



**Food Security and Biotechnology in Africa**



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# **MODULE 5**

## **ETHICS AND WORLD VIEWS IN RELATION TO BIOTECHNOLOGY**

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# Course Structure/ Module Content

- Unit 1; Overview of the subject of Ethics
- **Unit 2; Diversity of socio-cultural world-views and their impacts on the uptake of biotech**
- Unit 3; Ethical issues in the uptake of Biotech
- Unit 4; Case Studies of the influence of ethical concerns in the use /adoption of biotech

Total of 20 hours

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# Overview / Background to Module 5

- As an important tool for guaranteeing food security, biotechnology comes with ethical challenges
  - Biotech processes & products elicit considerable ethical questions, arguments & concerns
  - These ethical concerns are numerous because of different socio-cultural & religious world views
- Understanding the subject of ethics related to biotechnology will aid quality decision making
- Understanding the ethical concerns & strategies to manage them are essential for uptake of biotech.



# Aim of Module 5

To expose the students to ethical considerations and prevailing world views that influence disposition to, and uptake of biotechnology in different countries of the world



## Unit 2

# Diversity of Socio-cultural World-Views and their impacts on the uptake of Biotech(4h).

### Lecture /Discussion 1

Perception of various religious groups; Christians,  
Muslims, African Traditional on Biotech (1h/20m).

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# Unit 2: Lecture/Discussion 1; (1hr/20m)

## Perception of various religious groups; Christians, Muslims, African Traditional on Biotech.

Students are expected to consider and understand

- How different Christian groups perceive biotechnology
- How Muslims (different authorities) perceive biotechnology
- How African Traditional Beliefs perceive biotechnology
- Views from other Religions as they may affect biotech
- The way forward



# Ethics in Agriculture & Innovations



[www.Eco-imperialism.com](http://www.Eco-imperialism.com)

- Agriculture has been topic of philosophical, religious & political reflection (who is allowed to grow what?)
- Biotech is a precise and powerful tool to produce crops & animals with desired traits that aim to benefit farmers and consumers.
- As for all new technologies, biotech has instigated worldwide debate as a result of mixed messages from various people and religions
- Ethical concerns have been in the front burners of biotech debate which has polarised sectors across societies and cultures
- Since 2000, ethical considerations have become central in debates regarding biotech.
  - Council of Europe Parliamentary Assembly
  - Royal Society UK



# Agricultural Ethics

- Ethics related to agriculture is necessary to
  - determine right and wrong,
  - determine moral standards
  - justify singular or collective acts;
  - determine responsibility & justice
- Ethics in agricultural biotech encompass value judgments that cover production, processing, distribution of foods & products.
  - The FAO asserts that ethical values determine its reason for being; these being the values for food, enhanced well-being, human health, natural resources, and nature
- The goal is to “discover/ develop clear, non-contradictory, comprehensive, and universal standards for judging right and wrong actions and policies.” (CAST, 2005)





# Ethical issues in agricultural biotech....

Many of the ethical issues that form part of the biotech debate can apply also to food and agricultural systems . These include

## *Playing God*

- Genetic modification is said to involve human intervention into creation and hence, is an unnatural act;
- biotech is “so intrusive to life processes that they amount to a form of disrespect for humanity’s proper relationship to nature, a form of playing God”;



- Some religions ascribe a particular “essence” to each living organism and hence, connect the concept of gene with the idea of essence;
- ...biotech disrupts natural order and violates the limits of what humans are ethically permitted to do
- **Alternative views stress that science and progress are good and God-given faculties to help mankind support life and better manage the environment**

**In some of the considerations- biotech is treated as synonymous with GE**

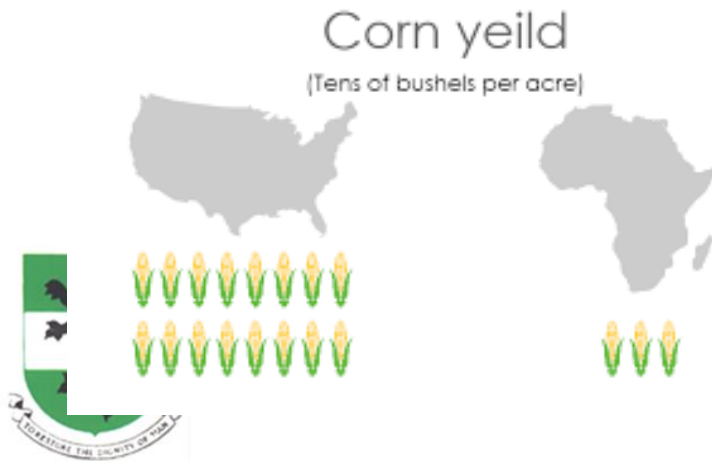


# ...Ethical issues in agricultural biotech...

## *General Welfare and Sustainability*

- Does the technology consider the pursuit of the greatest good together with the concept of sustainability for farmers and the environment?
  - Matters related to choice and food sovereignty are central to sustainability question
  - Technology can provide more food but it should not be detrimental to the environment or human health or disruptive of traditional systems
  - It is also an ethical issue if food that can provide more and better nutrition is not made available to those who need it most on account of belief systems

**Not to use a technology that has potential to improve the quality of lives of people is also a moral issue!**



- As an environmental issue, questions relate to concerns regarding environmental protection, sustainable use of biodiversity, economic growth and social equity
  - Will GM lead to loss of biodiversity?

