.	Brown sugar	Alcoholic beverages	Animal feeds
3.	Syrups	Dairy and ice cream	Guard crop
4.	Specialty products	Sweets and chocolates	
5.		Pharmaceutical	

Capacity utilization of Nigeria's Sugarcane Estates

Company	Area Planted (ha)	Land Available (ha)	Area Planted relative to total land (%)	Sugar Mill Capacity, (MT/Annum)
NISUCO, Bacita	5,600	12,500	44.8	60,000
Savanna Sugar Co., Numan	500	29,000	1.7	100,000
Lafiagi Sugar Co.	560	7,500	7.5	3,000
Sunti Sugar Co.	420	15,000	2.8	3,000
Total	11,080	64,000	17.3	166,000

POTENTIALS FOR SUGAR PRODUCTION IN NIGERIA

- Per capita sugar consumption estimated at 8kg
- Total consumption of sugar put at 1.3 million tonnes per annum
- Nigeria's needs are met by imports
- Identified sites in ALL THE GEOPOLITICAL ZONES are capable of producing atleast 2.0million tonnes of sugar per annum.

Projections

- Sugarcane estates are operating at 17% capacity
- with a total area of 64,000 hectares if put to produce sugarcane for bioethanol could yield 384,000 tonnes of ethanol annually.
- This would meet 40% of the current NNPC targeted three (3) million litres of ethanol per day for the E10 blend
- 400,000ha of sugarcane estates will meet E50 bioethanol
- It is feasible to attain self sufficiency in sugar and E50 bioethanol in the long run considering :
  - vast irrigable land area under the river basins and lowland fadama
  - provided that the right policy environment is created

Biofuels for Nigeria

- Attractive due to:
  - rising cost of fuel petroleum products
  - environmental concerns
  - Sustainability
- NNPC planned to develop a 10% bio-ethanol blend with Petrol
- This new policy is a petroleum extender
- Nigeria consumes 30 million litres of PMS daily
- Fuel ethanol in the fuel mix implies that PMS consumed would reduce significantly
- Feed stocks - sugar cane extracts, cassava, grain cereals, molasses, bagasse and cellulose

Advantages of Biofuels

- Environment friendly:
  - biodegradable
  - No spillages
  - produce less CO_2
- Biofuels are renewable:
  - CO_2 released is reabsorbed by green plants
  - biomass produced is converted to biofuels (in a cycle)
- Biofuels are easily produced and more economical to use
- Biofuels production encourages extensive agricultural activities to produce feedstocks
- Biofuels a boost the national economy
- provides the skilled and unskilled with jobs
- Biofuels will redistribute fuel across all the geopolitical zones

The Brazil Success Story

- **Research and Development of Superior Performance Cultivars**
- The Brazilian ethanol model is Founded on direct investments, subsidies and incentives for ethanol production and increase the use of ethanol as a substitute for gasoline.
- Brazil is now world's largest producer of both sugar and ethanol
  - a result of higher yields because of better climate and investments in more productive strains of sugarcane
- With Nigeria's vast agricultural resource and biodiversity as well as suitable climate for sugarcane cultivation focus should be on enhanced strains of sugarcane for sugar and ethanol production through conventional breeding and the use of biotechnology tools.

Biotechnology a tool for enhancing sugarcane production and sugar content

- Sugarcane is propagated vegetatively by cloning.
- Favours the spread of diseases
- Low multiplication ratio 1:15 compared to 1:500 for cereals
- Tissue culture - rapid and disease free seed-canes made available to farmers
- Recombinant DNA technology - the production of transformed sugarcane to improve traits of commercial interests.
- Biotechnology will make the bioethanol production more profitable, of higher quality standards and more environment friendly.

What is Micropropagation?

"... the asexual or vegetative propagation (multiplication) of plants in vitro "

Implies
- regeneration
- multiplication
- uniformity ??
- Disease-free

Fundamental abilities of plants

✓ Totipotency

the potential or inherent capacity of a plant cell to develop into an entire plant if suitable stimulated.
It implies that all the information necessary for growth and reproduction of the organism is contained in the cell

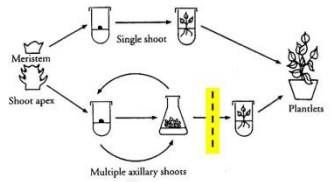
✓ Dedifferentiation

The capacity of mature cells to return to meristematic condition and development of a new growing point, followed by redifferentiation which is the ability to reorganize into new organs

✓ Competency

the endogenous potential of a given cell or tissue to develop in a particular way

Basic *in vitro* propagation ...



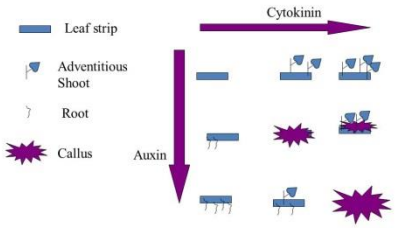
Benefits for propagation ...

- Rapid multiplication of clones
- Difficult species ?
- Genetic uniformity ?
- Aseptic conditions
- Micro- stock plants
- Controlled environment

Other applications ...

- *in vitro* micro-grafting
- Genetic conservation
- Plant improvement
- Experimental system

Control of in vitro culture



Steps of Micropropagation

- Stage 0 – Selection & preparation of the mother plant
  - sterilization of the plant tissue takes place
- Stage I - Initiation of culture
  - explant placed into growth media
- Stage II - Multiplication
  - explant transferred to shoot media; shoots can be constantly divided
- Stage III - Rooting
  - explant transferred to root media
- Stage IV - Transfer to soil
  - explant returned to soil; hardened off

Biotechnology Research AT IAR
ACTIVITY 1

SUGARCANE MICROPROPAGATION

The Need for Micropropagation of sugarcane

- BD98-001, BD98-002, BD99-001 and BD99-002 were developed by NCRI Badegi
- Evaluated in diffent Agro-ecological zone in Nigeria
- Multiplication of these cultivars to commercial scale is a challenge and may take 6-7 years to propagate them to commercial scale
- During this period the cultivars end up degraded and farmers receive low performance materials for planting

Stage 0

•Selection & preparation of the mother plant

•sterilization of the plant tissue takes place

Stage I

Initiation of culture

-explant placed into growth media

Callus initiation on 2,4-D protified MS media

Embryogenic callus

Somatic embryogenesis

Plantlets Regeneration from embryogenic callus on BAP enriched media

Plantlet developement from somatic embryos

Plantlets regeneration from bud section

Stage II

Multiplication

explant transferred to shoot media; shoots can be constantly divided

In vitro multiplication of plantlets on BAP enriched media

Well developed regenerated plantlets

Plantlets multiplication in the growth

Stage IV

Transfer to soil

explant returned to soil; hardened off

Acclimatization in the humidity chamber

Acclimatized seedlings ready for transplanting

Field establisment of tissue culture material for performance evaluation

Tissue cultured sugarcane in the field

Vigorous performance of tissue cultured sugarcane

Biotechnology Research AT IAR
ACTIVITY 2

MICROPROPAGATION OF PINEAPPLE

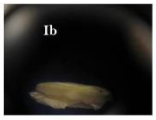
Pineapple (*Ananas comosus* L. var. smooth cayenne)

- Pineapple is the third most important tropical fruit after the banana and citrus
- The fruits are important source of vitamin A and B_1 and contain a protein digesting enzyme bromelin
- Pineapple fruits are consumed fresh or processed into canned fruit, juice, or jam
- Potentials exist for commercial production and processing of crop in Nigeria and other developing tropical countries
  - objective was to establish an efficient rapid micropropagation protocol for large scale propagation

Pineapple crown

Excise bud from the crown

Pineapple crown



Multiplication on MS mdiun portified withS.0µM BA

Biotechnology Research AT IAR
ACTIVITY 3

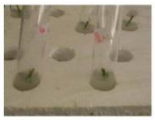
PRODUCTION OF SECONDARY METABOLITES FROM ARTIMESIA

Wormwood (*Artemisia annua*)

- Out of about 274 million cases of Malaria disease, nearly one million deaths (20%) mostly occurred among small children living in Africa
- 60% of rate of miscarriage and about 10-50 % of maternal death annually
- Increased resistance to anti malarial drugs has spread very rapidly
- Artemisinin- based combination therapy(ACT) the only safe and affordable treatment
- Aim is to develop an effective *in vitro* protocol for the enhancement of biosynthesis of secondary metabolites particularly Artemisinin

MERISTEM TIP CULTURE

Nodal Cuttings responding to various level of hormone treatments



Callus induction from Leaf

Callus development

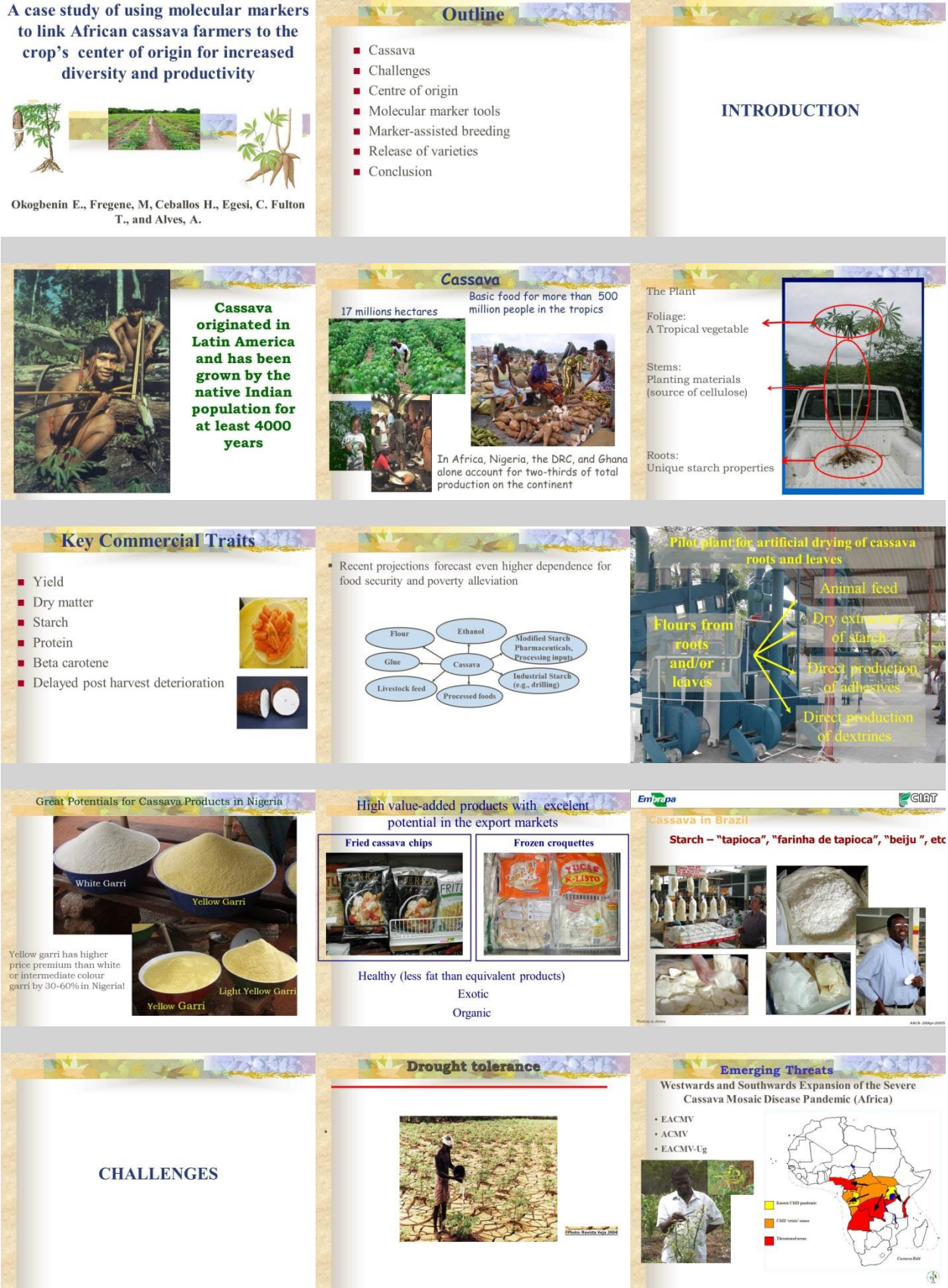
SUGARCANE BIOFACTORY
Capacity 200,000 plantlets/month

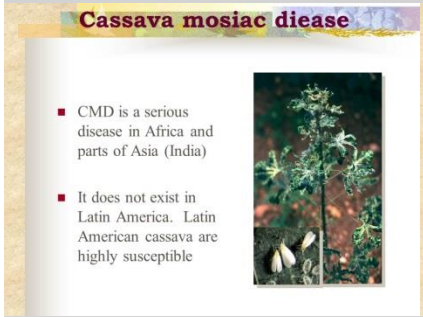
THANK YOU FOR LISTENING !!!

