Indigenous Knowledge and Plant Biotechnology: Is a Synthesis Possible?

False Banana in Ethiopia as a Case Study

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Plant Biotechnology for Food Security and Sustainable Agriculture

Genomics and Molecular Biology provide knowledge on the function of living organisms and on the mechanisms by which plants can respond to environmental challenges

1) Assessment of Genetic Variation

↓

Tools for genetic resources evaluation and management

2) Identification of useful genes

↓

Tools for genome-assisted breeding

A HUGE AMOUNT OF INDIGENOUS KNOWLEDGE IS AVAILABLE

Indigenous knowledge is that region-specific knowledge and practices of agriculture, natural resources management human and animal health etc developed by indigenous people applied to maintain and improve their livelihood

IK Characteristics and Importance

- It is a significant portion of mankind global knowledge
- based on experience
- tested over centuries
- adapted to local environment
- dynamic
- a social capital of the poor
- a guide to the sustainable use of natural resources

BUT can be lost forever

- passed orally from one generation to the next
- limited access

FOR MANY CROPS BENEFITS ARE NOT AVAILABLE

ORPHAN CROPS ARE CROPS WHICH HAVE RECEIVED NO ATTENTION BY RESEARCH NETWORKS

Not produced widely around the world

Not significantly traded

Rarely a target of advanced science also because of costs

BUT

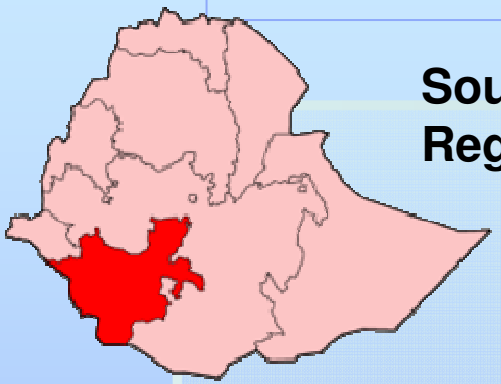
Crucial in regional food security

Often adapted to harsh environments

Characterized by ample genetic resources

Have high cultural value

The Multipurpose False banana (*Ensete ventricosum*) is the staple food for more than 20 million people



Southern Nations, Nationalities, and People's Region. More than 40 different ethnic groups

Only coltivated in Southern Ethiopia
The Ensete-Based Farming System prevented famine in the region
Each household < 1 Ha

The Multipurpose False banana

Human consuption as

- **fleshy underground stem**
- **The starchy pseudo-stem is processed to produce various types of dough**

Other uses

- **Feed for livestock**
- **Fiber for wrapping and roof**

Pictures from Dereje Fekadu

Ethiopian Institute of Agricultural Research

The Ensete-Based Farming System

The system is fragile due to

- climate changes, e.g. high temperature increases diseases
- danger of genetic erosion
- eccessive human load

Scientific knowledge very limited

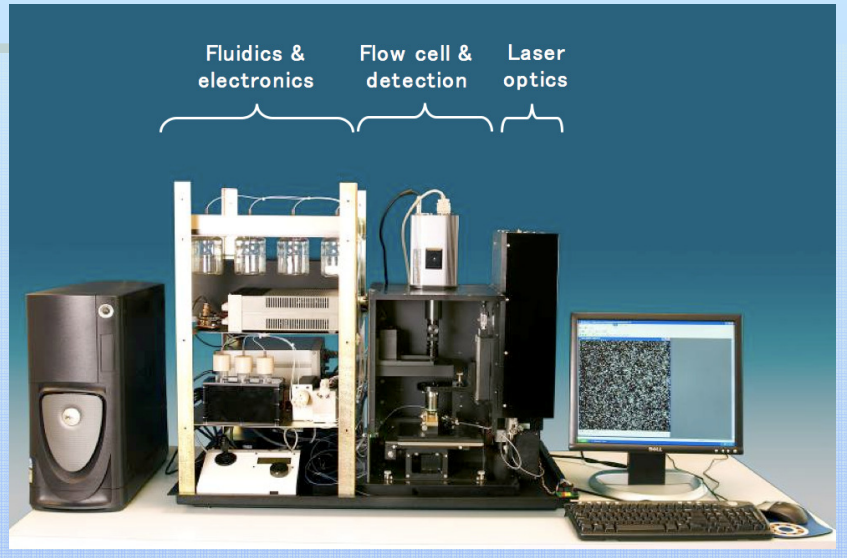
- no genome structure and content
- no genetics or molecular biology
- no characterization of germplasm
- reproductive biology poorly understood
- no breeding
- no information of microbiology or enzymology of transformation
- scant infomation on nutritive values

The Second Genomic Revolution

The so called NEXT-GENERATION SEQUENCING TECHNOLOGY are rivolutionizing biology

DNA Sequencing is no longer the bottle neck.
Genomic info for any crop is FAST and AFFORDABLE
Ex. Year 2000 10,000 US dollars for 10 molecular markers
Year 2011 10,000 US dollars an entire genome

NO LONGER ORPHAN CROP?



Tens of millions of sequences per run

Archive for the 'Funding' Category:

Crops for the Future

Supported by DFID

US$40 million project for sequencing genomes of African orphan crops announced at Clinton Global Initiative meeting

Physalis peruviana (WikiCommons)

A consortium led by UC Davis with CGIAR partners and the private sector plans to sequence the genomes of neglected African crops, with the ultimate goal of developing "new varieties [...] that are more nutritious, produce higher yields and are more tolerant of environmental stresses, such as drought". Genomic information generated through the project will be freely available to scientists around the world. Of the US$ 40 million needed by the project, US$7.5 million have already been raised. A list

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COMBINING INDIGENOUS KNOWLEDGE AND ADVANCED GENOMIC APPROCHES FOR *Ensete ventricosum*

IK of enset farming system

- biodiversity assessment at household level
- recording agricultural and trasformation practices
- define parameters by which farmers identify variation
- recording diffrences among households

Genomic Approches

- develop tools
- collect DNA
- genotyping of accessions
- training a new generation of young researchers

SYNTHESIS

- translate IK into numbers
- assess limitation of current genomic tools
- provide guidelines for germplasm management