# ....Ethical issues in agricultural biotech

## *Distribution of Benefits and Burdens*

- Developing countries are concerned about just distribution.
  - Will biotech further impoverish the poor?
  - Will the products of biotech be able to provide for those who really need them?
  - Will GM or biotech generate wealth for the society as a whole
- A technology's ability to increase or decrease the gap between the rich and poor renders it an ethical issue.
  - How will biotech fare here?
  - Products of modern biotech are introduced by private companies that have obligations to make profits (& by extension no obligation to protect the poor). True or false? How? Why?
    - Right to food and right of choice; Multinational vs. peasant farmers
  - Will the technology render subsistent farmers unemployed? Damage traditional ways of life?
- Other concerns relate to control and exploitation of genetic resources, consumers' choice and use of GM animals



# Religion, Culture and Agric. Biotech....

Catholic Church, Islam and Traditional practices-

- Islam supports beneficial scientific innovations to address food security; provided that the GM food meets the general criterion of *halalan tayyiba* (shariah permissible & of good quality)
  - In Malaysia, there is a fatwa that GM foods with DNA from pigs are haram for Muslims
- The Catholic Church recognises that Biotech has powerful social, economic and political impact; expects it should be used with prudence, objectivity & responsibility.
  - Modifying genes of plants & animals is theologically acceptable.
  - **It is "easy to say no to GM food if your stomach is full"** - Velasio De Paolis, (Pontifical Urban University)
    - This position seems to capture the attitude of the church as an institution, to GM foods



# .....Religion, Culture and Agric. Biotech

- The input of traditional practices to ethical discussions related to agriculture in Sub Saharan Africa is complicated.
  - Women are important farmers but not as important in decision making. Addressing this gap can be important for biotech uptake.
  - It is important that biotech fits traditional farming practices;
  - traditional seed systems, (selection, breeding, sharing & storage) are important and may adversely affect uptake if the new tech requires a change
  - Processing and storage of produce revolve around traditional procedures and the role of biotech in modifying these needs to be clarified



# .....Religion, Culture and Agric. Biotech

- Will farmers enjoy free entry - free exit or is adoption of biotech seeds and processes an irreversible choice?
  - What if a farmer changes his mind about biotech crop after losing traditional varieties?
- Will the food produced be of comparable quality and storability?
- Will the new tech offer sustainable benefit in yield, health outcomes, environment and other intangible?
- What about use of biotech derived crops and animals in traditional worship? **Broiler chicken is not sacrificed to the gods?**
  - These concerns are at the foundation of cultural response to the new technology in Sub Saharan Africa and need to be properly situated for ease of adoption.



# Views from other Religions

- Judaism:
  - One perspective emphasizes that humanity can "partner with God in the perfection of everything in the world,"
    - therefore accepts biotechnology to save and prolong human life as well as increase the quality or quantity of the world's food supply
  - Another perspective holds that GM is a violation of [Kilayim](#), the mixed breeding of crops or livestock because God made "distinctions in the natural world"
  - Food made from non kosher animals are likely to be non-kosher? But what about gene transfers?





# Moving Forward in Ethical issues- FAO.....

The FAO recommends that in dealing with ethical challenges, states/ corporations & organisations should:

- Create mechanisms to balance interests and resolve conflicts
- Support & encourage broad stakeholder participation in policies, programs, & projects
- Encourage individuals, communities and nations to engage in dialogue, and ultimately, to do what is ethical
- Develop & disseminate widely the information and analyses necessary to make wise and ethical decisions





# .....Moving Forward in Ethical issues- FAO

- Ensure that decision-making processes in international food and agriculture policy are well understood & transparent
- Foster the use of science & technology in support of a more just and equitable food and agriculture system
- Ensure that programs, policies, standards and decisions always take ethical considerations into account so as to lead to enhanced well-being & environmental protection
- Develop codes of ethical conduct where they do not currently exist.
- Periodically review ethical commitments & determine whether or not they are appropriate, in the light of new knowledge & changes