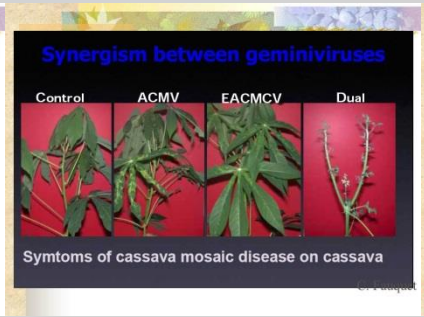
Together we can make biotechnology work for farmers in Africa

Cassava Centre of Origin Case Study

Emmanuel Okogbenin – National Root Crops Research Institute, Umudike




Cassava mosiac diease
CMD is a serious disease in Africa and parts of Asia (India)
It does not exist in Latin America. Latin American cassava are highly susceptible


Synergism between geminiviruses
Control
ACMV
EACMCV
Dual
Symtoms of cassava mosaic disease on cassava

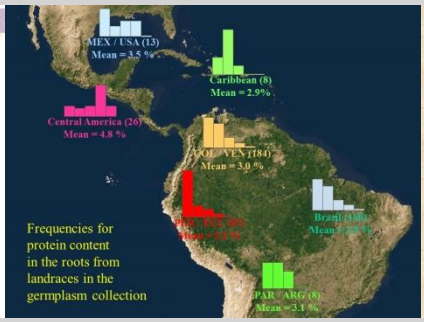

CBB scoring scale (1 = no symptoms)
2
3
3
4
5

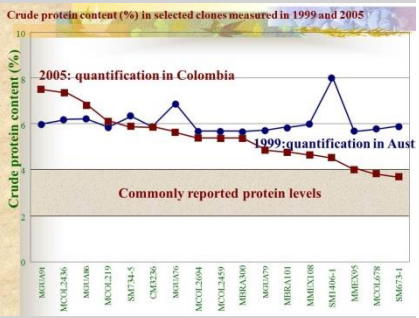

PPD evaluation procedure
100%
80%
60%
40%
20%
10%
0%

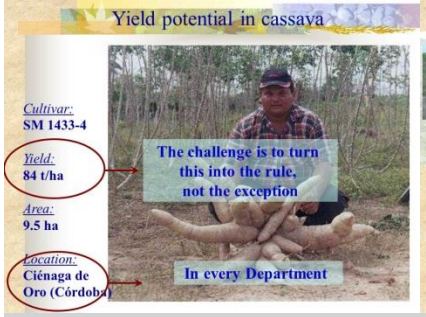

Cassava breeding and evaluation schemes currently used at CIAT
Elite germplasm recombined trough sexual crosses (hand or open pollinations).
Thousands of botanical seeds are produced each year.
Seedlings from botanical seed are grown in screenhouses and then transplanted to the field.
F1 [6000 GENOTYPES]
Shipment to Target Environment
Clonal Evaluation Trial [4000]
Preliminary Yield trial [800]
Advanced Yield Trial [300]
Regional Trial [90]


The challenges for Nigeria:
Solving problems and adding useful traits to the crop
Sustaining steady and stable yield levels
Enhancing cassava nutritional quality in vitamins and protein contents for the malnourished poor
Creating an export-market driven cassava industry
Transforming cassava into a major player for economic development and wealth creation

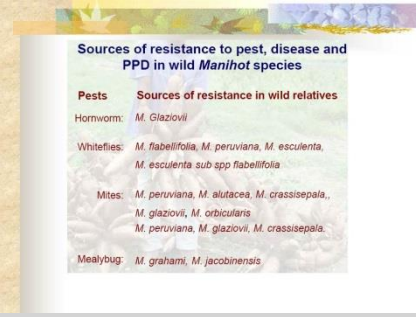

CENTRE OF ORIGIN
Source of genetic diversity (genetic variation)


MEX / USA (13)
Mean = 3.5 %
Caribbean (8)
Mean = 2.9%
Central America (26)
Mean = 4.8 %
COL / VEN (184)
Mean = 3.0 %
Brazil (100)
PAR / ARG (8)
Mean = 3.1 %
Frequencies for protein content in the roots from landraces in the germplasm collection


Crude protein content (%) in selected clones measured in 1999 and 2005
Crude protein content (%)
2005: quantification in Colombia
1999:quantification in Aust
Commonly reported protein levels
MGI1491
MCOL2436
MGI1486
MCOL219
SM734-5
CM8236
MGI1476
MCOL2684
MCOL2459
MBRA500
MGI1479
MBRA101
MMEX108
SM1496-1
MMEX95
MCOL678
SM673-1


Yield potential in cassava
Cultivar:
SM 1433-4
Yield:
84 t/ha
Area:
9.5 ha
Location:
Ciénaga de Oro (Córdoba)
The challenge is to turn this into the rule, not the exception
In every Department

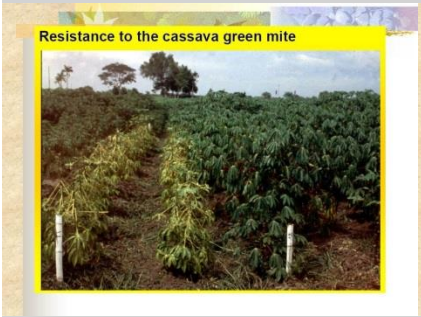

Mining wild gene pools
Involving wild relatives
F1 with M. tristis and M. flavellifolia high in protein content
F1 with M. walkerae reduced post-harvest physiological deterioration
M. aesculifolia
M. tomentosa
M. aromata
M. dichotoma


Sources of resistance to pest, disease and PPD in wild Manihot species
Pests
Sources of resistance in wild relatives
Hornworm: M. Glaziovii
Whiteflies: M. flabellifolia, M. peruviana, M. esculenta, M. esculenta sub spp flabellifolia
Mites: M. peruviana, M. alutacea, M. crassisepala,, M. glaziovii, M. orbicularis M. peruviana, M. glaziovii, M. crassisepala.
Mealybug: M. grahami, M. jacobinensis


Sources of resistance to pest, disease and PPD in wild Manihot species
Diseases
Sources of resistance in wild relatives
Root Rots: M. pseudoglaziovii, M. guitaginensis, M. filementosi,
Bacterial blight: M. esculenta sub spp flabellifolia
Super elongation: M. esculenta sub spp flabellifolia, M. pseudoglaziov
CMD: M. glaziovii
There are three traits we are still looking for:
Acyanogenesis
Apomixis
Herbicide resistance

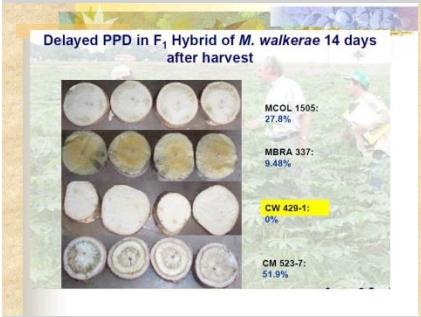

Segregations from a self-pollinated clone of the germplasm collection
Can this mutation in plant architecture lead to a "green revolution" in cassava?
It could be envsioned that this plant type can withstand 30,000 or 40,000 pl/ha


Plant architecture

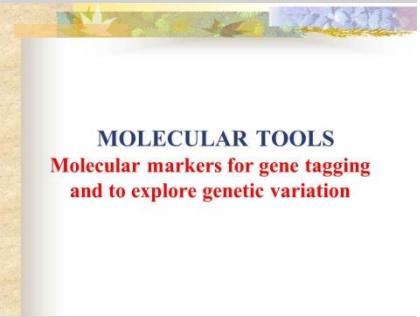

Resistance to the cassava green mite


Leaf retention

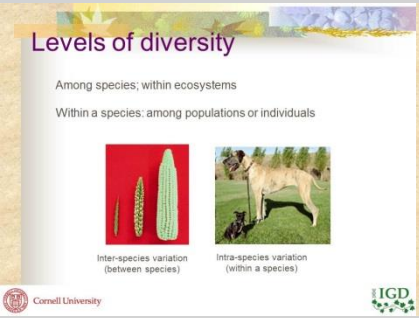

Resistance to white flies in landraces of cassava
Resistant cassava MECU-72
Susceptible cassava


Delayed PPD in F_1 Hybrid of *M. walkerae* 14 days after harvest
MCOL 1505: 27.8%
MBRA 337: 9.48%
CW 429-1: 0%
CM 523-7: 51.9%

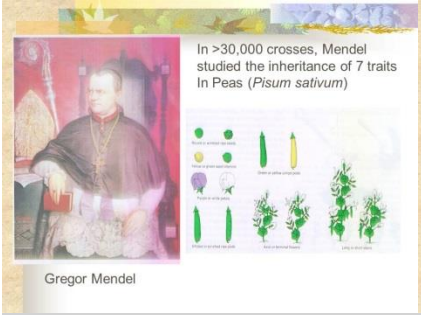

Traits that we hope to generate and identify variation for:
Variation in starch quality and distribution in cassava roots from Brazilian landraces
Starch quality:
Low or no amylose
Low or no amylopectin
Different granule size
Change in P-bound starch
"Sugary" cassava

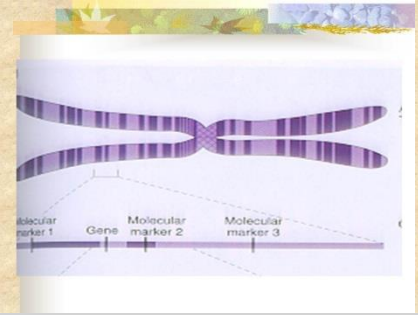

MOLECULAR TOOLS
Molecular markers for gene tagging and to explore genetic variation

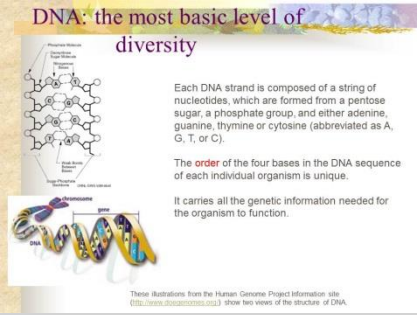

"Diversity": What does it mean?
✓Variability among living organisms
✓Biological Diversity, genetic diversity
✓Genomic diversity - on a whole genome scale
Cowpea at IITA, Nigeria
Cornell University
IGD

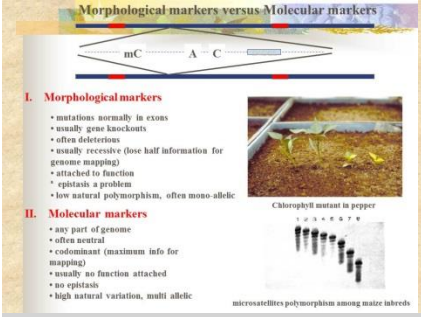

Levels of diversity
Among species; within ecosystems
Within a species: among populations or individuals
Inter-species variation (between species)
Intra-species variation (within a species)
Cornell University
IGD

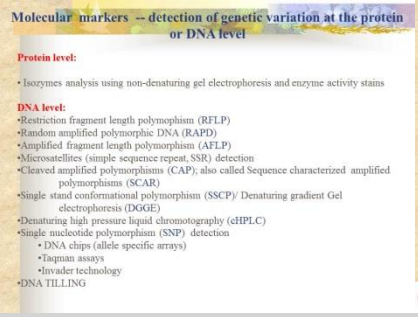

Allelic diversity
Alleles are variants of a particular gene or DNA segment
Example: eye color
Image from Discovermagazine.com

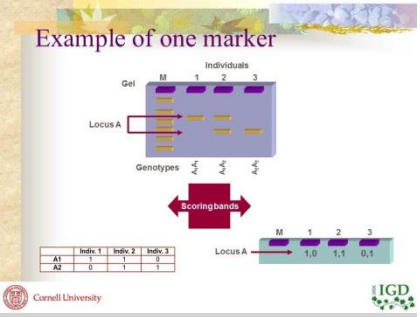

In >30,000 crosses, Mendel studied the inheritance of 7 traits In Peas (*Pisum sativum*)
Gregor Mendel

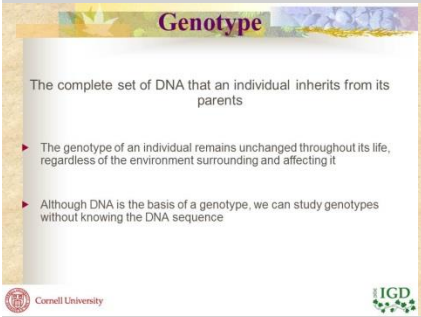

Gene
Molecular marker 2
Molecular marker 3

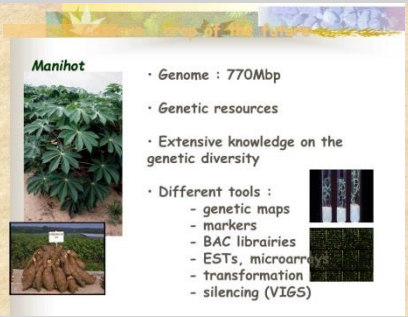

DNA: the most basic level of diversity
Each DNA strand is composed of a string of nucleotides, which are formed from a pentose sugar, a phosphate group, and either adenine, guanine, thymine or cytosine (abbreviated as A, G, T, or C).
The order of the four bases in the DNA sequence of each individual organism is unique.
It carries all the genetic information needed for the organism to function.
These illustrations from the Human Genome Project Information site (http://www.doegenomes.org/) show two views of the structure of DNA.

