

# The Philippine Agriculture and Forest Biotechnology Agenda

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## Bio-Physical & Socio-Economic Environment

- ❑ Burgeoning population : by 2020-7.5 B (world); 122 M (Philippines)
- ❑ More mouths to feed – must increase grains production by 50% (world); rice production by 40% (Philippines)
- ❑ Agriculture and natural resources dwindled by deforestation, overgrazing and land conversion
- ❑ Declining health and environmental quality and our rich biodiversity
- ❑ Exploitation of our genetic resources by other countries
- ❑ Improving competitiveness an urgent call due to globalization and free trade regimes



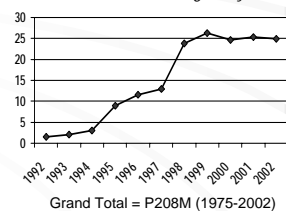
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## Biotechnology Investments

- Realizing the need for:
- more efficient ways to produce food
  - manage resources and minimize environmental degradation
  - develop a globally competitive ANR sector
  - a more diverse and improved biological stock

... the Philippines invested around P43M from 1975 to 1991, P40M from 1992-1997 and P125M from 1998-2002 in biotechnology.

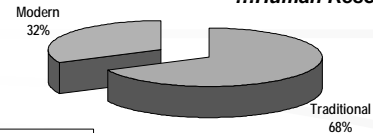
..... 2003 to date – being analyzed



Grand Total = P208M (1975-2002)  
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## Biotechnology Capability (2002)

...Human Resources



### Modern

- Gene Cloning/Mapping/Fingerprinting, 11.5%
- Microbial Biotechnology/Bioremediation, 6%
- Transformation/Genetic Engineering, 4%
- Molecular Marker, 3%
- Others, 7.5%

Total = 317 Biotechnologists

Region 4, 56%  
 NCR, 15%  
 Region 3, 6%  
 Others, 23%

### Traditional Biotechnology

- Tissue Culture, 14%
- Microbiology, 10.5%
- Biofertilizer, 5.5%
- Enzymology, 4%
- Fermentation, 4%
- Reproductive Biotechniques, 3.5%
- Others, 24.7%

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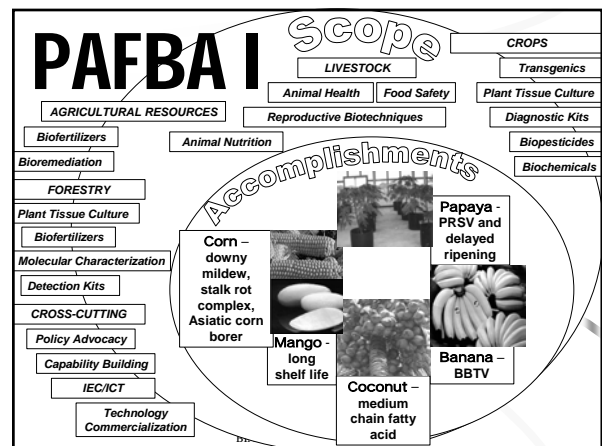
## Policy Environment

- Agriculture and Fisheries Modernization Act (R.A. 8435 AFMA), 22 December 1997, Biotechnology 10% of total AFMA Budget (4% of total R&D Budget)
- Malacañang Memorandum 21 January 2000, Institutionalization of national policy on biotechnology
- DOST-National S&T Plan (2002-2020)



■ President G.M. Arroyo's Policy Pronouncement on Biotechnology:  
*"We shall promote the safe and responsible use of modern biotechnology and its products as one of several means to achieve and sustain food security, ... sustainable and safe environment"* (Malacañang Memo of 16 July 2001)