# Concluding.....

- Every stakeholder has a responsibility to strive to understand what is at stake and to contribute to resolution of ethical challenges
- A good understanding of belief and doctrinal positions will aid coexistence within and across societies and reduce conflict by encouraging respect for diverse positions
- It is understandable that even a very sound technology may meet resistance ***if it is poorly communicated***
  - Biotech is currently poorly communicated in Africa and this has negatively impacted perception & uptake.
  - Poor knowledge is widespread amongst both populace and policy makers; this should be addressed using appropriate educational policies and processes

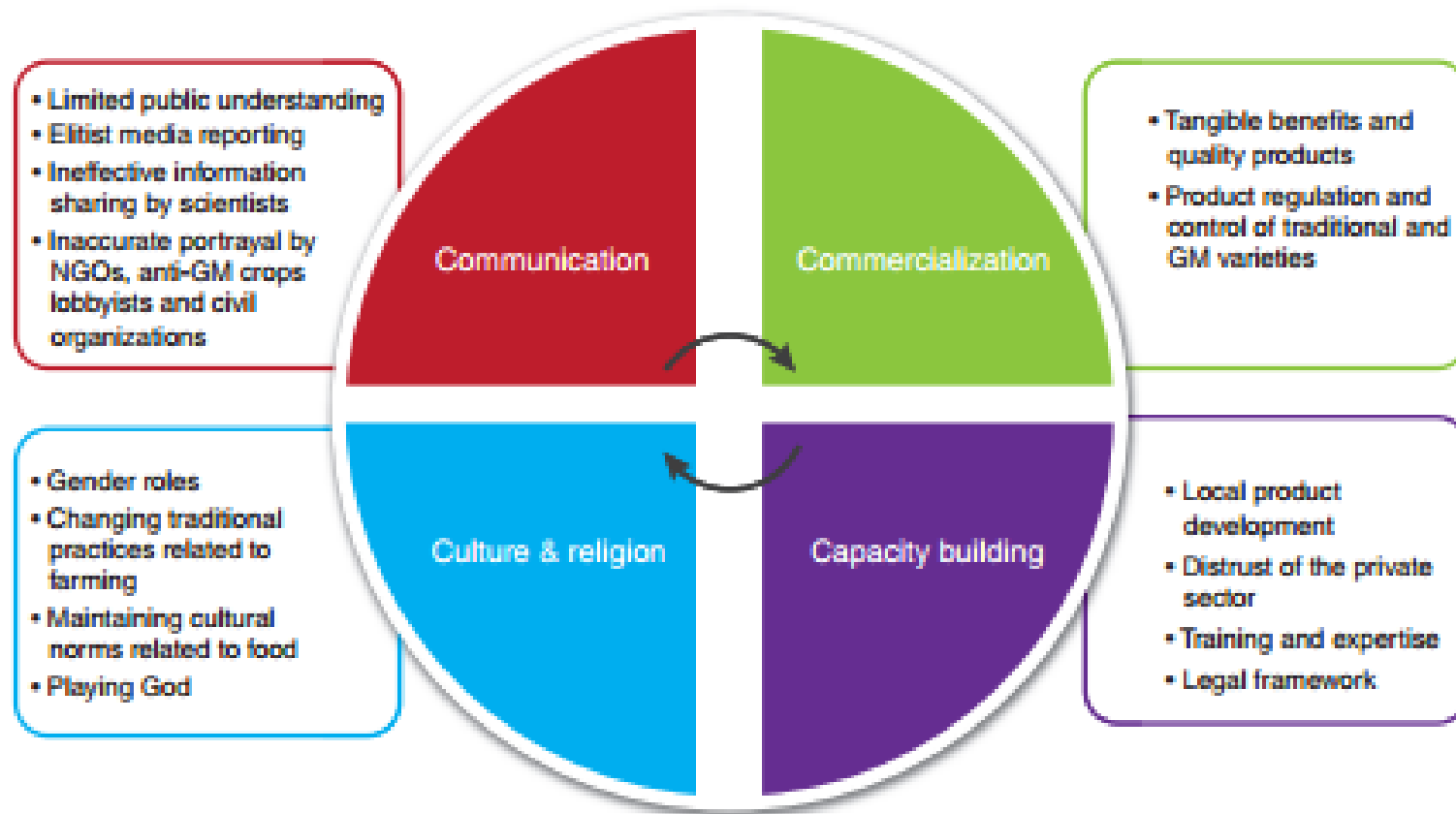


# .....Concluding

- A good understanding of ethics will help to determine what information is needed by society and how to deal with different opinions.
- Negotiation of positions need to be based on trust to enable stakeholders to participate in decision making
- Capacity Building across the stakeholder range will enable clearer understanding and aid adoption of technologies.
  - This is critical for policy makers, researchers & communicators to enable local ownership and identity.
- Local ownership is critical for trust building. People are likely to trust home grown technologies where they can identify with sources; as against external sources that are perceived as imposed.
  - If biotech is home grown local people are likely to look at it as their own



# Factors in adoption of Agric. Biotech-Sub Sahara Africa



Ezezika et al 2012 Nature Biotech 30; 38-40



## Unit 2

# Diversity of Socio-cultural World-Views and their impacts on the uptake of Biotech(4h).

### Lecture /Discussion 2

Traditional beliefs systems that may impact  
biotech uptake and adoption (1h/20m).