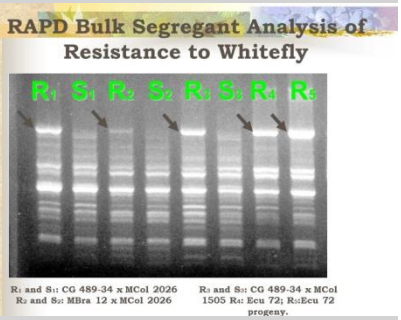

Morphological markers versus Molecular markers
mC
A
C
I. Morphological markers
• mutations normally in exons
• usually gene knockouts
• often deleterious
• usually recessive (lose half information for genome mapping)
• attached to function
• epistasis a problem
• low natural polymorphism, often mono-allelic
II. Molecular markers
• any part of genome
• often neutral
• codominant (maximum info for mapping)
• usually no function attached
• no epistasis
• high natural variation, multi allelic
Chlorophyll mutant in pepper
microsatellites polymorphism among maize inbreds

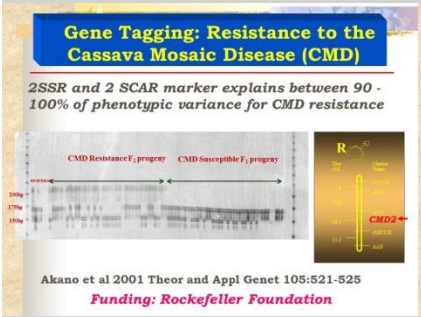

Molecular markers -- detection of genetic variation at the protein or DNA level
Protein level:
• Isozymes analysis using non-denaturing gel electrophoresis and enzyme activity stains
DNA level:
•Restriction fragment length polymophism (RFLP)
•Random amplified polymorphic DNA (RAPD)
•Amplified fragment length polymorphism (AFLP)
•Microsatellites (simple sequence repeat, SSR) detection
•Cleaved amplified polymorphisms (CAP); also called Sequence characterized amplified polymorphisms (SCAR)
•Single stand conformational polymorphism (SSCP)/ Denaturing gradient Gel electrophoresis (DGGE)
•Denaturing high pressure liquid chromotography (cHPLC)
•Single nucleotide polymorphism (SNP) detection
• DNA chips (allele specific arrays)
•Taqman assays
•Invader technology
•DNA TILLING

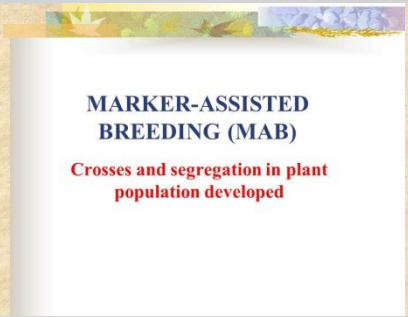

Example of one marker
Individuals
Gel
M 1 2 3
Locus A
Genotypes
Scoring bands
Indiv. 1 Indiv. 2 Indiv. 3
A1 1 1 0
A2 0 1 1
Locus A
M 1 2 3
1,0 1,1 0,1
Cornell University
IGD

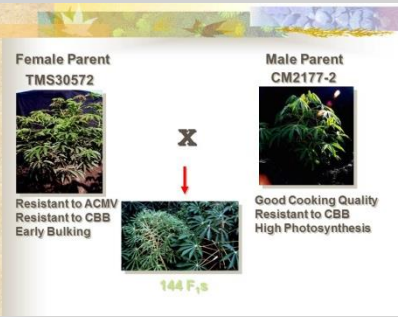

Genotype
The complete set of DNA that an individual inherits from its parents
The genotype of an individual remains unchanged throughout its life, regardless of the environment surrounding and affecting it
Although DNA is the basis of a genotype, we can study genotypes without knowing the DNA sequence
Cornell University
IGD

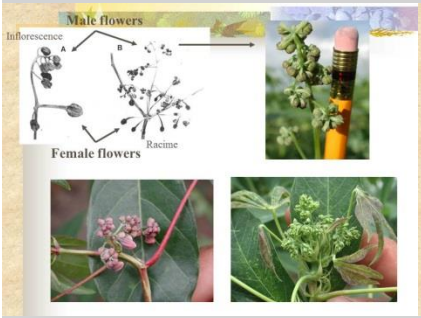

Manihot
· Genome : 770Mbp
· Genetic resources
· Extensive knowledge on the genetic diversity
· Different tools :
- genetic maps
- markers
- BAC librairies
- ESTs, microarrays
- transformation
- silencing (VIGS)

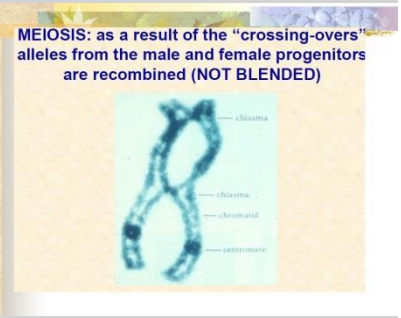

RAPD Bulk Segregant Analysis of Resistance to Whitefly
R1 S1 R2 S2 R3 S3 R4 R5
R1 and S1: CG 489-34 x MCol 2026
R2 and S2: MBra 12 x MCol 2026
R3 and S3: CG 489-34 x MCol 1505 R4: Ecu 72; R5:Ecu 72 progeny.


Gene Tagging: Resistance to the Cassava Mosaic Disease (CMD)
2SSR and 2 SCAR marker explains between 90 - 100% of phenotypic variance for CMD resistance
CMD Resistance F1 progeny
CMD Susceptible F1 progeny
CMD2
Akano et al 2001 Theor and Appl Genet 105:521-525
Funding: Rockefeller Foundation

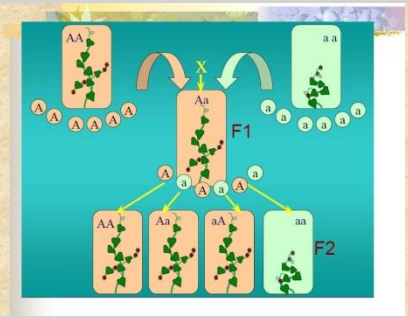

MARKER-ASSISTED BREEDING (MAB)
Crosses and segregation in plant population developed

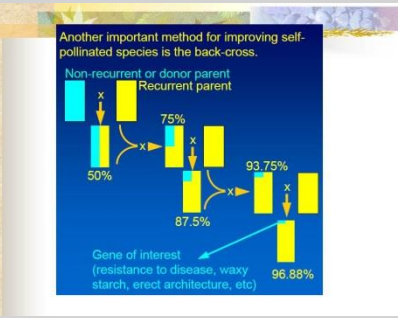

Female Parent
TMS30572
Male Parent
CM2177-2
X
Resistant to ACMV
Resistant to CBB
Early Bulking
Good Cooking Quality
Resistant to CBB
High Photosynthesis
144 F1s

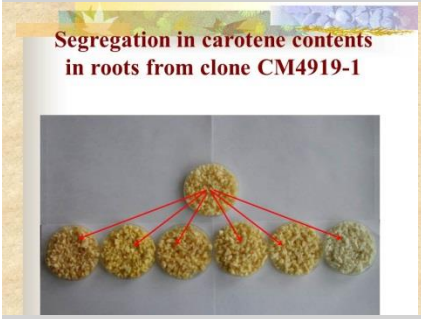

Male flowers
Inflorescence
Racime
Female flowers


MEIOSIS: as a result of the "crossing-overs" alleles from the male and female progenitors are recombined (NOT BLENDED)
chiasma
chromatid
centromere

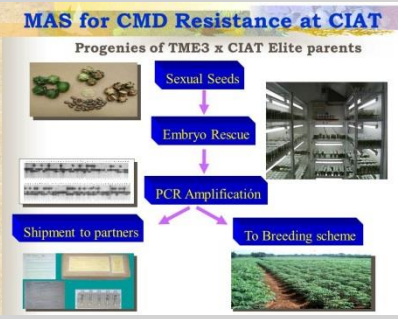

Generating variability in plant breeding: crosses in cassava


AA
aa
X
Aa
F1
AA
Aa
aA
aa
F2

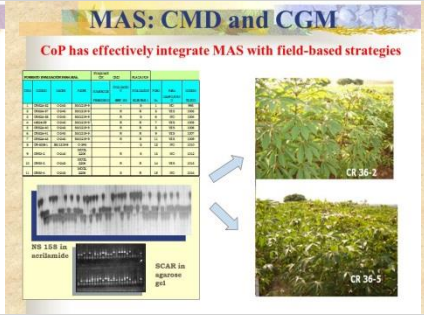

Another important method for improving self-pollinated species is the back-cross.
Non-recurrent or donor parent
Recurrent parent
50%
75%
87.5%
93.75%
96.88%
Gene of interest
(resistance to disease, waxy starch, erect architecture, etc)

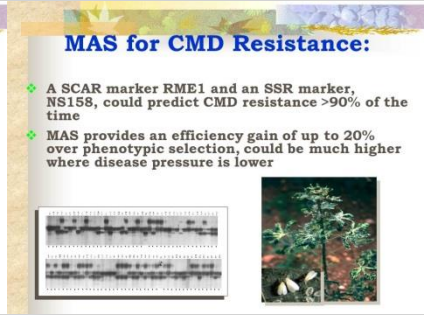

Segregation in carotene contents in roots from clone CM4919-1

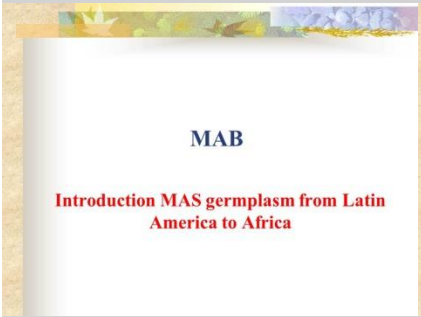

MAB
Marker-assisted selection (MAS) for CMD


MAS for CMD Resistance at CIAT
Progenies of TME3 x CIAT Elite parents
Sexual Seeds
Embryo Rescue
PCR Amplification
Shipment to partners
To Breeding scheme


Access to Highthroughput Labs
KBio science
LGC Genomics

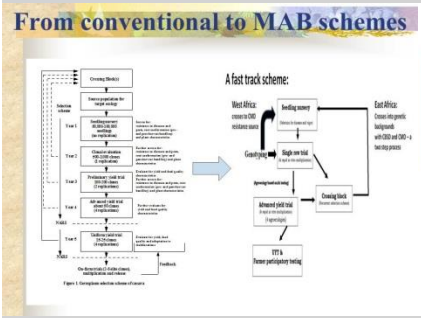

MAS: CMD and CGM
CoP has effectively integrate MAS with field-based strategies
NS 158 in acrilamide
SCAR in agarose gel
CR 36-2
CR 36-5


MAS for CMD Resistance:
A SCAR marker RME1 and an SSR marker, NS158, could predict CMD resistance >90% of the time
MAS provides an efficiency gain of up to 20% over phenotypic selection, could be much higher where disease pressure is lower

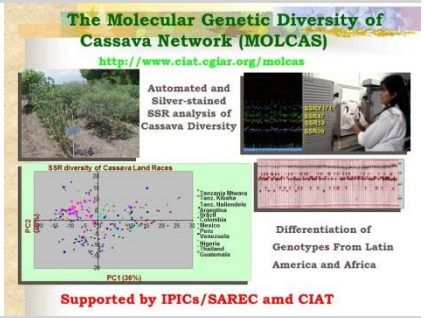

MAB
Introduction MAS germplasm from Latin America to Africa

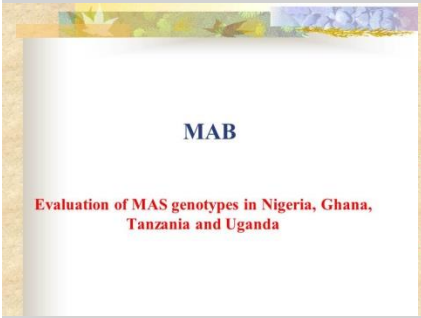

Facilities

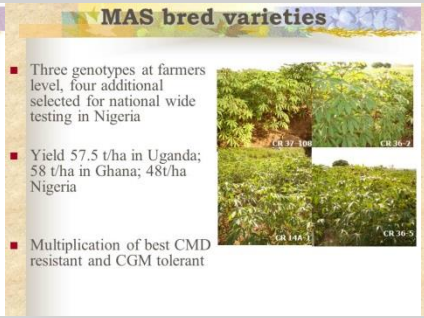

Mock Plantlets undergoing hardening

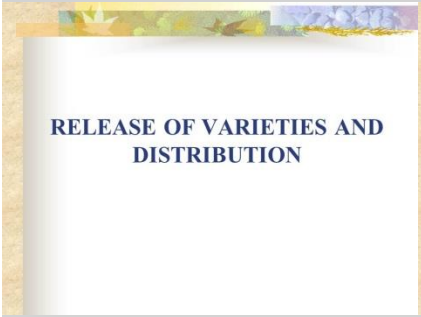

From conventional to MAB schemes
A fast track scheme:

