Enhancing the livelihood of TN Farmers through BARC Technologies

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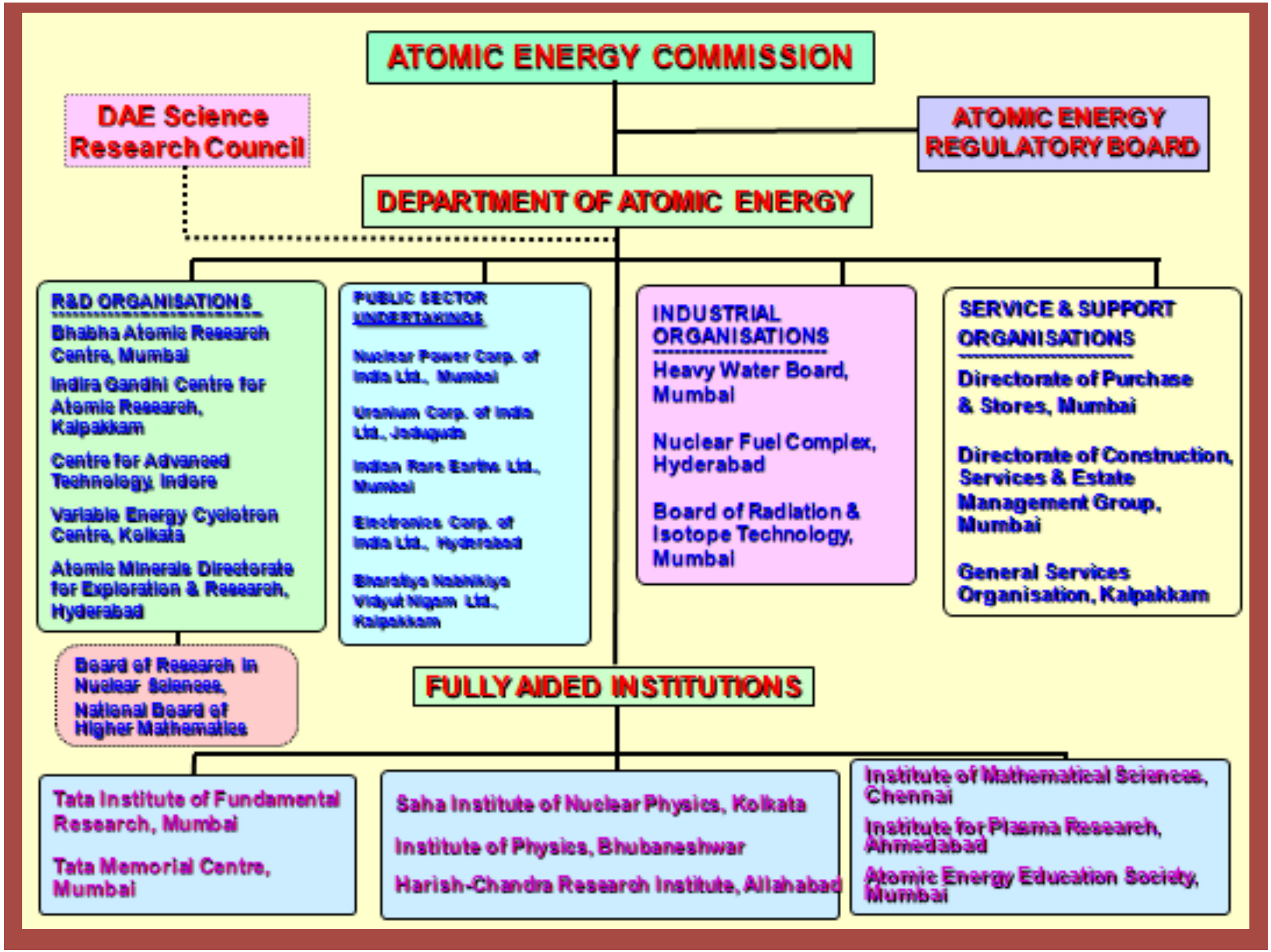
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R&D ORGANISATIONS
Bhabha Atomic Research Centre, Mumbai
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PUBLIC SECTOR UNDERTAKINGS
Nuclear Power Corp. of India Ltd., Mumbai
Uranium Corp. of India Ltd., Jaduguda
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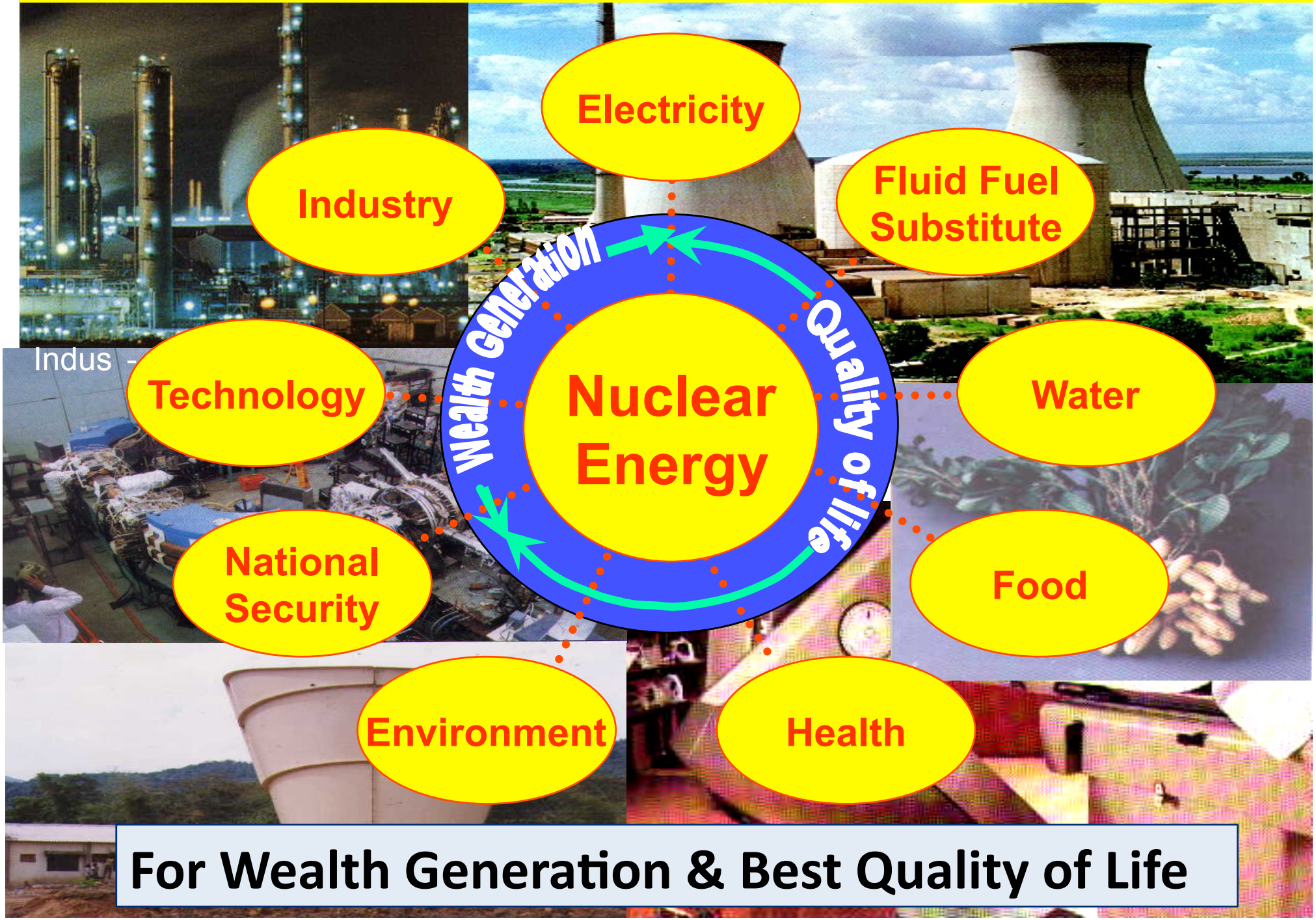
INDUSTRIAL ORGANISATIONS
Heavy Water Board, Mumbai
Nuclear Fuel Complex, Hyderabad
Board of Radiation & Isotope Technology, Mumbai
SERVICE & SUPPORT ORGANISATIONS
Directorate of Purchase & Stores, Mumbai
Directorate of Construction, Services & Estate Management Group, Mumbai
General Services Organisation, Kalpakkam
Board of Research in Nuclear Sciences,
National Board of Higher Mathematics
FULLY AIDED INSTITUTIONS
Tata Institute of Fundamental Research, Mumbai
Tata Memorial Centre, Mumbai
Saha Institute of Nuclear Physics, Kolkata
Institute of Physics, Bhubaneshwar
Harish-Chandra Research Institute, Allahabad
Institute of Mathematical Sciences, Chennai
Institute for Plasma Research, Ahmedabad
Atomic Energy Education Society, Mumbai