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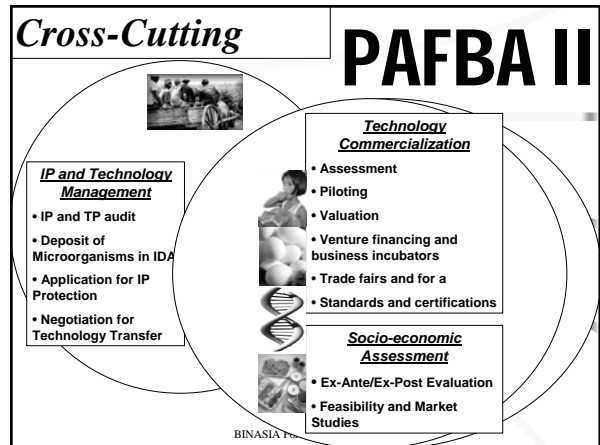
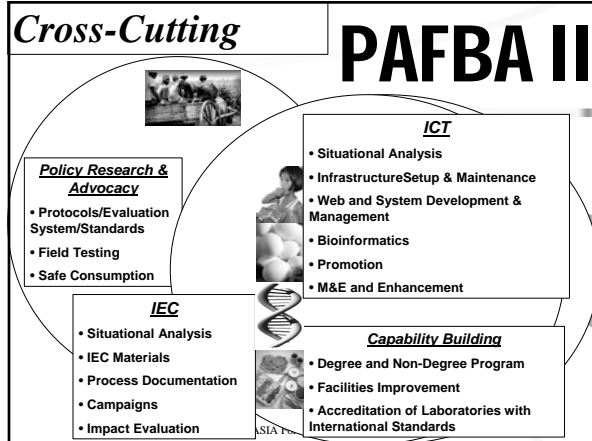
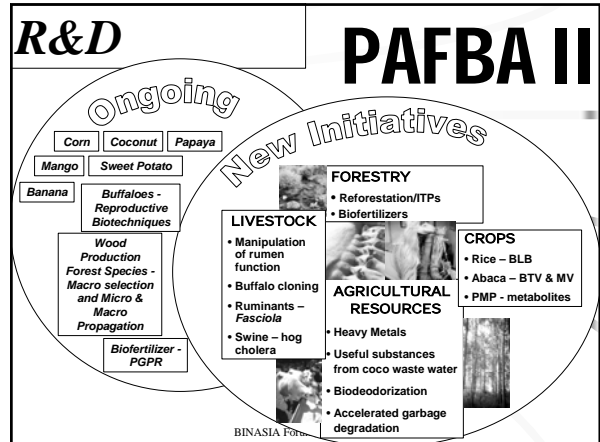


## PAFBA II

### VISION

PAFBA II hopes to achieve efficient and sustainable AFNR sectors that contribute significantly to the equitable distribution of socioeconomic and environmental welfare through the safe and responsible use of biotechnology

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## THE PROCESS

- PARTICIPATORY and MULTISTAKEHOLDER APPROACHES
- SYSTEMATIC PRIORITY-SETTING TOOL THAT IS SIMPLE, COST EFFECTIVE, AND RAPID

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## CRITERIA

- PRESELECTION SECTORAL CRITERIA
  - Competitive edge of the technology
  - Commercial and technical feasibility
  - Sociocultural importance/acceptability, environmental and health advantages
  - Nature of the crop ( e.g. abaca- endemic)
  - Absence of international agency doing biotechnology research
  - Availability of local resources
  - Support for current program
  - Biosafety

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## CRITERIA

- TECHNICAL CRITERIA  
IMPACT OF PROJECTS IN TERMS OF ADDRESSING THE NEEDS ( STEEP)
- STRATEGIC CRITERIA  
FOCUS ON THE OPPORTUNITIES AND NICHES THAT THE PROJECT CAN ADDRESS

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Pili (not included in target)	ID	Molecular assay for sex determination	Sex detection protocol for pili
Banana (not included in target)	For verification	Somaclonal variants	Disease resistant variety
Corn pest ( <i>Diplodia macrospora</i> )	Being adapted for research	Fungal pathology	Breeding method

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Sweet potato	Commercial	Tissue culture protocol for SP	Virus-free planting materials
Sugarcane	7 rhizospheric & endophytic bacterial isolates identified that could promote growth; DNA sample of 500 varieties extracted; as of 1998, 18 greenhouses, 8 TC laboratories, 2783 plantlets distributed	PGPB (plant growth promoting bacteria); DNA markers; Data and linkage analysis; DNA microsatellite markers; Diversity analysis dendrogram map; Tissue culture protocol for sugarcane	Sugarcane variety resistant to downy mildew and smut resistance genes; virus free planting materials