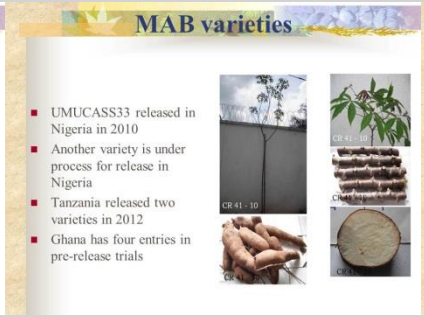

Plant Materials
Nigerian
32 Nigerian Landraces
10 NRCRI Breeding Accessions
12 IITA Breeding Accessions
Latin American
16 CIAT Breeding Accessions
10 Wild Manihot derivatives
Total: 80 Accessions


The Molecular Genetic Diversity of Cassava Network (MOLCAS)
http://www.ciat.cgiar.org/molcas
Automated and Silver-stained SSR analysis of Cassava Diversity
SSR diversity of Cassava Land Races
Differentiation of Genotypes From Latin America and Africa
Supported by IPICs/SAREC amd CIAT

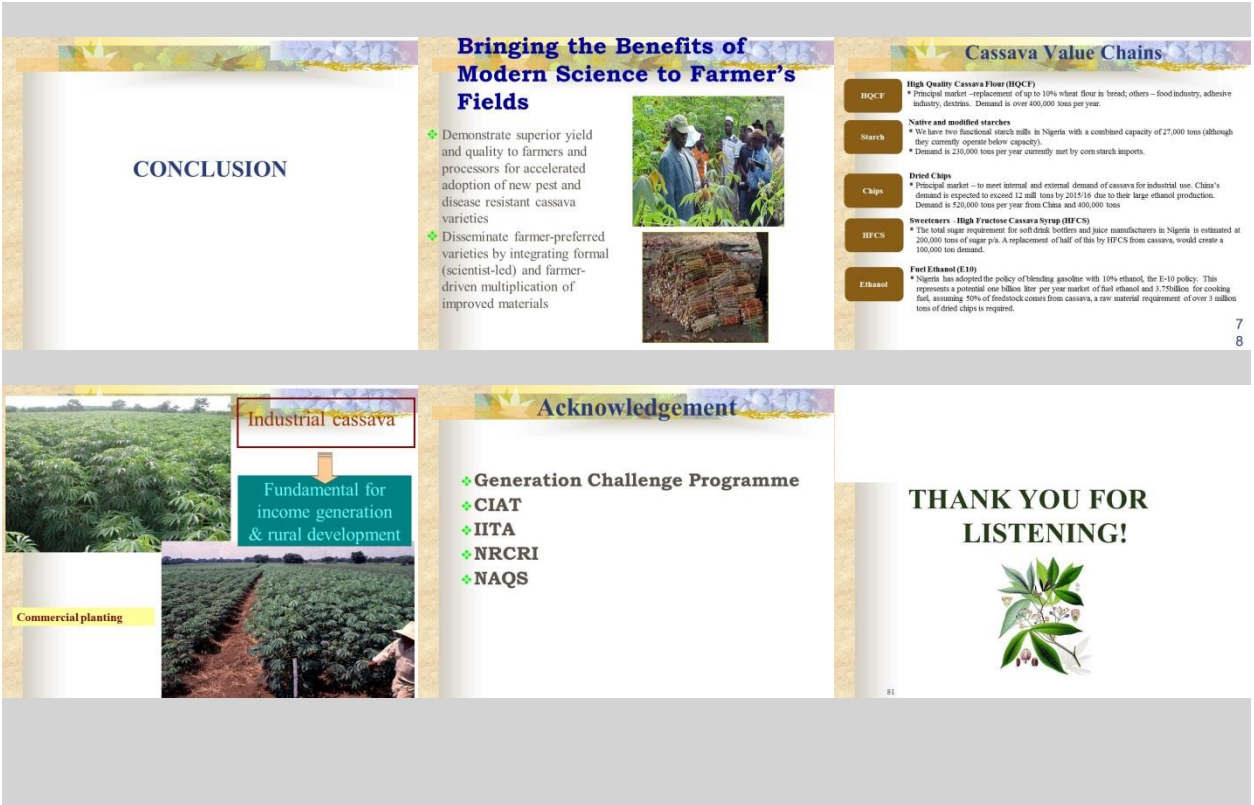

MAB
Evaluation of MAS genotypes in Nigeria, Ghana, Tanzania and Uganda


MAS bred varieties
Three genotypes at farmers level, four additional selected for national wide testing in Nigeria
Yield 57.5 t/ha in Uganda; 58 t/ha in Ghana; 48t/ha Nigeria
Multiplication of best CMD resistant and CGM tolerant


RELEASE OF VARIETIES AND DISTRIBUTION


MAB varieties
UMUCASS33 released in Nigeria in 2010
Another variety is under process for release in Nigeria
Tanzania released two varieties in 2012
Ghana has four entries in pre-release trials


AGRICULTURAL TRANSFORMATION AGENDA
GROW FOOD | CREATE JOBS | ENSURE SECURITY


CONCLUSION
Bringing the Benefits of Modern Science to Farmer's Fields
Demonstrate superior yield and quality to farmers and processors for accelerated adoption of new pest and disease resistant cassava varieties
Disseminate farmer-preferred varieties by integrating formal (scientist-led) and farmer-driven multiplication of improved materials
Cassava Value Chains
HQCF
High Quality Cassava Flour (HQCF)
* Principal market –replacement of up to 10% wheat flour in bread; others – food industry, adhesive industry, dextrins. Demand is over 400,000 tons per year.
Starch
Native and modified starches
* We have two functional starch mills in Nigeria with a combined capacity of 27,000 tons (although they currently operate below capacity).
* Demand is 230,000 tons per year currently met by corn starch imports.
Chips
Dried Chips
* Principal market – to meet internal and external demand of cassava for industrial use. China's demand is expected to exceed 12 mill tons by 2015/16 due to their large ethanol production. Demand is 520,000 tons per year from China and 400,000 tons
HFCS
Sweeteners - High Fructose Cassava Syrup (HFCS)
* The total sugar requirement for soft drink bottlers and juice manufacturers in Nigeria is estimated at 200,000 tons of sugar p/a. A replacement of half of this by HFCS from cassava, would create a 100,000 ton demand.
Ethanol
Fuel Ethanol (E10)
* Nigeria has adopted the policy of blending gasoline with 10% ethanol, the E-10 policy. This represents a potential one billion liter per year market of fuel ethanol and 3.75billion for cooking fuel, assuming 50% of feedstock comes from cassava, a raw material requirement of over 3 million tons of dried chips is required.
78
Industrial cassava
Fundamental for income generation & rural development
Commercial planting
Acknowledgement
Generation Challenge Programme
CIAT
IITA
NRCRI
NAQS
THANK YOU FOR LISTENING!
81

Groundnut Germplasm Case Study

Maimuna Abdulmalik – Ahmadu Bello University, Zaria

In vitro conservation of groundnut germplasm

by

M.M. Abdulmalik & I.S. Usman
Department of Plant Science, Institute for Agricultural Research
Ahmadu Bello University Zaria

Introduction

- Groundnut (Arachis hypogaea L.) is an important source of protein and edible oil in the world.
- Nigeria ranks third after India and China in terms of production (FAOSTAT 2010).
- Production is constraint by low quality of seeds as these deteriorate rapidly in storage particularly in the tropics (Delouche et al., 1973).
- Conventional methods used by our subsistence farmers to store seeds (RMRDC, 2004) are inadequate for long term storage.
- Newly improved varieties are fast replacing our traditional varieties.

- Groundnut germplasm are conventionally stored in gene banks and seeds are the most preferred propagule used.
- Due to their high lipid content and thin seed coat they cannot tolerate the gene bank conditions for longer periods like true orthodox seeds.
- This has led to the suggestion that the groundnut should be considered as suborthodox (Vasquez-Yanes and Arechiga 1996, Gagliardi, et al., 2000).
- Studies on groundnut seeds viability in storage in IAR revealed that all the entries evaluated had viability of 50% or less by 1 year and 25% by 2 years of storage.

- The IAR maintains its varieties and cultivars by planting every season.
- Not only is this laborious, time consuming and expensive but also plants are exposed to the possible risk of pest, disease and environmental stresses.
- Thus, cryopreservation is considered as important complimentary strategies for ex situ conservation.

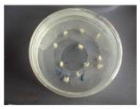
- Cryopreservation or storage in liquid nitrogen at temperature of –1960C, at which all the cells are in a state of suspended animation, is the most promising method of invitro germplasm storage
- advantages
  - enables long term storage of the plant material
  - require less space
  - less labor
  - it's cheap at the long run
  - genetic stability
  - elimination of viral disease.
- Cryopreservation techniques
  - Desiccation
  - Vitrification
  - Encapsulation vitrification
  - Encapsulation dehydration
  - Droplet freezing

Material and Methods

- Plant material- Seeds of four groundnut (Arachis hypogaea L.) varieties.
- Surface sterilized of seeds
  - -5min in70% alcohol,
  - -20min in 10% NaOCl+ 2-3 drops of tween 20
  - -rinsed thrice with sterile distilled water
  - - 10min in 5% NaOCl + 2-3 drops of tween 20
  - -washed three times with sterile distilled water.
- Seeds were soaked in sterile distilled water for 3hr.
- Embryonic axes were excised

Vitrification technique

- Preculturing of embryonic axes on solidified MS medium supplemented with 0.3M sucrose for 24hr.
- treatment with a loading solution (2M glycerol plus 0.4M sucrose dissolved in MS medium) for 15min at 25°C.
- Treated embryonic axes were transferred to 2ml cryovials and 1ml PVS2 was added dehydrated for 2hr.
  - **PVS2**
    (30% (w/v) glycerol, 15% (w/v) ethylene glycol and 15% (w/v) dimethylsulfoxide (DMSO) in MS medium with 0.4M sucrose)



Desiccation

- Embryonic axes were excised and subjected to desiccation under the air current of a laminar flow cabinet for 4hr.
- Moisture content was determined on fresh weight basis after drying in a 100°C oven for 24hr (3 replicates of 10 embryonic axes per duration).
- Desiccated and non desiccated (control) embryonic axes were placed in 2ml sterile cryovials.

- Cryovials were directly immersed into liquid nitrogen (-196°C) and held for 1hr.

- Thawing took place in a water bath at 40°C for 2min.

- Embryonic axes were cultured individually in test tubes containing 10ml of MS medium (Murashige and Skoog, 1962) supplemented with 15mg/L 6-benzylaminopurine (BAP) and solidified with 8g/L agar.

- Cultures were maintained in a growth chamber at 26±2°C under 16hr light/8hr dark photo period provided by white inflorescence.

- Regenerated microshoot of groundnut after 4weeks

- Microshoots were subcultured in MS media supplemented with 1mg/L NAA for rooting

- **Hardening-off & acclimatization**
  - Conditioning plantlets to the external env't• i.e. before transfer to field conditions


Expected Impact
• Groundnut plantlet in the screen house
• Genebank managers have a complimentary biotechnology conservation technique
• Breeders have wide array of groundnut germplasm
• Improved groundnut seeds that are high yielding and resistant to pest and diseases and better adapted to changing climates made available to farmers
• Groundnut pyramids of Kano flourishing
THANK YOU FOR LISTENING

Genetic Modification

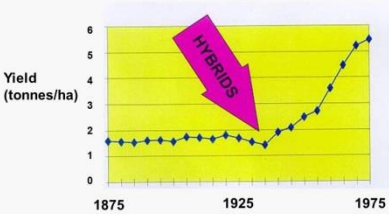
Professor Jim Dunwell – University of Reading

School of Agriculture, Policy and Development

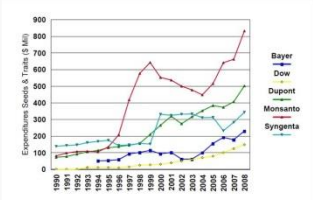
GM Crops: Production, Commercialisation and Regulation

Jim Dunwell

USA: Historic Maize Yields

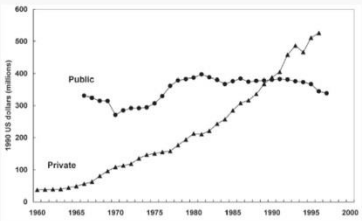


Expenditure on Seeds & Traits



Wilson & Dahl 2010

US Spending on Plant Breeding



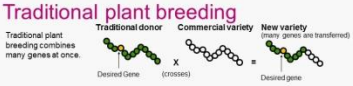
Recap

- Ever more sophisticated techniques to introduce new/desired traits into plants
- But, what if:
  - The plants with the traits won't breed with each other
  - Your crops are sterile
  - The desired trait isn't available
  - You don't have time to follow a conventional breeding/back-crossing process
  - You want to do something new (make a vaccine etc)

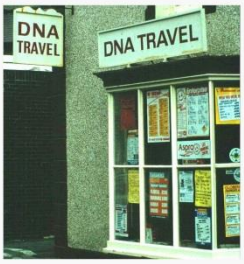
Previous technologies

- All technologies and processes described so far are pretty non-specific, and can be time consuming
- Especially genetic variation aspect. You can want to introduce a single trait, but breeding "mixes everything up"
- Imagine you want to build a better car. You have a 4x4 which is good for getting around on your roads, but want it to go faster.
- Current technologies analogous to taking lots of 4x4s and lots of Porsches; rebuilding new cars from 50% of the pieces of each; and then seeing which ones work and which don't.
- When all you want to do is put the engine from one car into the body of the other one.