MULTIFACETED APPLICATIONS OF ATOMIC ENERGY



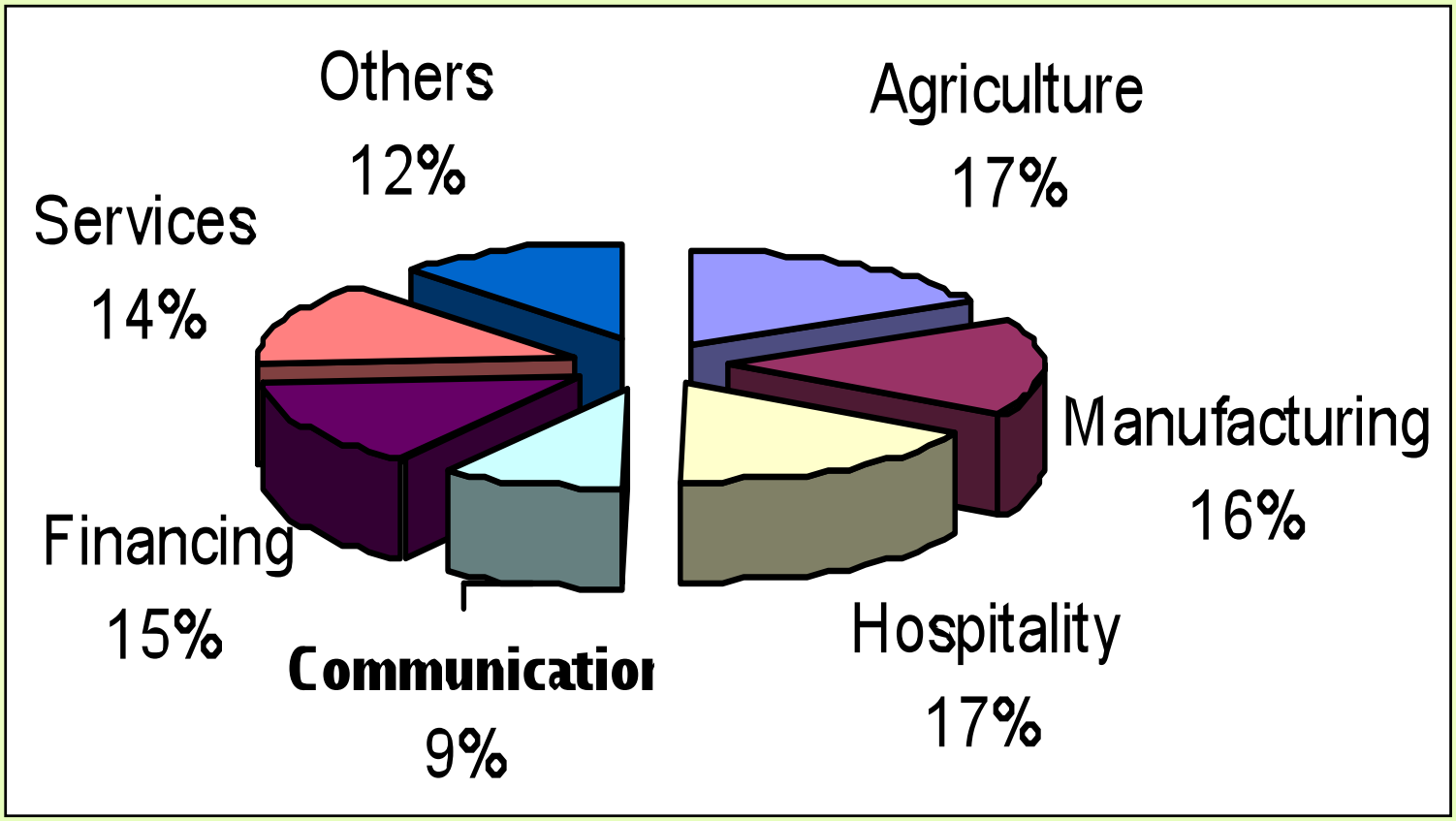
For Wealth Generation & Best Quality of Life