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Coconut	Being applied/for commercialization	DNA markers, genome map; high density map; cadang-cadang test kit for coco products; DNA markers for outstanding population & hybrids; field management protocol	Improved variety true-to-type plants; improved variety; quality coco-products; true-to-type population of coconut; true-to-type macapuno seedlings for plantation

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Diagnostic kit	For verification	Pure culture of Colletotrichum; Protocol for fungal DNA extraction; DNA markers for colletotrichum; Protocol for sample preparation and DNA amplification; PCR primers for detection of specific pathogen	Diagnostic kit for mango anthracnose

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Bioinsecticides	verification	MA frusants; Protoplast fusion procedure for MA	Recombinant strain of MA for ACB and DBM
	verification		DNA probes of fungi and insect
	For further research	Genetic diversity of <i>M. fijiensis</i> population dynamic	
	Being applied for research	Genome map of <i>R. solanacearum</i>	Breeding method resistant variety
	For commercialization		Biopesticide (NPV) formulation

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Biofertilizer	For commercialization	Protocol for isolating PGPR; Process of producing PGPR inoculant	PGPR strain; PGPR inoculant
	Being applied for research	DNA probes	Soil conditioner
	commercial	Strain identification	Soil conditioner

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Reproductive biotechniques of goats and sheep	Being applied for research	<ul style="list-style-type: none"> <li>Protocol on liquid and frozen storage of buck/ram semen suitable under Philippine condition;</li> <li>Suitable semen diluent;</li> <li>Protocol on SOET</li> </ul>	<ul style="list-style-type: none"> <li>Artificial insemination training manual;</li> <li>Highly superior goats and sheep</li> </ul>

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Reproductive biotechniques of water buffaloes	Mature	Protocol on IVF/IVF and vitrification	Genetically superior buffaloes
Reproductive biotechniques of dairy type animals	Mature	Protocol SOET	Genetically superior dairy-type animals
Reproductive biotechniques of goats	Being commercialized by CLSU	Protocol SOET and cryopreservation	Genetically superior goats

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Rumen microflora/ animal nutrition	For confirmation	Information on legume species with by-pass proteins	Animal nutrition protocol
Animal health and food/feed safety	For validation and patent application	PCR-based detection kits for pathogenic bacteria in meat, milk, egg and their products	Safe dairy and poultry product

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## Summary of R&D Undertakings

### PAFBA I

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Mass propagation	For utilization	Macropropagation protocol	Hedge gardens for <i>G. arborea</i> , <i>P. indicus</i> , <i>S. macrophylla</i> , <i>E. deglupta</i> , & <i>E. deglupta x E. pellita</i>
Micropropagation	For utilization	Shoot sterilization procedures; Tissue culture protocol	Tissue culture plantlets; Plantation of tissue cultured-plantlets
	For verification	Tissue culture protocol for 9 rattan sp.	Field demo using tissue cultured plants

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### PAFBA I

CROSS-CUTTING CONCERN	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Molecular Biotechnology Laboratory	Being utilized	Laboratory facilities	1 Biotech Laboratory, 4 BL2 Units

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Coconut	Completed cDNA library, transformation protocol, and promoter. For Phase II novel genes protocol for gene cloning and tissue protocol for clonal production	CDNA library of coed endosperm; transformation protocol; cloned aleosin promoter; novel genes	GM coconut with high lauric acid content

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Corn	Completed radioactive protocol for SSR, A7LP and RGA, DMR genes map mapping, and non-Bt insecticidal protein	F2 mapping population DNA fingerprints of stalk rot; DMR genes map mapping population; Non-Bt insecticidal protein; cell and tissue culture regeneration protocol	Corn variety resistant to stalk rot

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Papaya	Continuation through ACIAR SE protocol	SE protocol; somatic embryos, TC protocol for papaya transformation and regeneration	Papaya variety with prolonged shelf life

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Papaya	T1 generation undergoing BL2 evaluation; Completed in June 2003 (DOST fund); Continued thru IPB funding	SE protocol; somatic embryos, TC protocol for papaya transformation and regeneration	Papaya variety resistant to papaya ringspot virus (PRSV)