Traditional plant breeding



Plant biotechnology

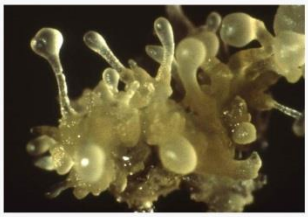


Ideal Transformation Method

- Can be applied to any genotype
- Produces fertile plants
- Has high efficiency
- Introduced gene is single copy
- Gene is stable and expressed over time/generations
- No background genetic change

7

Maize: Embryogenic Cultures

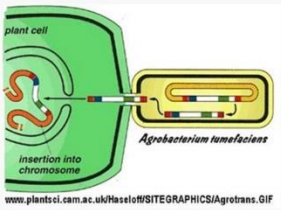


Indirect Methods

- Use of natural systems

Natural System for Gene Transfer

Agrobacterium Gene Transfer



Direct DNA Methods

- No need for bacteria

Particle Gun

"We won't know if it's worked until we find the plant"

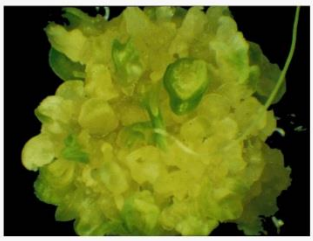
Biolistics

John Sanford

Particle Bombardment

Embryos after Particle Bombardment

Regenerating Wheat Embryo in Vitro



Regenerated Wheat Plants

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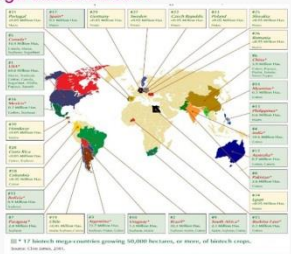
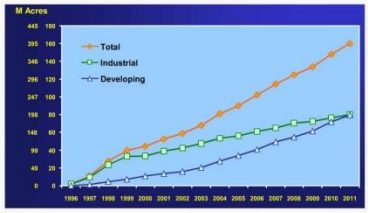
Jonathan Swift

"And he gave it for his opinion, that whoever could make two ears of corn..to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together" Jonathan Swift, 172

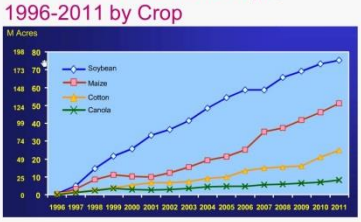
Biotech Crop Countries and Mega-countries 2011



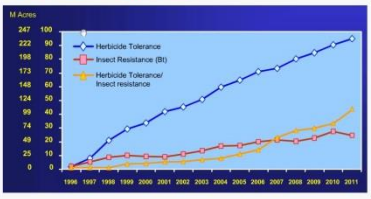
Global Areas of Biotech Crops 1996-2011



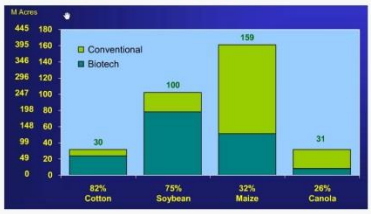
Global Area of Biotech Crops, 1996-2011 by Crop



Global Areas of Biotech Crops, 1996-2011 by Trait



Global Adoption Rates (%) Principal Biotech Crops 2011



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GM Crops 2011

- Biotech crops reached 160 million hectares, up 12 million hectares on 8% growth, from 2010, as the global population reached a historical milestone of 7 billion on 31 October 2011.
- A 94-fold increase in hectarage from 1.7 million hectares in 1996 to 160 million hectares in 2011 makes biotech crops the fastest adopted crop technology in the history of modern agriculture.
- Of the 29 countries planting biotech crops in 2011, it is noteworthy that 19 were developing and 10 were industrial countries.

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Approved GM Traits in US

Trait	Example
Herbicide tolerance	Bromoxynil, glufosinate, glyphosate, sulfonylurea
Insect resistance	Bt kurstaki, Bt tenebrionis
Virus resistance	Papaya ringspot, cucumber mosaic, zucchini yellow mosaic, watermelon mosaic, potato leaf roll, potato Y
Male sterility	Barnase/barstar
Modified ripening	ACC synthase, ACC deaminase SAM hydrolase, polygalacturonase
Modified oils	high lauric, myristic, oleic

30

Herbicide Tolerant Sugar Beet

Control GM

Herbicide Tolerant Sugar Beet

Advantages of Herbicide Tolerance

- Reduction of pre-emergent sprays
- Treatment can be left until weeds emerge
- No-tillage systems are possible
- Costs can be reduced
- Ease of agronomy

Brazil - Double Cropping without Irrigation

Harvesting Soybean, sowing Corn, with no tillage

Insect Resistance

35

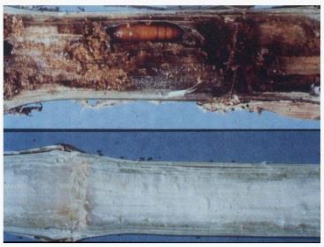
Bacillus thuringiensis (Bt) Toxin on Corn Borer

Control without toxin

Bt Toxin on Corn Borer

with toxin

Bt in Corn (maize)



Bt Corn

Insect Resistant Transgenic Rice with Bt against Stem Borer

Water Stress

Monsanto

Disease Resistance

1. Virus Resistance (approved products)

Transgenic Papaya Line with Resistance to PRSV

Deregulated in USA 1996

Now approved for sale in Japan, 27 May 2010

GM Control

GM Virus Resistant Papaya

45

"Input" and "Output" Traits

Input effects

- Crop protection (eg. insect, fungal control)
- Agronomic effects (eg. cold-tolerance, drought tolerance)

Output effects

- Higher yields
- High oil, modified starch, modified protein etc
- Modification of flavour and sweetness
- Post-harvest benefits eg. anti-sprouting, anti-bruising, ripening control
- Enhancement of beneficial components eg. vitamins

First GM Product in UK 1996

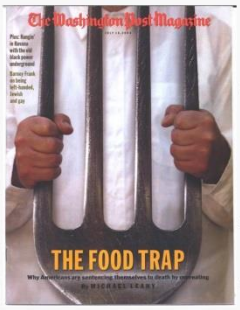
Reduced level of polygalacturonase enzyme

Commercialisation Pipeline

Output Traits

Why are fish oils important in human diet?

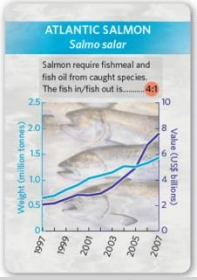
- Specific fatty acids found in fish oils are prevalent in specialised organs (such as the brain, eyes & testes). These are the n-3/omega-3 long chain polyunsaturates
- Mammals have a very limited ability to synthesise these fatty acids, so we need to obtain them from our diet
- Some human genetic disorders are directly linked to an inability to make these fatty acids. There is also some evidence of a reduced capacity to synthesise them in old age and/or diseased states.
- The fatty acids found in fish oils are NOT the same as those in vegetable oils
- Long chain Omega-3 fatty acids play a role in anti-inflammatory responses
- Long chain Omega-3 fatty acids have been shown to play a role in prevention of cardiovascular disease and re-occurance of infarction. They may also play a role in childhood IQ, depression and dispraxia.



Moderate consumption (0.5–2g/day) of omega-3 long chain polyunsaturated fatty acids found in fish oils can help reduce the risk of CVD and metabolic syndrome.

Unfortunately, wild fish stocks (the predominant source of these fatty acids) are in decline due to over-fishing and pollution of the marine environment. Also the demands of aquaculture

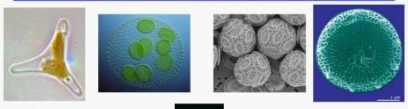
Fish farming is a net consumer of fish oils and is unsustainable..



Unfortunately, marine fish in aquaculture require dietary provision of omega-3 LC-PUFAs. Aquaculture is a massively expanding industry, already consuming a large % of wild capture fish oil & meal. Vegetable oils cannot substitute for the dietary fish oils.

Thus, there is a pressing need to find a sustainable source of fish oils for aquaculture.

The synthesis of omega-3 LC-PUFAs in transgenic plants



The sources of genes for LC-PUFA biosynthesis are marine algae

Identify algal genes for the synthesis of omega-3 polyunsaturates & transfer them to oilseeds

Regenerate transgenic plants with novel fatty acid traits.

Timeline – project started 1994 (!!)

Benefits of Omega-3 Fatty Acids

Algae naturally produce Omega-3 fatty acids that have health benefits for humans.

Humans don't typically eat algae, but fish do. Fish like salmon tend to have higher levels of Omega-3 fatty acids.

Goal: Develop a land-based source of oil with a nutritional profile similar to fish oil but an improved flavor

Monsanto

Establishing a novel oils platform in *Camelina sativa*.

Most successful Arabidopsis-evaluated constructs will be introduced into Camelina sativa.

Camelina is a Brassicaceae and easily transformed. Oil profile is similar to Arabidopsis, so results should be equivalent or better to that observed in the model system. We have determined baseline datasets for lipid composition over seed development for Camelina

1 Acre of Omega-3 Soybeans: Comparison

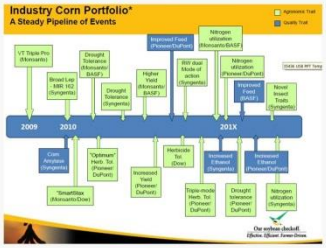
•OMEGA-3 SOYBEANS

Just one acre of Omega-3, SDA-enriched soybeans is equal to…

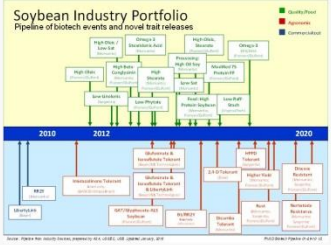
13,000 Salmon

Discovery	Phase 1	Phase 2	Phase 3	Phase 4	Launch

GM Corn Pipeline



Soybean Pipeline



US Soybean Export Council

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International Dimension

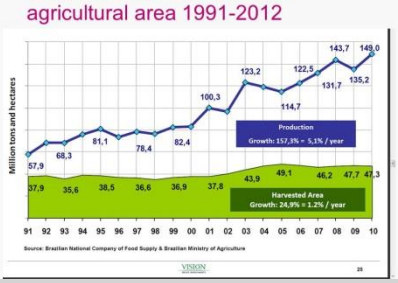
Potential to Reduce Yield Gap

All Crops	Yield Gap (%)
North America	33
West /Central Europe	36
Eastern Europe/Russia	63
South America	52
East Asia (China)	11
South Asia (India)	55
Sub Saharan Africa	76

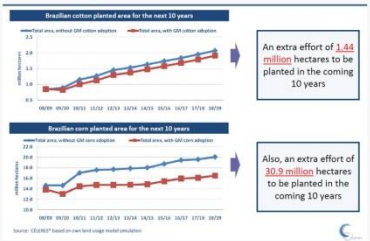
Source: Fischer, Hizsnyik, Prieler, Wiberg, 2010.

OECD Trade and Agriculture Directorate

Brazil: Grain production and agricultural area 1991-2012

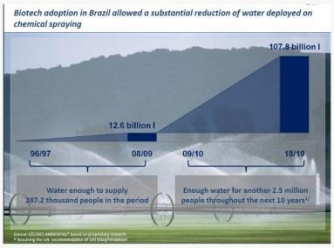


GM Crops in Brazil

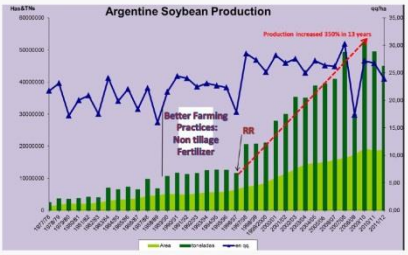


Celeres 2010

GM in Brazil: Water Saving



Celeres 2010



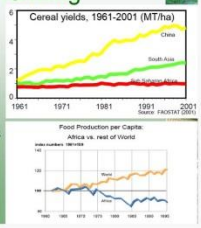
Bt Cotton in India

In the period, 2002 to 2008, Bt cotton generated economic benefits for farmers valued at $5.1 billion, halved insecticide requirements, contributed to the doubling of yield and transformed India from a cotton importer to the major exporter. In 2008 alone, the benefits accruing from Bt cotton in India was US$1.8 billion.