Enhancing the livelihood of TN Farmers through BARC Technologies

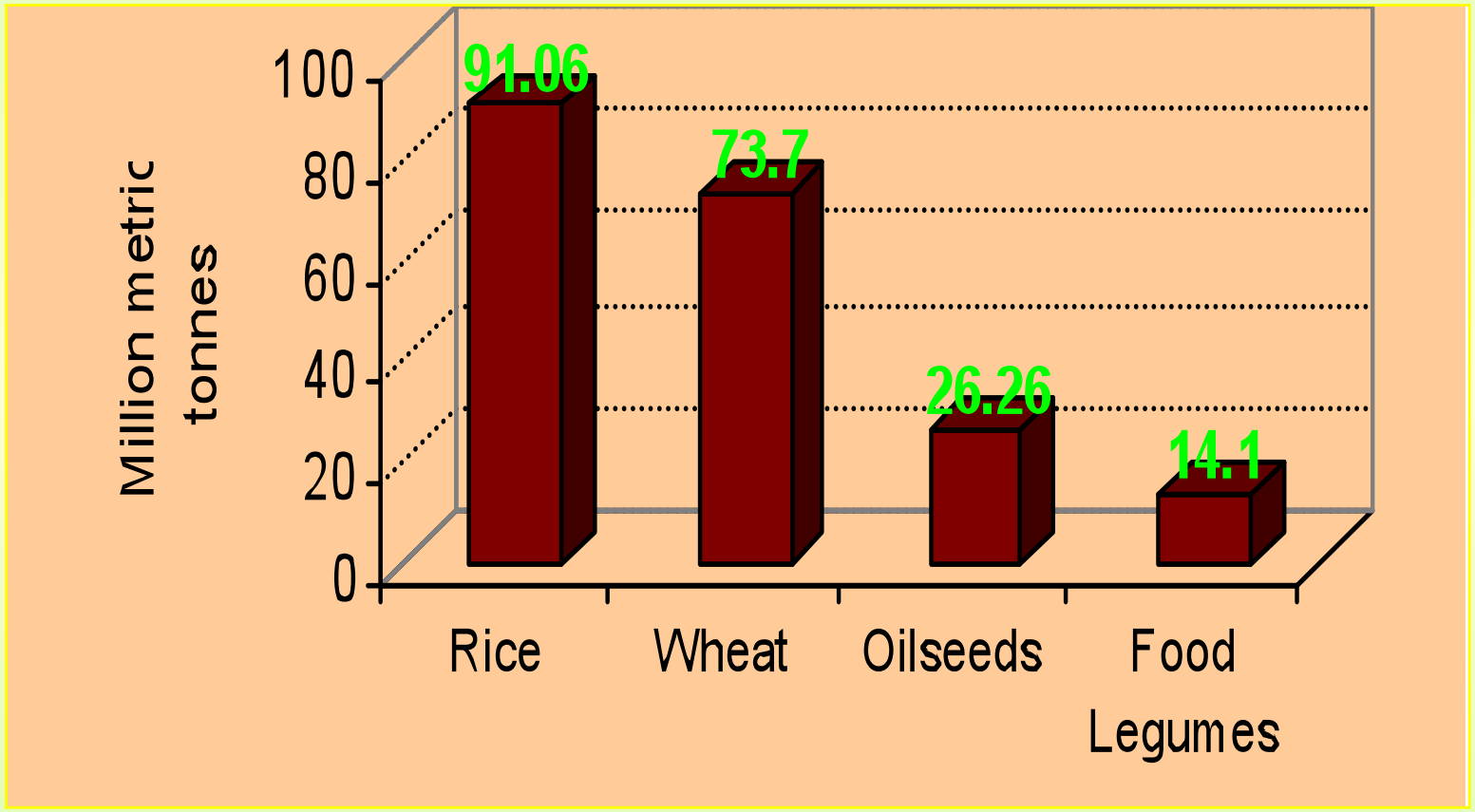
- High-yielding, Drought-resistant, Disease-tolerant & Early-maturing Trombay Seed-varieties (mainly Oilseeds & Pulses)
- Gamma Irradiation Plants
- Empowering the Farmers & Rural Entrepreneurs