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Banana	Completed regeneration protocol for banana and gamma radiation procedure for banana mutant lines	DNA fingerprints of banana germplasm; regeneration protocol; transformation system; gamma radiation procedure for banana mutant lines; BBTV diversity analysis and distribution; TC plantlets; cell suspension protocol for somatic embryogenesis; somatic embryos	GM banana with banana bunchy top virus (BBTV) resistance

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Papaya	Completed genetic diversity analysis of PRSV; PRSV distribution map, cloning procedure for PRSV; Completed DNA markers for papaya DNA fingerprints of papaya germplasm; gene constructs of papaya CP gene; T1 generation undergoing BL2 evaluation; Completed in June 2003 (DOST fund); Continued thru IPB funding	Genetic diversity analysis of PRSV; PRSV distribution map; Cloning procedure for PRSV; DNA markers for papaya; DNA fingerprints of papaya germplasm; Gene construct of papaya CP gene; SE protocol; somatic embryos, TC protocol for papaya transformation and regeneration	Papaya variety resistant to papaya ringspot virus (PRSV)

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## Summary of R&D Undertakings

### LEDAC

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Sweet potato	Completed December 2005 requesting for Phase II in order to do transformation	SPFMV genetic diversity; Cloning procedure; Gene construct of SPFMV; Transformation of regeneration protocol for UPLB and USP varieties; somatic embryos	Sweet potato feathery mottle virus (SPFMV) resistant variety

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## Summary of R&D Undertakings

### PAFBA II

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Rice	In progress	Protocols for rice transformation	Bacterial leaf blight (BLB) resistant rice variety
Abaca	Proposal from LSU undergoing evaluation	Protocols gene constructs	Banana bunchy top virus (BBTV) resistant abaca
Endemic plants	In progress	Tissue culture protocol	Secondary metabolite production

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## Summary of R&D Undertakings

### PAFBA II

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Buffaloes	Still in process of proposal evaluation	-	Improved buffalo breed
Ruminants	Did not materialize since the proponent has not yet submitted the detailed project proposal	-	Optimized rumen ecosystem of cattle, buffaloes, and goats

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## Summary of R&D Undertakings

### PAFBA II

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Detection kit	Processing of proposal is deferred since the laboratory is under renovation	-	Recombinant Fasciola gigantica cathepsin L. proteinase for early detection of fasciolosis
Diagnostic kit	Did not push through since the proponent has resigned from UPLB	-	Diagnostic kit for hog cholera (classical swine fever)

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## Summary of R&D Undertakings

### PAFBA II

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Reforestation /ITP development	For endorsement to other funding institutions;	Planting materials	Quality trees
Biofertilizers and ITP development	Endorsement to other funding agencies depends on commercialization of tissue culture materials	Protocols	Biofertilizer

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## Summary of R&D Undertakings

### PAFBA II

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Bioremediation of heavy metals	For GC approval (P3.4M for 4 years)	protocols	Clear environment
Recovery of valuable substances from waste coconut water	Not pursued	-	-

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## Summary of R&D Undertakings

### PAFBA II

COMMODITY	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Biodeodorization of livestock waste	Not pursued	-	-
Rapid garbage degradation	Ongoing	Protocols (waste Deregulation)	Clean environment

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## Summary of R&D Undertakings

### PAFBA II

CROSS-CUTTING CONCERN	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
Conduct of campaigns	Completed the regional IEC campaign	IEC materials	People aware of biotechnology
Institutional capability building	Proposed training needs assessment, workshop, and communication strategy plan for GM Papaya risk communication	Training modules	Well trained participants Effective communication strategy

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## Summary of R&D Undertakings

### PAFBA II

CROSS-CUTTING CONCERN	TECHNOLOGY STATUS	INTERMEDIATE PRODUCT	ULTIMATE PRODUCT
IP and TP audit	Completed IP audit on papaya projects; Ongoing on PGPR and coconut genes	Patentable technology	Patent protection

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## Future Directions

- Integration of biotech programs
- Private sector driving the biotech industry
- Product-based roadmap (R&D with commercialization roadmap)

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Thank you for listening

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