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## Unit 2: Lecture/GD 2; (1hr/20m)

# Traditional beliefs systems that may impact biotech uptake and adoption

Students are expected to appreciate the impact of the following practices on agricultural innovation (biotechnology adoption) in Africa:

- Seed systems

### Characteristics of different seed systems

- Variety selection
- Seed production
- Seed dissemination, marketing and procurement
- Advantages and constraints to the different seed systems
  - Regulatory frameworks

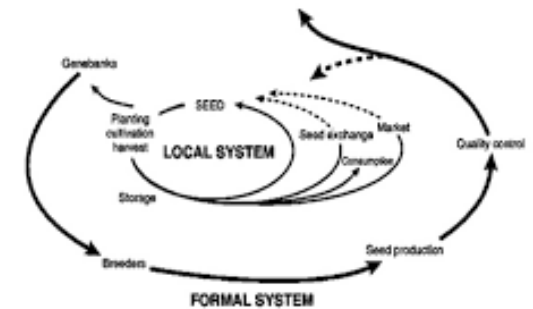


# Background to seed systems

- Peasants farmers are the main contributors to biodiversity and the original source of all current improved seeds
- They preserve, renew and select plant varieties and animal breeds within their social, economic and cultural systems
- They do not see themselves as owning living things. Their rights are considered as collective and relate to all matter involving the production of food and free access to genetic resources
- The seeds produced and the informal exchange of those seeds lie at the heart of their contribution to biodiversity
- In time some of these seeds have been standardised, improved & distributed through more formal channels



## AFRICA SEED SYSTEMS



Gitu, 2015



# Background to seed systems

- Developments in genetic engineering have led seed manufacturers to focus more on genes than plants.
  - Modified genes are patented, which privatizes and hampers distribution. These seeds are available only through these corporates, (a third channels driven by biotech companies). **This is at the root of the biotech challenge**
- Peasants and smallholders in Africa access seeds mostly through traditional routes and more recently, in a limited way through more formal routes.





# Informal or Traditional seed systems...

- Traditional seeds are selected and preserved in situ in the conditions in which the farmer grows his crops.
  - Seed related activities are integrated and locally organised
  - Seeds produced by the farmers are disseminated by the farmers; directly from their own harvest, through barter, among friends, neighbours & relatives & through local grain markets / traders.
- These activities are part of grain production and not organised as discrete or independent event.
  - This is particularly the case in vegetative propagated crops such as cassava in which cuttings are obtained free from family, friends, acquaintances or strangers.



# ..Informal or Traditional seed systems...

- The local grain market is a growth point that is displacing farmer seed.
  - Local markets bring grains that are sorted and used by farmers for seed.
  - This is different from commercial, formal sector seed which is produced on specialised fields within the framework of a seed business enterprise.
  - This channel has evolved and grown as a dependable source for seeds and good way of pushing out new seeds
  - Quality of seed is ascertained on the basis of word of mouth, opinion of grain dealer or experience of farmer



## ....Informal or Traditional seed systems

- are guided by local technical knowledge and standards (farmer integrity, seed performance & market forces).
- provides most of the seeds (80% to 100%) used by farmers in most of SS- Africa. Cassava cuttings are obtained nearly 100% on the informal seed system
- proponents of the system consider it the best way to ensure crop resilience and agro-biodiversity and see the formal system as a threat
  - It is a cheap
  - It spreads easily
  - It is not subject to tight regulation of formal system
  - It can sustain peasant form of subsistence agriculture



# The formal Seed Systems....

This can be characterised by a clear chain of activities

- The first step is usually plant breeding and improvement for formal release.
  - Where this exists, it is driven by maize (due to vast need, large difference in yield between hybrid & tradition varieties, rapid loss of genetic quality of hybrids under farmer seed management & technical complexity of production)
- Variety identity, purity and physical, physiological and phyto-sanitary quality are maintained through regulations and breeding
- Seed marketing takes place through official seed outlets (and via national /corporate agric research systems) subject to applicable regulations.



# .....the formal Seed Systems

- In this system, seed is distinguished from grain.
- It is important when seed is used to grow crops for commercial purposes (e.g., export or further industrial processing); uniformity and high quality of product has to be guaranteed
- Proponent of the formal system consider it a prerequisite for sustained crop productivity.
  - it is commercially driven with small contribution (less than 20% yet) in Africa seed market

In much of SS- Africa the informal and formal systems co-exist; and in between, there is an integrated system that draws from elements of both systems.