BARC's Expertise in crop improvement

Agriculture sector is an important contributor to GDP



Major Crop Production in India

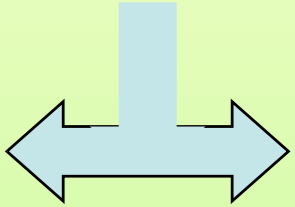


National Issues in Oilseeds & Grain legumes

- **Narrow genetic base**
- **Stagnation in productivity**
- **Biotic and abiotic stresses**
- **Lack of quality seeds of improved varieties**
- **Restricted on marginal areas with poor inputs**

Enhancing Efficiency of Crop Based Production System

- On a sustainable basis
- Through appropriate cropping system
- By value addition & diversification of products

Remunerative  Globally competitive

Improvement of Crops @ BARC

Major emphasis is on Oilseeds and Pulses

Groundnut	Pigeonpea	Rice
Mustard	Mungbean	Wheat
Sunflower	Uridbean	
Soybean	Cowpea	

Trombay (BARC) Crop Varieties Released for Commercial Cultivation

- 42 crop varieties have been developed at BARC & released for commercial cultivation in different agro-climatic zones in the country
- Some of the varieties are very popular and grown extensively, very popular throughout the Country.
- Improved characters include higher yield, earliness, large seed size, resistance to biotic & abiotic stresses.

BARC Trombay Varieties

BARC Varieties .pdf

Pod type in groundnut

Parallel reticulation

Parent **TGM 94**

Dumb-bell pod

Parent **TGM 59** **TGM 117**

TAG 24 **TPG 41**

- Semi-dwarf habit, medium, thick, dark-green leaves
- Matures in 115-120 days
- Determinate flowering
- Large seed: 80g /100 seeds or Bold type count 35/40
- High oleic acid (62%)
- Seed dormancy of 25 days

TBG 39 or TDG 39

TBG 39 or TDG 39 **TG 37A**

- Virginia bunch, medium, thick, dark-green leaves
- Matures in 115-120 days
- More number of branches
- Large seed: 80-90g/100 seeds or Bold type count 35/40

TG 37A

TN Agri & Prison Depts' Successful Joint Venture

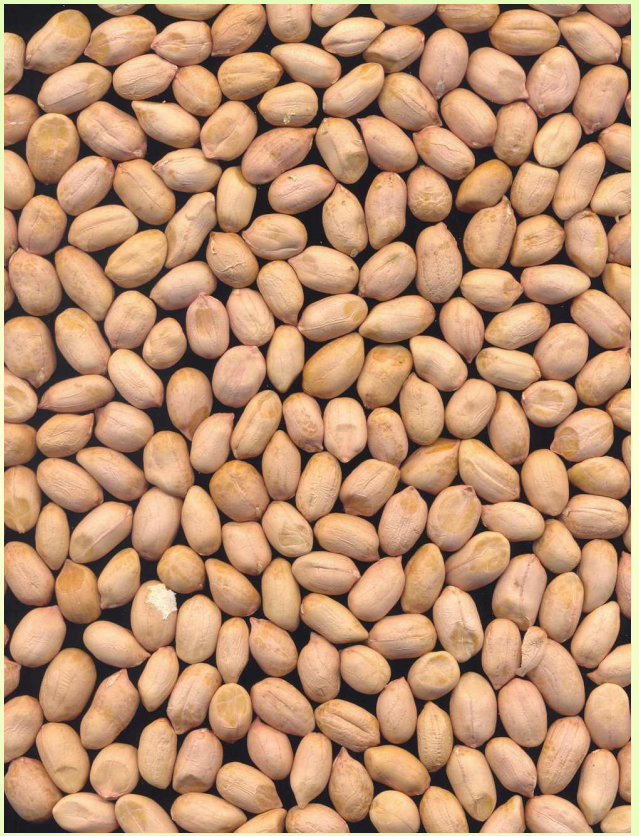
- Semi-dwarf habit, medium, thick, dark-green leaves
- Determinate flowering, Early maturity
- Smooth pods with thin shell
- Wider adaptability
- Tolerance to moisture stress
- Java type count: 60/70
- Tolerance to collar rot and peanut bud necrosis disease

Most popular groundnut variety

- Early maturing, semi-dwarf habit, high harvest index (>50%), high partitioning and water use efficiency
- Released for Maharashtra, W. Bengal, Rajasthan and Karnataka
- Popular in AP, Goa, Gujarat, MP, Orissa, Punjab and Tamil Nadu
- Identified as National Check Variety for summer trials
- Responds well under improved agronomical practices when >9,000 kg/ha yield achieved