ISAAA 2010

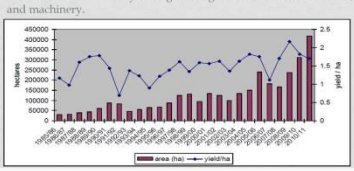
African Agriculture: Under-Performing

- Yields are stationary or declining
- Yet population has continued to increase
- Production per capita is declining



South African Experience: HT Soybeans 1

- Yields were relatively stagnant for the 15 years prior to introduction of HT soy beans .
- Introduction of HT soy bean had little if any impact on yield
- Farmers benefited mainly through saving on weed control chemicals, fuel and machinery.



South African Experience: HT Soybeans 2

- Soy bean farmers increased production (due to the ease of weed control management with HT.
- Demand for labour has increased.
- Increased employment opportunities also in the soybean processing sector (crushers, oil-cake, animal feed).
- Saving on foreign exchange

South African Experience: HT Maize 1

Insecticide saving impact of Bt
•Few smallholder farmers apply insecticides = little insecticide or labour saving
•Higher yields would mean more labour, but this was found to be minimal

Labour saving impact of HT maize
•A main benefit for HT adopting smallholder farmers is the labour saving impact
•A labour saving technology is not ideal for a country with a high unemployment rate but labour is a limiting factor for many subsistence farmers due to migration to urban areas and high prevalence of HIV/AIDS

South African Experience: HT Maize 1

2006/07	Herbicide application	Manual weeding	Harvesting	Total
Conventional and Bt with manual weeding	0.0	21.0	10.1	44.5
HT (RR) with chemical weed control	4.0	0.0	13.9	39.4
2007/08				
Conventional and Bt with manual weeding	0.4	13.1	8.9	31.5
HT (RR+BR)	4.0	0.8	8.0	17.0

Transgenic Drought Tolerant Maize under water stress in CFT, Lutzville, RSA Mar 2011

[redacted]

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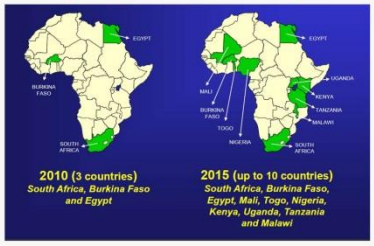
Maruca Resistant- Cowpea

Developing high quality insect-resistant cowpea varieties for use by smallholder farmers

Implementation of appropriate regulation is a must to spur adoption of biotech crops in Africa



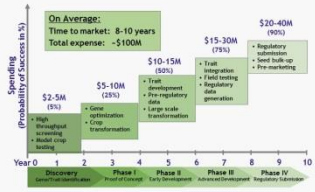
Policy on GM crops...

- Most parties engaged in product development find the operative policy environment on GM crops in Africa to contain highly precautionary overtones!

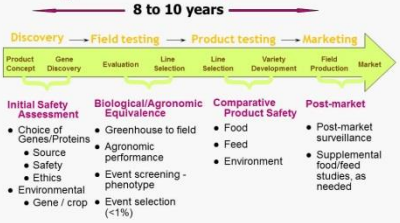
Courtesy, C. Juma, Harvard Univ.

- An overly precautionary policy position is burdensome to product development and often turns away investments in GM technology

Ag Biotech has Lengthy Product Development Cycle and Large Investment Process



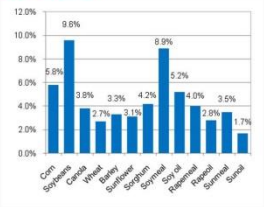
Safety Assessment Occurs Throughout the Development Process



Charles Darwin
(1809-1882)

"If the misery of the poor be caused not by the laws of nature, but by our institutions, great is our sin"

Increase in World Commodity Prices without Biotech



Brookes et al 2010

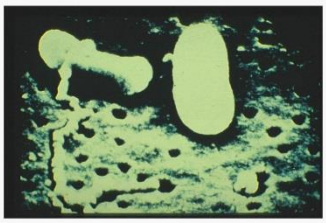
81

Future Prospects

- High value products
- Healthy food
- Biofuels
- Phytoremediation

High Value Products

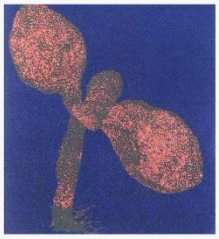
Polyhydroxybutyrate PHB



Plastics in Plants

Plastics in Plants

Plastics in Plants

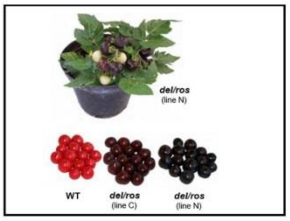


Healthy Food

Golden Rice: Increased Vitamin A

Golden Rice.org

Increased Anthocyanins in Tomato: Use of *Antirrhinum* Transcription Factor



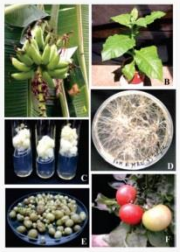
Protection against heart disease etc ? Martin et al 2008

Increased Anthocyanins in Tomato

	ug /gfwt	umol/gfwt
control	2.82	0.01
E8-Rosea1	9.74	0.03
E8-Rosea1 + E8-Delila Plant N	951.47	1.52
E8-Rosea1 + E8-Delila Plant Z	77.12	0.12

Pharming in Plants

Vaccines in Plants



Kumar et al. 2007

Conventional Field Crops

Maize
Rice
Barley

Novel or Non-food Field Crops

Other Crops

Tobacco - antibodies
Safflower - insulin
Alfalfa
Sugar Cane

Harvesting *Nicotiana*

Sterile F_1 Hybrids

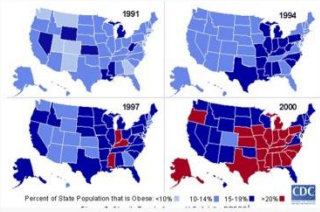
University Kentucky

First Pharma Product?

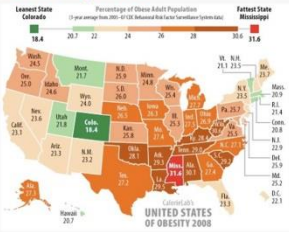
- Proinsulin from Safflower

Why Insulin?

Obesity Trends Among US Adults



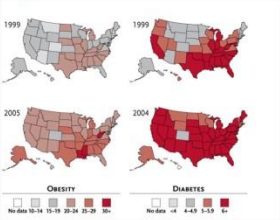
USA Obesity 2008



Increasing weight is associated with an overall increase in risk

- Overall mortality up to 2.5-fold in the 30-44 age group, less at older ages
- Cardiovascular mortality up to 4-fold in the 30-44 age group, less at older ages
- Diabetes up to 5-fold
- Hypertension
- Gall bladder disease

Obesity and Diabetes

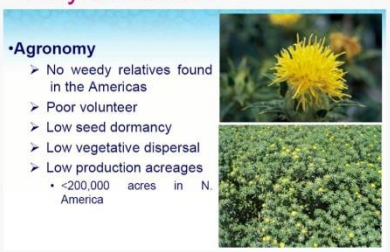


Insulin demand in USA

- In excess of US$7.1 billion today
- Predict US$15 billion in 2012

SemBioSys

Why Safflower?



- **Agronomy**
  - No weedy relatives found in the Americas
  - Poor volunteer
  - Low seed dormancy
  - Low vegetative dispersal
  - Low production acreages
    - <200,000 acres in N. America

SemBioSys

Why Safflower?

The biology of safflower makes it an excellent vehicle for PMP production.

- **Gene-flow**
  - Predominately self-pollinating (80-90%)
  - Virtually no wind transportation of pollen
  - Insects are biggest transport factors

SemBioSys

Safflower: Field Production

SemBioSys

Other Species used for Pharma Production

Arabidopsis	Pea
Banana	Pigeon pea
Carrot	Spinach
(flax)	Sunflower
Lotus corniculatus	Sweet potato
Lupin	Tomato
Papaya	White clover

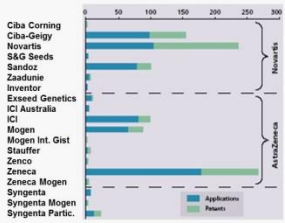
(also duckweeds, moss and algae)

Economic Perspective

IP and Industry Structure

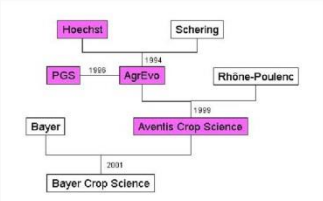
Five companies hold 75 percent of all ag-biotec patents

Syngenta Patent Portfolio



Graff et al 2003

AgBiotech Consolidation



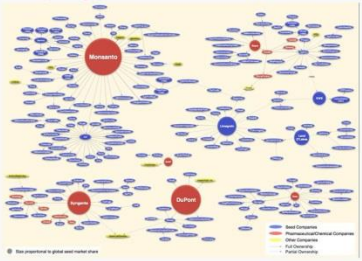
(CAMBIA)

The process of consolidation of IPR began in earnest in August 1996 with AgrEvo's purchase of Plant Genetic Systems (PGS) for $730 million, made when PGS's prior market capitalization was $30 million.

According to AgrEvo, $700 million of the purchase price was assigned to the valuation of the patent-protected trait technologies owned by PGS.

Pila 2008

Company Consolidation 1996-2008



Howard 2009

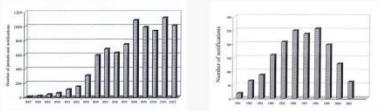
Public/Political Perspective

GM in Europe

Nature Biotechnology, April 2011

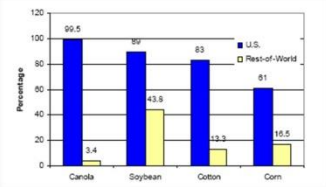
Effect of European Moratorium

USA **Europe**



1995: USA 684, UK 37 (EU 213)
2008: USA 874, UK 2 (EU 83)
2009: USA 691, UK 2, (EU 104)

Intensity of Biotech Crops US vs Rest of World, 2006



Conclusion

- Global economic success
- Potential novel GM approaches
- International diversity of attitudes
- China ($3.5b), Brazil investment
- EU split
- US/EU asynchronous approval

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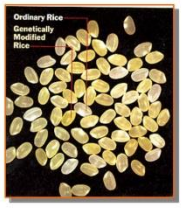
Genetic Modification and Science Communication

Professor Jim Dunwell – University of Reading

Communication: GM and the Media

Jim Dunwell

Vitamin-enhanced: Golden Rice



Understanding the GM food revolution

Types of Media

- TV
- Radio
- Newspaper

Differences between Types of Media

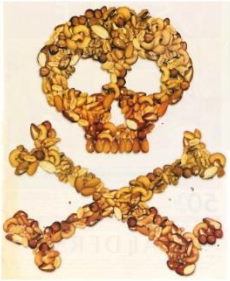
- Legal obligations
- Broadcast media have legal responsibility to be 'impartial': Broadcasting Standards Commission
- Not the case for written journalism: Press Complaints Commission

Facing the Press

- Of all media, newspapers longest lasting.
- Often first to publish, followed up by TV/radio.
- Crisis, controversy and conflict provide good story.

Modern Myths

- Allergenic nuts
- Tryptophan
- Pollen and butterflies
- Potatoes and rats
- Plant viruses



MP sparks off bogus modified food scare

MP links genetic food to 37 deaths

Brussels to debate ban on mutated food crops

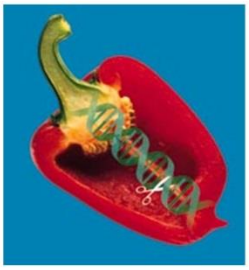
Gene crops could spell extinction for birds

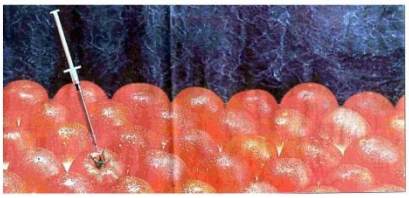
Recurrent Problems

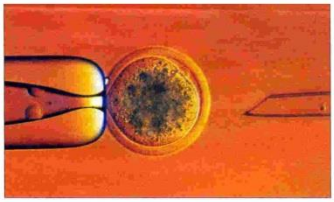
- 'Mad boffin' syndrome
- The need for drama/conflict
- Overestimating knowledge
- The cutting room floor

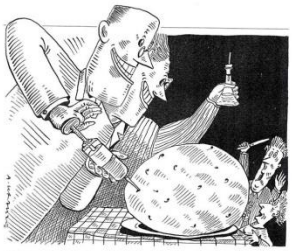
THE KNOWLEDGE

GAP









Stop the crops

THE QUESTION OF SCALE

•THE QUESTION OF SCALE

Genetic Engineering

Distortion

'The Independent' Newspaper

Modified pollen kills threatened butterfly

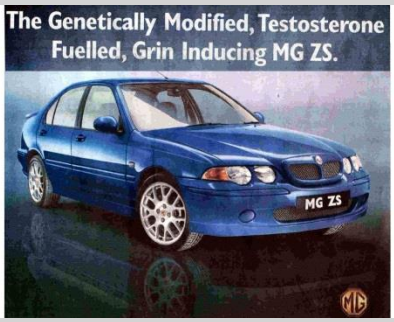
'The Scientist' Magazine

THE QUESTION OF CONTEXT

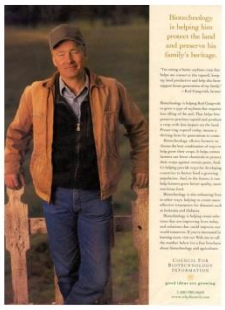
Products of Modern Breeding

Effect of One Gene!