# Integrated seed system.....

Integrated seed systems improve the local supply system by borrowing technologies and improvements from the formal and informal sectors.

- Focus is on improving local varieties through breeding and selection and introducing improved seeds from national and international research systems
- This system makes use of locally improved seeds and seeds from the formal system
- It lies between the informal and the formal, introducing both improved varieties and proven quality local varieties



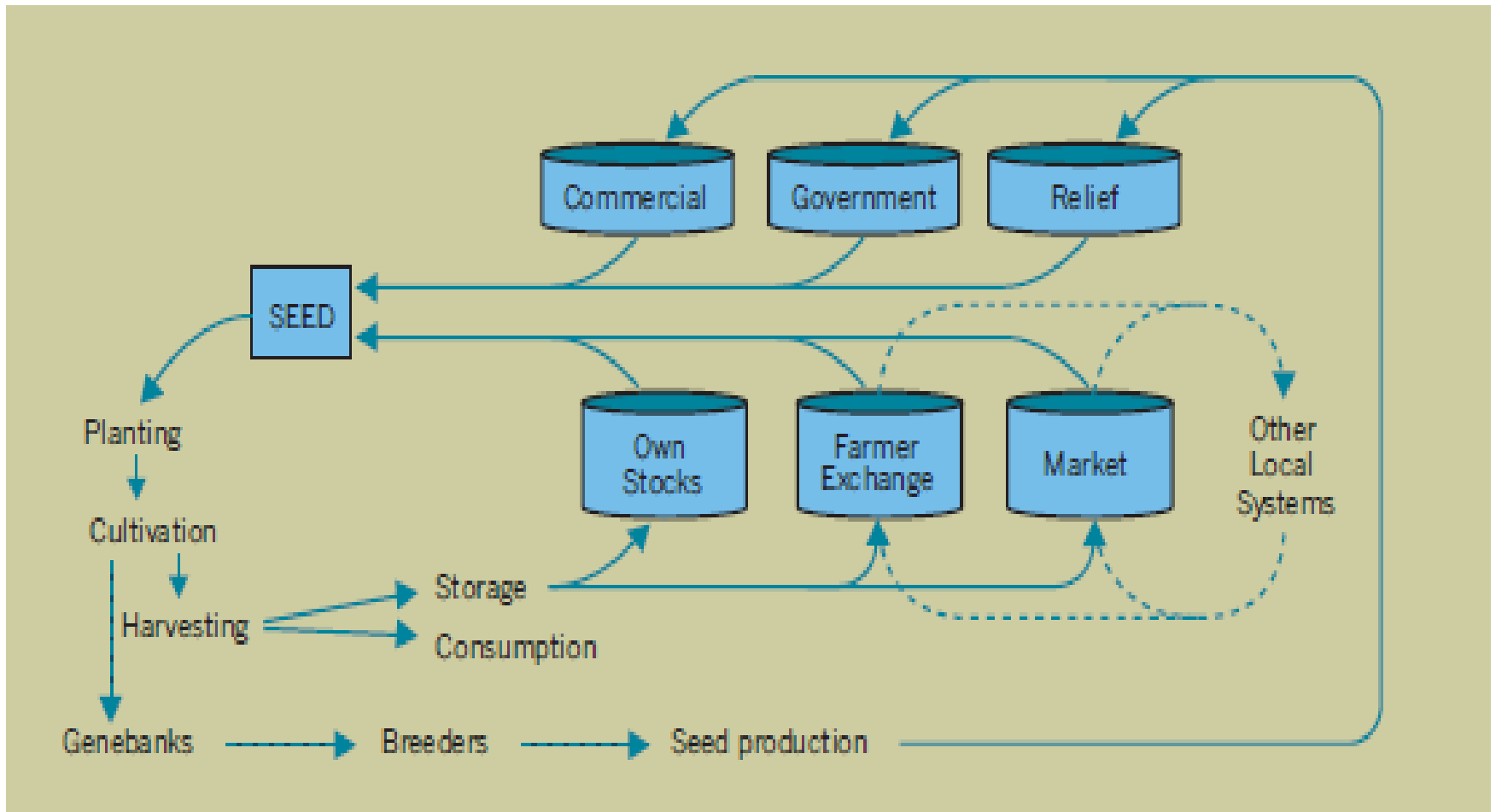


# .....Integrated seed system

Integrated seed systems improve the local supply system by borrowing technologies and improvements from the formal and informal sectors.

- It has contributed to supply of quality planting materials: root/tuber, legumes, pulses, grains and orphan crops that will not feature importantly in the formal and commercial seed system.
- Profit motive is not very strong because of the strong involvement of government and international agricultural centres.
- This system is driving improvement in the informal seed system and together they contribute over 80% of the needed planting materials in SS-Africa





Channels through which farmers source seed are depicted by cylinders. Own seed stock, exchange with others and purchase through local seed/ grain markets constitute informal channels. Commercial seed stockist, government research outlets constitute formal channels. Government and relief (represented by international Agric. centres also play in the integrated system (Taken from Practice Brief No. 6; understanding seed systems used by small farmers in Africa)





# Regulatory Frameworks

- Access to seeds is at the bottom of food sovereignty;
- Regulations that seeks to control availability and free access to seeds are to be seen as attempt to regulate food choices.



The challenge of regulation is to evolve a seed system that guarantees food sovereignty while ensuring access to quality and quantity of food needed by all.



IF YOU GIVE SOME-ONE A FISH,		THEY EAT FOR A DAY.
IF YOU TEACH SOME-ONE TO FISH,		THEY CAN FEED THEMSELVES UNTIL THE WATER IS CONTAMINATED OR THE SHORELINE IS SEIZED FOR DEVELOPMENT.
IF YOU SUPPORT A SOCIAL MOVEMENT,		THEN WHATEVER THE CHALLENGE, THEY CAN ORGANIZE WITH THEIR PEERS AND STAND UP FOR THEIR INTERESTS.



# Regulatory Frameworks

Food sovereignty may be guaranteed by farmer seed independence; keeping seed exchanges between farmers outside seed market controlling regulations thus:

- protect seeds as part of our common heritage,
- recognize the rights of peasants to develop (in an inclusive manner involving public or private research), use and freely exchange seeds
- generalized marketing of seeds adapted for independent traditional farming, for small-scale & local supply chains
- rebuild & expand local & traditional farmer managed seed systems
- involve peasants' organizations in defining and implementing the rules & laws governing access to genetic resources

Governments have responsibility to protect farmers & evolve regulatory system that guarantee farmer rights and protect investment etc. on the basis of AU model concerned with access to and, protection of the rights of local communities over their biological resource, knowledge & practice



**Food Sovereignty Assembly**  
Gaining control of our food

*Students are encouraged to read and compare UPOV 1978 and UPOV 1991 as regulatory frameworks*

# Existing Regulatory system/ concluding...

International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) entrusts governments with the protection of farmers' rights:

- Rights to save, use, exchange and sell farm-saved seeds and propagating material
- Right to participate in decision-making regarding the use of plant genetic resources
- Right to fair and equitable sharing of the benefits arising from their use

A number of other legal frameworks also exist to regulate seed availability such as:

- *International Union for the Protection of New Varieties* (UPOV 1978 & 1991),
- *Trade Related Aspects of Intellectual Property* (TRIPS) and
- *World Intellectual Property Organisation* (WIPO)

*These may have different attitudes to the regulation envisaged in the ITPGRFA*



## Unit 2

# Diversity of Socio-cultural World-Views and their impacts on the uptake of Biotech(4h).

Lecture /Discussion 3

African Traditional Harvest Processing  
Techniques (1h/20m).

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# Unit 2: Lecture/GD 3; (1hr/20m) African Traditional Harvest Processing Techniques

Threshing  
Winnowing  
Roasting  
Smoke drying  
Fermentation  
Etc.

Students are expected to appreciate the traditional practices, and how their use by communities may impact adoption of agricultural innovation (including biotech) in Africa