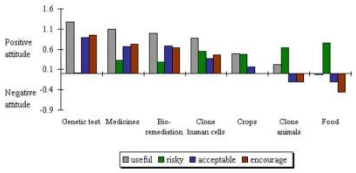
SEEING THE WHOLE PICTURE



INTERNATIONAL PERSPECTIVE



European Attitudes to GM



Societal Concerns about Food Biotech

- Food Safety
- Environment
- Socio-Economic
- Corporate Control
- Ethical

Perception of Agriculture

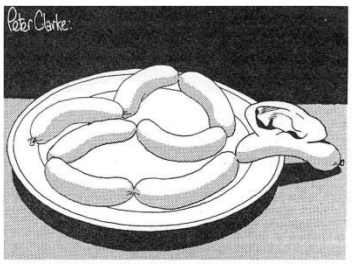
TRUST?

- **Do you trust what scientists say regarding the safety of:**

	A lot	A little	Not at all
Organ transplants	57	35	7
New medicine	37	55	8
Mobile phones	28	52	21
British beef	33	44	22
GM food	16	44	40
Cloning animals	13	38	49

TRUST?

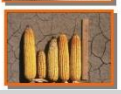
»	A lot	A little	Not at all
Teachers	68	28	4
Doctors	74	24	3
Police	53	41	6
Scientists	35	54	12
Politicians	10	65	25
Journalists	4	49	48



The Question of Balance

Biotechnology can Benefit Global Agriculture

- Environmental Impact - Decreased Use of Pesticides
- Reduce Losses from Pests and Diseases
- Improve Nutrient Efficiency
- Improve Productivity



Drought Exacerbates the Need for Food Aid


DAILY NATION
The newspaper that serves the nation
Moi: Save our starving nation
Biwott blamed over power crisis
Donors rally to the President's Sh11bn aid plea

In Kenya year 2000

- 30 out 53 districts affected
- 22 million people affected
- 2.2 million at risk of starvation

Why Public Anxiety with Biotech Crops?

- **Societal Concern About Biotech is Understandable**
  - **Strong Assurance of Safety Needed**
  - **Unfamiliar with the Technology**
  - **Lack of Reliable Information**
  - **Unaware of Safeguards**
  - **Negative Media Opinion**
  - **Opposition by Activist Groups**
  - **Mistrust of the Industry**

Scientific Community has neither addressed public concerns nor communicated the value of this technology effectively

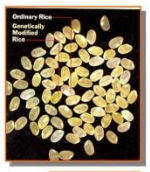
Why Opposition to Biotech in Europe?

- Distrust of Regulators. No FDA.
- Food Scares..*BSE,*
- Mistrust of Companies
- Cultural Affinity for Food
- Reverence for Environment
- Media Sensationalism; Green Activists


This will make you sick
Act now: stop patenting on crops
ACTIONAID
ActionAid campaigns against food patenting

Golden Rice

- Milled rice has no beta-carotene
- Vitamin A deficiency - 200 million children and woman
- About 500,000 children go blind (60 every hour)
- 2 million children die each year
- Golden Rice may provide one of the many solutions
- Soon to be on the market



Ingo Potrykus (Switzerland) and Peter Beyer (Germany)

THE HIDDEN AGENDA

Reality (Nature Magazine)

- "It seems that intergeneric gene flow might occur by transgene introgression within the genome of the weeds, but slowly and at a low probability under natural optimal conditions because four generations were needed to provide herbicide-resistant plants with a chromosome number and morphology close to that of the weed. It is likely that under normal agricultural conditions this event is rare when the wild radish is the female parent" - *Chevre*

Interpretation (Guardian)

- 'Demon Weed' Fear
- GENETIC engineering could create superweeds, scientists from the national agricultural research centre at Le Rheu in France report in the journal Nature today. Big chemical companies have been working on herbicide-resistant soya and cotton unaffected by weed sprays.
- But environmental campaigners are worried that the gene for herbicide resistance could transfer itself naturally to a wild plant and create a herbicide resistant weed that could take over the world. – *Tim Radford*

GM Field Trial

Rothamsted Research 2012

Maruca Resistance (Bt) Cowpea Case Study

Mohamed Lawan Umar – Ahmadu Bello University, Zaria, Nigeria

Deployment of Bt gene Technology for Transformation of Cowpea against maruca

Presented at B4FA media Fellowship training 24th – 27th Sept 2012, IITA, Ibadan, Nigeria

Muhammad Lawan Umar
Department of Plant Science, Institute for Agricultural Research, ABU-Zaria
E-mail: mlumar@abu.edu.ng , lumar@wacci.edu.gh

Terms used in the topic

- ✓ Gene Deployment- system of assigning specific resistance gene to a specific area to control insect
- ✓ Bt–=*Bacillus thurengiensis* (soil microorganism)
- ✓ Bt gene- gene obtained from soil bacterium
- ✓ Maruca- flying insect (lepidopteran)

Cowpea

✓Most important legumes in Africa

✓Over 60 million people consume cowpea products everyday in Nigeria

Cowpea

✓Provides employment to millions people

Cowpea farmer

Cowpea processor & consumers waiting

Cowpea production

- ✓ Grows everywhere but mostly Savanna/Derived Savannas
- ✓Africa is the leading cowpea producer in the world
- ✓ Nigeria accounts for > half (58%) of worldwide production
- largest consumer and largest importer
  - National Deficit over 500,000 tons

*Made up through imports-20 billion naira

Causes of production deficit

✓Drought

Parasitic Flowering Plants

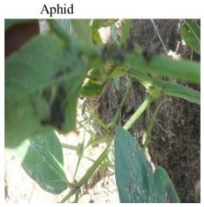
Striga

- Alectra

Constraints to production- Insect

Flower thrips

Aphid



CONSTRAINTS TO PRODUCTION- MARUCA

Up 80% yield loss

Maruca larva

Maruca adult

Constraints to production- Maruca cont'd

Maruca damages the flower

Constraints to production- *Maruca* cont'd

✓ *Maruca* damages the pod

Pod damage

SOCIO-ECONOMIC EFFECT-*MARUCA*

- ✓Up to 80%Yield loss for Grains
- ✓Poor Quality Grains-Reduced Income
- ✓Estimated Revenue loss at 400kg/ha-35.52 billion naira
- ✓Food insecurity
  - Spreads Poverty
  - Malnutrition
  - Poor health

IMPACT –*MARUCA RESISTANT COWPEA*

- ✓Increase yield up to 20 times
- ✓Improve Quality of the Grains
- ✓Reduce cost of Production- increase income
- ✓ Food security
  - Reduce Poverty
  - Improve health

STRATEGIES - CONTROL MARUCA

Insecticide sprays

Host plant Resistance

PAST EFFORTS -MARUCA

- ✓ Research institutes- developed and released many varieties
- Consumers preferred traits- seed size, colour
- ✓Identified source of resistance:
- Diseases resistance- TVU 12349
- Aphid resistance-TVU 3000, IT84S-2246-4
- Parasitic weeds- IT81D-994
- ✓ Source of resistance to *maruca?????*

PAST EFFORTS MARUCA

- ✓ Screening Techniques Developed- Louis Jackai
- ✓ Screened 15,000 accessions, no resistance found
- ✓ Unsuccessful wide crossing with Resistance in *Vigna vexillata* Fatokun et al(2002)

Way out???

Bt cowpea: History

- ✓ International Symposium on Cowpea improvement- Dakar, Jan 2001
- ✓ Birth of NGICA
- ✓ Group of experts meeting, Nairobi, (2003)- application of crop biotechnology as the potential strategy to combat *maruca* (Huesing et al, 2011)
- AATF- gene access
- Partners - USAID, CSIRO, IAR, INERA and CSIR-SARI RF (Popelka *et al*, 2006)

Strategies for Bt-cowpea Deployment

- ✓ Laboratory work- CSIRO, Australia
- Developed system of gene introgression/transfer
- Transferred the gene into IT86D-1010 (Cowpea genotype)
- Preliminary efficacy test - conducted in a glass house

Strategies for Bt-cowpea Deployment

- ✓ Confined Field Trial (CFT)- a small-scale experimental field trial of a GM plant species performed under regulated conditions
- Critical step- development & commercialization, *Maruca* resistance cowpea variety

Small Scale Field Test [Confined Field Trial (CFT)]

- Why CFT?
- ✓ Assess the performance of the transformed cowpeas under natural condition
- ✓ Assess the level of gene expression
- ✓ Assess interaction of the test material by environment
- ✓ Maintain control over planting materials and harvest prior to biosafety assessment

CFT APPROVAL PROCESS

- Application- submitted to NBC of the FMENV (December 23, 2008)
- NBC & Biotechnology experts- reviewed the application
- Regulators- interact with the research team

Biosafety requirements

- NBC – scrutinized application, assessed the facilities and verify measures put in place

CFT-site Maruca rearing laboratory

Regulatory

- ✓ One year permit for CFT granted by the Biosafety office- March 2009
- ✓ Outcomes of the first CFT necessitated the extension to 2013

IMPORT PERMIT-NAQS

IMPORT PERMIT PROCESSED AND GRANTED- NAQS

Checked the package Verified the content of the package

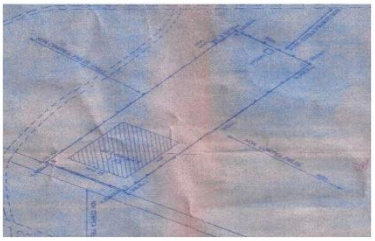
SEED STORE

Seeds Verified, Recorded and Kept Before Planting

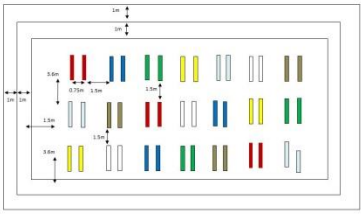
Verification completed Seed temporarily stored

Moving from Laboratory to Field

CFT-SITE PLAN



FIELD LAY OUT



CAN YOU SEE THE DIFFERENCE?

ISOLATION DISTANCE MONITORING

- ✓ Monitoring the surrounding field done
  - Before planting
  - Growing period on weekly basis
- ✓ Aim- to destroy all sexually compatible plants to prevent- Gene flow

Volunteer plant

Removed

Yield and Damage- Assessment

✓Yield potential-

✓Harvesting & threshing - manually by hand

✓ Insect damage- attempts to penetrate the wall of the pods and seeds assessed

TRANSPORTATION

✓Plant materials that need further investigation are:

- Labeled
- Packaged- secure multiple containers to prevent loss/damage in case of accident

Primary

Secondary

Tertiary

DISPOSAL OF MATERIAL

- All plant materials that do not need further investigation - disposed

OUT COMES

✓AFTER 3-YEARS OF FIELD EXPERIMENT

-----One of the test materials indicates:

- Exceptional – resistance to maruca
- 20 fold yield increase compared to untransformed cowpea
- What next?????

TRANSFER- RESISTANCE GENE-

ACKNOWLEDGEMENT

Research team

NGICA

Biotechnology for Agriculture in Nigeria

Dr Christian Fatokun – Deputy Director, International Institute for Tropical Agriculture, Ibadan, Nigeria

IITA

Biotechnology for Agriculture in Nigeria

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Biotechnology:- Manipulation of biological elements (plant or animal) to develop new products

***Fermentation*: Production of alcohol from sorghum or sugar cane, akanmu from corn etc.**

***Tissue Culture*: Small plant parts placed on nutrient media containing hormones.**

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***Genomics*: Sequences of nucleotides that make up DNA.**

***Modern Biotechnology*;**
Genetic engineering;
R-DNA technology;

Transformation:- A gene is taken from one organism and inserted in another to give the latter the desired trait.

- **Transgenic is produced. :-**

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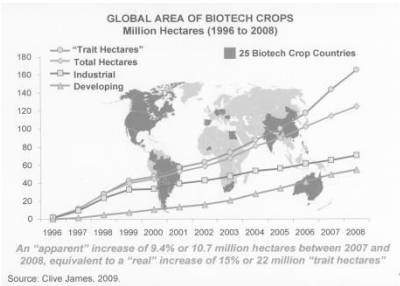

Source: Clive James, 2009.