# Introduction

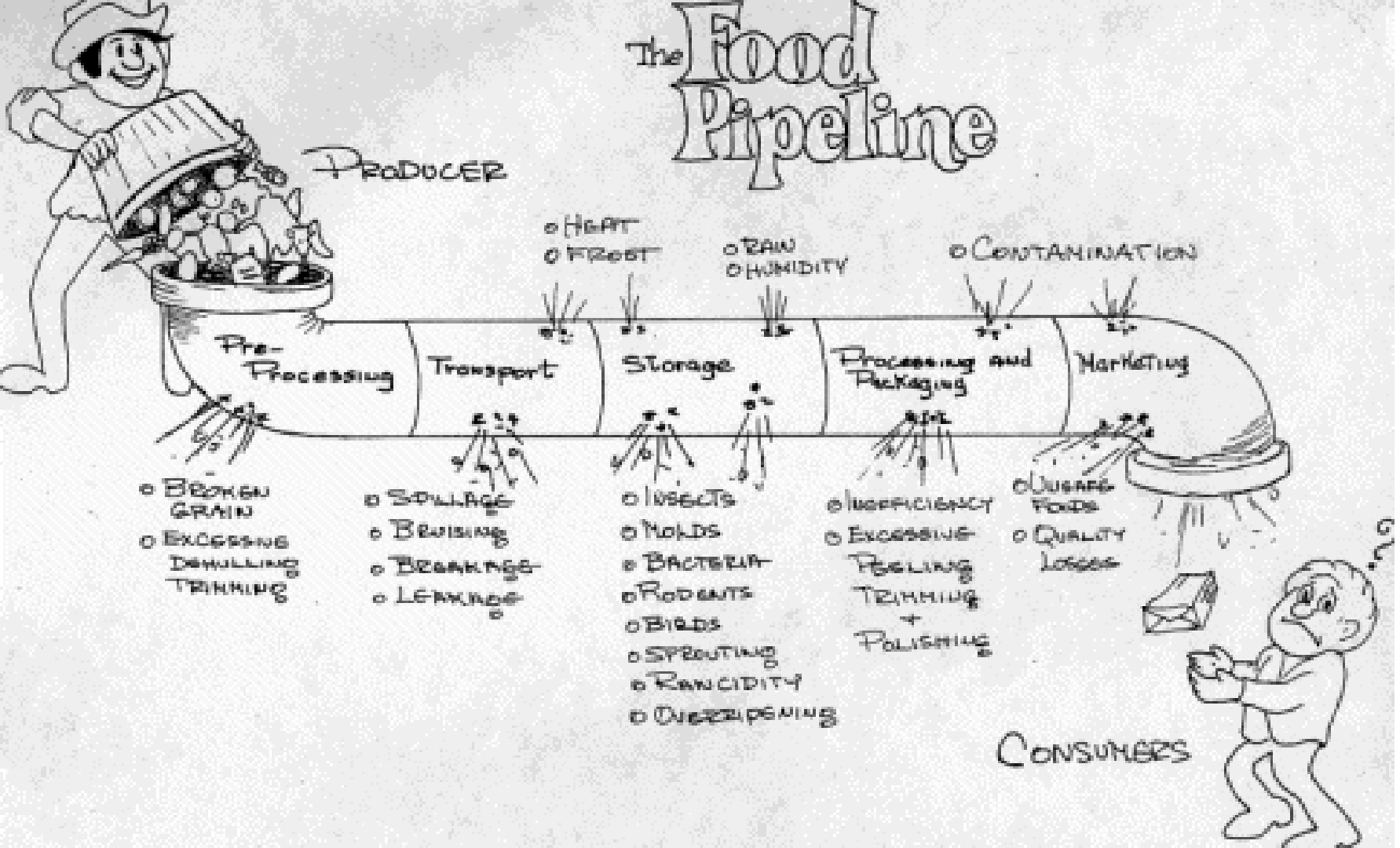
- In most ecological zones in Africa, crop production is seasonal, rain-fed
  - Household food security requires year-round, sustainable food supply.
- Adequate food systems are needed, along with efficient processing & distribution to ensure equitable & adequate supplies
- Agricultural produce are processed differently in different communities depending on whether it is grain, legume, root/tuber, vegetable, fruit or animal (including aquaculture) product.
- Production and post-harvest losses (up to 40% loss) are drivers in processing and post-harvest handling innovations



# Some traditional food processing techniques

Operation	Objectives	Features
Threshing	To detach grain kernel from panicle	Carried out by trampling on the grain or beating it with sticks. Labour -intensive, inefficient, low capacity may be community based
Winnowing	To separate the chaff from the grain.	Done by throwing the grain into the air. Labour intensive, low capacity, inefficient
Milling	To separate the bran and germ from endosperm	Carried out by pounding in a mortar with pestle or grinding with stone. Laborious, inefficient, limited capacity. Community mechanised mills may exist
Parboiling (e.g. rice)	To facilitate milling and enrich milled rice	Done by steeping paddy rice in cold or warm water followed by steaming in bags in drums. Limited capacity, poor quality product
Drying	To reduce moisture content and extend shelf life.	Product is spread in a thin layer in the open (roadside, rooftop, packed earth etc.) or over fire. Labour intensive, requires considerable space or energy, poor quality
Fermentation	To extend shelf life, inhibit pathogens, impart desirable sensory qualities, improve nutritional value or digestibility	Natural mostly mixed impure culture fermentation with microbial flora selection; labour intensive; crude processes. Limited capacity, variable quality. Trade is limited due to quality inconsistencies. GMP is absent and most commercial products are obtained by kitchen technologies. Mostly implemented by women (and in specialized instances by men only)





**The food pipeline: Route of post harvest losses of food (after Bourne, 1977, cited by FAO)**

Losses along this pipeline can range from below 10% to over 40% depending on the nature of produce





# Cereals/ Legumes and Pulses.....

Cereal processing in Africa typically follows the following steps

- harvesting;- depends on degree of maturity; Important for success of subsequent operations
- pre-drying in the field; good for successful preservation but increases other risks
- threshing; success increases with dryness of grain prior to harvest; labour intensive
- winnowing; success depend on weather conditions; labour intensive
- Drying (increasingly important in root/ tuber crops, plantains and bananas and meat)



# .....Cereals/ Legumes and Pulses

- storage; mostly done by families at home or on the farm. Communal (cooperative), commercial silos are beginning to operate in many countries.
  - primary processing: cleaning, grinding, etc.
  - secondary processing: baking, frying, cooking, etc.
  - packaging, marketing; utilization by customers

Most of processes are implemented by women;  
innovation policies need to address their peculiarities.