IITA

According to International Service for the Acquisition of Agric-biotech Applications – ISAAA in 2011

- **GM adoption was by 16.7 million farmers**
- **On 160 million hectares**
- **In 29 countries: 10 developed**
  : 19 developing

- **In Africa on 2.5 million hectares**
- ***Crops:***

- **Corn**
- **Soybean**
- **Cotton**
- **Canola**

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In Nigeria Agriculture is characterized by:
Low Productivity

- **Small Holdings, subsistence**
- **Poor soils**
- **Mercy of the rains**
- **Limited access to irrigation facilities**
- **Unimproved planting materials**
- **Diseases, Pests, Drought, Heat, Weeds**
- **Storage and Transportation**
- **Inadequate funds**
- **Limited mechanisation (Inadequate tools)**
- **Ageing farming population**

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Major Food Crops

Tubers:

- **Cassava, Yams, Potatoes, Cocoyam**

Grains:

- **Maize, Rice, Sorghum, Millet, Cowpea, Soybean, Bambara, Pigeonpea, Phaseolus beans**

Plantains/Bananas

Fruits and vegetables

Oil Palm/ Coconut/ Groundnut

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Yam production and marketing

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At IITA tissue culture is being applied to facilitate crop improvement

In plantain/banana:- Black sigatoka disease

IITA

Plantain/Banana

Constraints:- Black sigatoka - 40% yld loss;

- **Banana streak virus – 60% yld loss;**
- **Weevils**
- **Nematodes**
- **Fusarium wilt/ Bacterial wilt**
- **Banana die back virus**

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Embryo rescue for hybrid seed

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Cowpea – called beans in Nigeria

- **Mostly grown and consumed in SSA**
- **High protein content in grains up to 25%;**
- **Hence cheap source of protein;**
- **Approx 3.3 m tonnes on 9.8 m ha;**
- **Average grain yield is 600 kg/ha;**
- **Potential grain yield is upto 2.0 t/ha.**

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Cowpea

Biotic contsraints:– Aphids;
- Flower bud thrips;
- Legume pod borer;
- Pod sucking bugs;
- Grain Weevil;
- Bacterial blight;
- Fusarium wilt;
- *Striga gesnerioides*

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An intractable pest is *Maruca vitrata*

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- Screened over 10,000 accessions for resistance;
- Led to efforts at developing GM cowpea with *Bt* gene;
- Cowpea with *Bt* gene now available.

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- *Bt* cowpea has been evaluated under confined field trials
- *Bt* gene efficacious against *Maruca vitrata*
- Further evaluations in B. Faso and Ghana
- Plans to transfer *Bt* gene to good genetic background
- Marker assisted selection to facilitate

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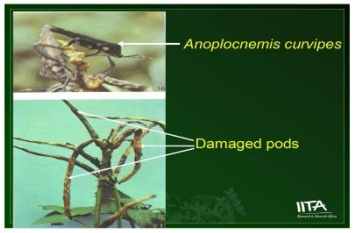
Pod sucking bugs



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Benefits of Biotechnology

- Rapid multiplication of new clones/varieties
- Prolonging Shelf Life of Fruits, Vegetables and Flowers
- Extend Crop Area and Season
  - Stress Tolerance - Drought, Acidity, Salinity, Heat, Water logging
- More Nutritious Food
- Healthy Produce, Low Toxins
- Pharmaceutical Proteins
- Clean Up of Environment
- Industrial Products
- Value-Added Products

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Improved food safety

Improving Cassava for Nutrition, Health and Sustainable Development - BioCassava Plus, a multi-disciplinary team of scientist- Ohio State University, USA and DDPSC - Acyanogenic cassava

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Food fortification

- Rice for High Beta Carotene, Vitamin E and Enhanced Iron and Zinc bioavailability - ProVitaMinRice Consortium, Albert-Ladwigs-Universität Freiburg, Germany

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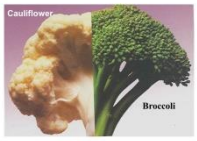

Both are derived from same ancestor, *Brassica oleracea*. They were devoped over several years and generations through breeding and selection. With bioengineering can be made more precisely over a short period of time. (Bradford et al. 2004)

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	Recombinant technology	Conventional technology
Gene source	Unlimited	Usually limited to relatives within species; could also between genera
	Usually one or a few known genes	Usually many blocks of genes of unknown identity
	Gene flow can be monitored during subsequent generations	Individual gene flow can be monitored
Location of genes	Random into recipient genome	Normally – but not always – genes remain in sites in which they evolved

Source: Boulter, 1995

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Marker assisted breeding using DNA in cassava and cowpea

Cowpea: Aphid resistance

- Bacterial blight resistance
- Striga resistance
- Drought tolerance

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Is Nigeria prepared for GMOs? Some challenges

Research infrastructure:-

- Few trained scientists in molecular biology
- Only few laboratories exist with facilities for biotech research – SHESTCO was to be a flagship
- Virtually all needed reagents have to be imported
- Good news is possibility for outsourcing some services

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Is Nigeria prepared for GMOs? Some challenges

- Complex crop combinations in farmers' fields make certain GMO crops unattractive
- Only a few GM crops are available for planting
- Likely increase in cost of procuring seeds for planting
- Limited access to inputs for more productive farming
- Insufficient information on GMOs
- Fear of consumers attitude to produce
- IPR issues
- Biosafety regulations

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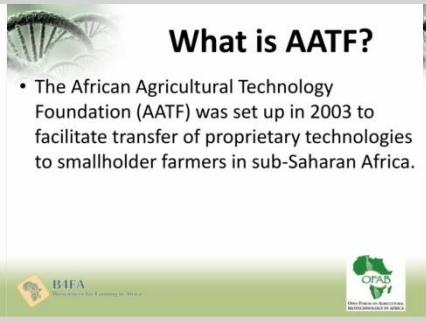
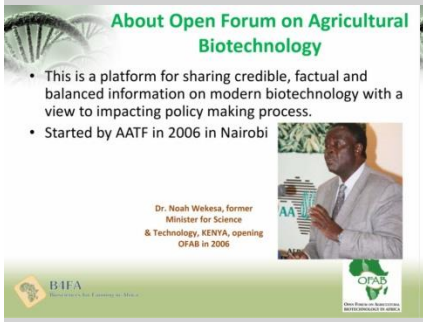
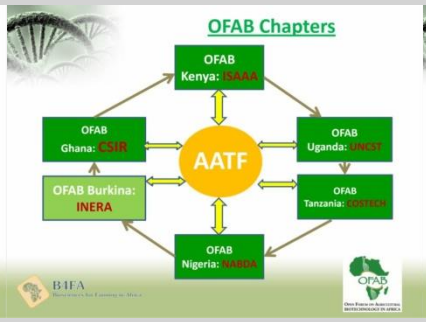
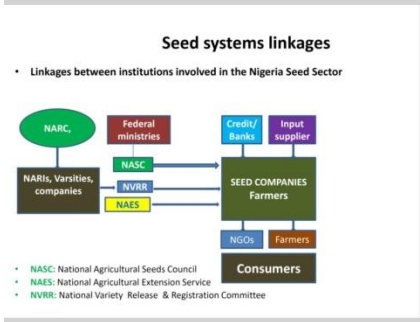
Commercial Dimensions of Agricultural Biotechnology

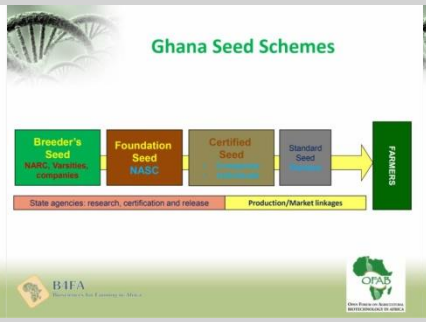
Daniel Otunge – African Agricultural Technology Foundation, Nairobi











Role of regional organizations

These provide funding for research, technology transfer and also facilitate better regulatory environment

- NEPAD centers of excellence
- CORAF/WECARD (West & Central African Council for Agricultural Research & Development)
- ECOWAS (Economic Community of West African States)
- AGRA (Alliance for the Green Revolution in Africa)
- AATF
- FARA (Forum for Agricultural Research in Africa)

SEED REGULATORY ENVIRONMENT

Seed regulation in Nigeria

- Nigeria has policies, rules, regulations and laws, which govern seed breeding standards, seed variety testing, variety release, seed promotion, dissemination, marketing, quality control, conflict resolution, import and export.
- Varieties are release through the **National Variety Registration and Release Committee.**
- The committee should assist in promotion of newly released varieties

Seed regulation in Nigeria

The following are the key regulatory documents journalists should read to understand the regulatory situation:

- ✓ National Agricultural Seeds Decree (No 72 of 1992): obsolete
- ✓ National Agricultural Seeds Act (new)
- ✓ National Harmonized Seed Rules and Regulations
- ✓ Nigerian Minimum Seed Certification Standards
- ✓ Seed Certification Manual
- ✓ Seed Testing manual
- ✓ Seed Law Enforcement Manual
- ✓ **Biosafety Law: *Still awaiting presidential assent!***

The new body to implement the act is:

- ➢ **National Agricultural Seeds Council of Nigeria** (NASC) under the Federal Ministry of Agriculture and Rural Development

Regulatory environment

There is need to guard against bad governance of the seed sector if it is to flourish

Overregulation:

Use of other inputs

Use of other inputs like fertilizer is still very low in Nigeria :

- Inputs are very expensive due to taxes
- Not availability,
- Poverty

Hence interventions by:

- **Seed companies,**
- **Relief agencies,**
- **Governments (e.g. e-pocket fertilizer 50:50)**
- **NGOs (e.g. AGRA, IFDC)**
- **Churches**

HOW SEEDS REACH FARMERS

Role of seed companies

- The seed companies in Nigeria are increasingly becoming the central players in production and distribution of seeds to farmers.
- They reach farmers through:
  - ➢ Agro-dealer networks
  - ➢ Demonstration plots
  - ➢ Sales and marketing agents
  - ➢ Promotion (not adequately done)
  - ➢ Media
  - ➢ Farmer field days
  - ➢ Exhibitions

Companies have failed to play above roles effectively, leading to lack of awareness of availability and benefits of certified quality seeds.

Role of extension service:

- Government extension staff are responsible for agriculture extension
- However, generally the extension service is:
  - ➢ **Ineffective**
  - ➢ **inefficient**
  - ➢ **Underfunded**
  - ➢ **Understaffed**
  - ➢ **Corrupt** (stories of staff using motorcycles for private business)

Role of information:

Sources of information on new seed varieties include:

- Seed companies The mass media
- agro-dealers,
- NGOs
- Extension service
- Use of ICTs
- Farmer associations
- Exhibitions

Farmer level promotion

This is mainly done by:

- ➢ Seed companies (sales agents)
- ➢ Industry association (SEEDAN)
- ➢ Traditional meetings
- ➢ Demo farms
- ➢ Farmer field schools
- ➢ IEC materials, etc
- ➢ Extension service
- ➢ Farmer Groups *(e.g. All Farmers Association of Nigeria)*
- ➢ NGOs, (AATF, AGRA, ISAAA, World Vision, Action Aid, Oxfarm, among others)

(SEEDAN: Seed Development Association of Nigeria)

Role of AFSTA:

- The African Seed Trade Association is an industry body formed to promote trade in quality seeds and innovative agricultural technologies
- It has about 26 National Seed Trade Associations and 70 member seed companies spread across Africa.
- In Ghana it operates through SEEDAN.
- Main programs include: ASIESA, WASA,COMRAP and Biotech awareness.

Role of AFSTA:

- The national associations partner with government departments and seed companies to create channels through which farmers can access seeds more easily.
- Organizes annual congress where farmers get information at exhibition booths.

Congress: 5-8 March 2013

AFSTA Congress 2013 MAURITIUS

Role of AGRA:

- The AGRA's Program for African's Seed Systems (PASS) is perhaps the most ambitious and well coordinator effort to improve supply of seeds to farmers in Africa.
- PASS aims to increase Africa's capacity to breed, produce and deploy quality seeds to farmers

Dr Joe Dvries, PASS Director

THE STATUS OF PLANT INTELLECTUAL PROPERTY RIGHTS (IPRS) IN Nigeria

What is IPR

- IPRs are legal instruments used to protect creations of the mind which have commercial value, such as inventions, e.g. the Gene Gun.
- They grant exclusive rights to the breeder against unauthorized access
- New plant varieties are protected under:
  - ✓ **TRIPS** (Trade-Related Aspects of IPRs) **Agreement**
  - ✓ **UPOV** (International Convention for the Protection of New Varieties of Plants
  - ✓ **ARIPO** (African Regional Intellectual Property Organization) .

B4FA

IPRs

- Few countries in the sub-region protect Plant Breeder's Rights.
- This has negative impacts on availability of quality breeder's seeds.

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Nigeria IPRs situation

- In Nigeria the Patent and Designs Act, Chapter 344 of 1990 prescribes products eligible for patent right.
- Section 1, Sub-section (4) excludes plant or animal varieties from patenting

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Nigeria IPRs situation

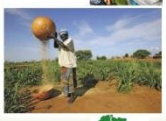
- Reforms are under way: the **Intellectual Property Commission Bill (IPCOM)** that is fully compatible with the TRIPS Agreement has been presented to the National Assembly for debate.
- It is critical to protect **breeder's rights** if plant breeding in Nigeria is to go a notch higher and be able to satisfy national needs.

B4FA

Challenges facing adoption of improved seeds

The following are some of the major challenges facing the seed systems in Nigeria:

- Lack of awareness of new seeds and their benefits
- Negative attitudes towards **'agric'** seeds
- Weak seed market systems
- Moribund extension service
- Weak enforcement of regulations
- Counterfeiting
- Subsistence mentality
- Mistrust of seed companies by farmers



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THANK YOU

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