Storage problems may sometimes arise with the introduction of new, high-yielding varieties. Traditional crop varieties may be more resistant to storage pests than improved varieties. Obtaining the benefit promised by new varieties is not a straight forward matter of increased yield as there are new storage challenges



**Winnowing; How Africans hope to feed rapidly growing population and grow the economy!**

Space , time labour and losses to weather changes can be a problem



# Opportunities for post harvest loss reduction

- **Distribution**

- improving communications: ensure that excess stocks in one area reach areas in short supply;
- better trading facilities: more & improved markets and shops, better stock of preserved foods in village shops, more cooperative-type shops.
- promoting equitable distribution of especially nutritious foods, for high need populations-children, elderly and pregnant and lactating women

- **Storage**

- control of pests: rodents; insects; fungi; birds
- protective measures against destructive animals including elephants
- educating people about safe and hygienic home food storage

- **Processing and Packaging**

- Loss control measures targeting this segment of the food pipeline can vary with process requirement and technologies

- **Marketing**

- Loss control needs will depend on the level of processing



# Improving Grain storage

Improving crop storage comes with cultural challenges for peasants because of the need to adjust cultural processes

- Dry grain well before putting it into storage and keep dry.
- Store only clean grain in clean containers; Keep grain cool and protect from large changes in outside temperatures.
- Protect grain from insects and rodents by following the rules for cleanliness and insect/rodent -proof storage.
- Waterproof buildings and containers as much as possible.
- Check grain in storage regularly to make sure it is not infested.
- Proper use of insecticides (herbal & chemical)



Versus



## Root/ Tuber crops; Plantains and Bananas.....

- Highly perishable and accounts for 40% of the energy needs of about 50% of the population of SS- Africa.
- Urbanisation is challenging the supply of these foods due to perishability.
- Improved supply will benefit from minimal processing (e.g., drying) & improvement in transport / supply infrastructure
  - Many control measures applicable to grains/ legumes may also apply



## .....Root/ Tuber crops; Plantains and Bananas

- Perishability is a major constraint to production.
- For those with considerable dormancy (yams, coco-yams and sweet potatoes) storage is carried out by families.
  - Cassava is simply left in the field until needed.
  - In all cases, post harvest losses can be very high- up to 100%
- Processing is mostly by women; their needs have to be considered in process improvement strategies to ensure uptake of innovations.





# Cassava Processing into Gari





# Food Processing

- Foods are processed to improve their digestibility and appeal.
- To extend availability of foods beyond area and season of production
- To provide consumers with diversity, choice & improved nutrition
- The most basic level of processing is preservation, practiced for generations in traditional societies to provide for times of scarcity
- In urban centres, people have access to more convenient commercially processed foods, and many traditional processes are dying out.
  - urbanisation may support acceptance of biotech products
- Village-based processing includes basic transformation activities (eg. milling)
- Processing, (individual or group basis), provides employment for millions of rural people particularly women
  - Cassava to gari; fresh to smoked fish that transform highly perishable commodities to durable ones



# Food processing stages

- Primary processing refers to the immediate post-harvest handling activities.
  - drying,
  - threshing or shelling.
    - Such operations reduce the fibre content and may extend the storage life
- Secondary processing, or transformation, usually involves some alteration in the foodstuff to facilitate subsequent use.
  - Cereal and legume grains may be cleaned, graded, tempered or parboiled, dehulled and polished or split into halves.
  - Tubers may be peeled and sliced and then sun dried.
  - Many grains are ground, pounded or milled and sieved to give various grades of meal or flour
- Tertiary processing involves conversion of uncooked materials into new products and combinations for consumption.



# Adaptation of new food technologies.....

- Capacity to preserve food is related to level of technological development.
- Slow progress in upgrading traditional processes contributes to food insecurity in rural Africa.
- Simple, low-cost, traditional processes are the bedrock of small-scale enterprises crucial to rural development and is driven by women.
- Processing is vital to reducing post-harvest losses and increasing food availability. Growth in this sector has been slow in Africa
- Success in adoption of some new processing techniques suggests ease of adoption of other new technologies if they are properly tailored



# .....Adaptation of new food technologies

- New technologies that grow out of traditional practices have high chance of success; some of these include:
  - mechanization of gari process,
  - production of instant yam flour or flakes,
  - production of soy-ogi, etc.
  - acceptance of yam flour as substitute for pounded yam
- They reduce labour, increase food availability, reduce loss & improve income