TAG 24

TG 51



- Semi-dwarf habit, medium, thick, dark-green leaves
- Early maturity (90-95 days)
- Determinate flowering
- Higher shelling out turn (75%), Medium large seed (60g/100 seeds)
- Released for Orissa, WB, Bihar and North-Eastern states (2008)
- Tolerance to stem rot, *Heliothis* and *Spodoptera* incidences under natural field conditions

TG 37A **TG 51** **TG 38**

TPG 41

Variety released for All India

Large seed

120 days maturity

20 days dormancy

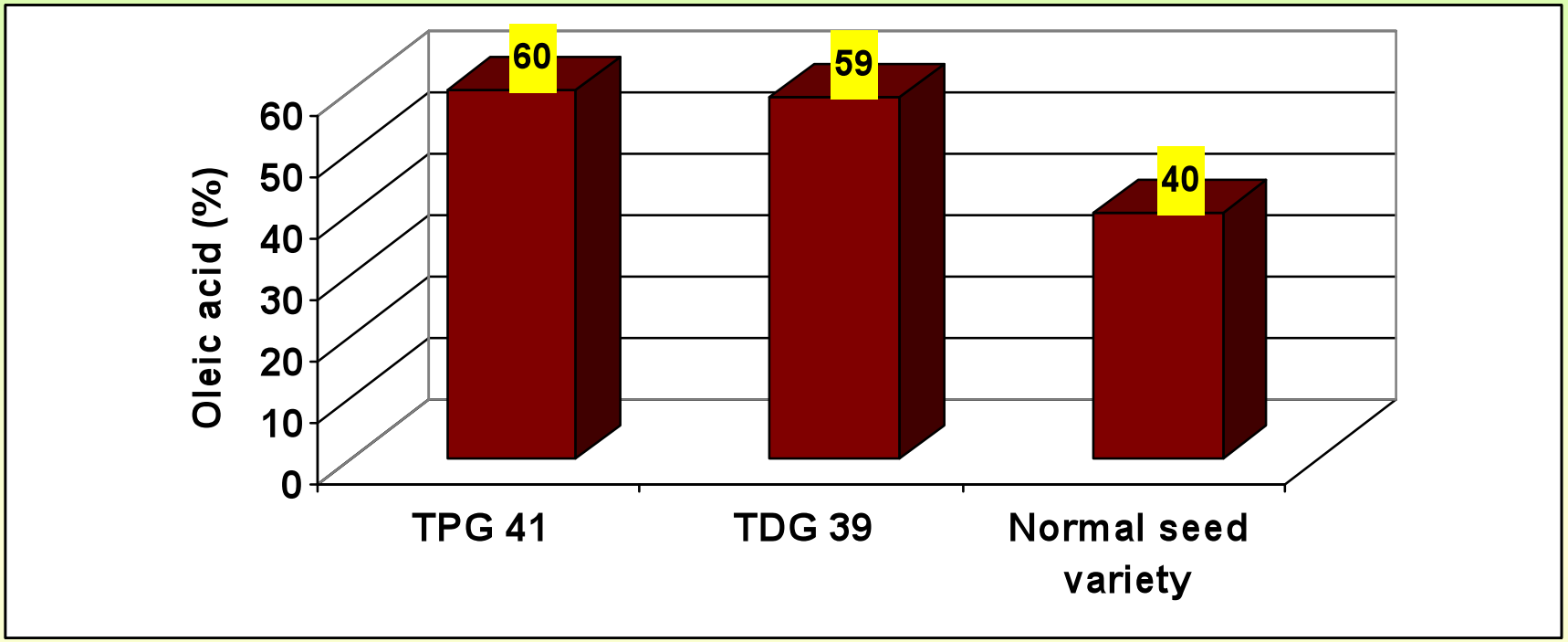
High oleate

- Semi-dwarf habit, Small, thick, dark-green leaves
- Determinate flowering, Early maturity
- Smooth pods with thin shell and higher shelling %
- Released for Bihar, Orissa, West Bengal and North Eastern States (2006)
- More spherical seeds Java type Count 60/70
- Tolerant to stem rot and dry root rot incidences

TG 38

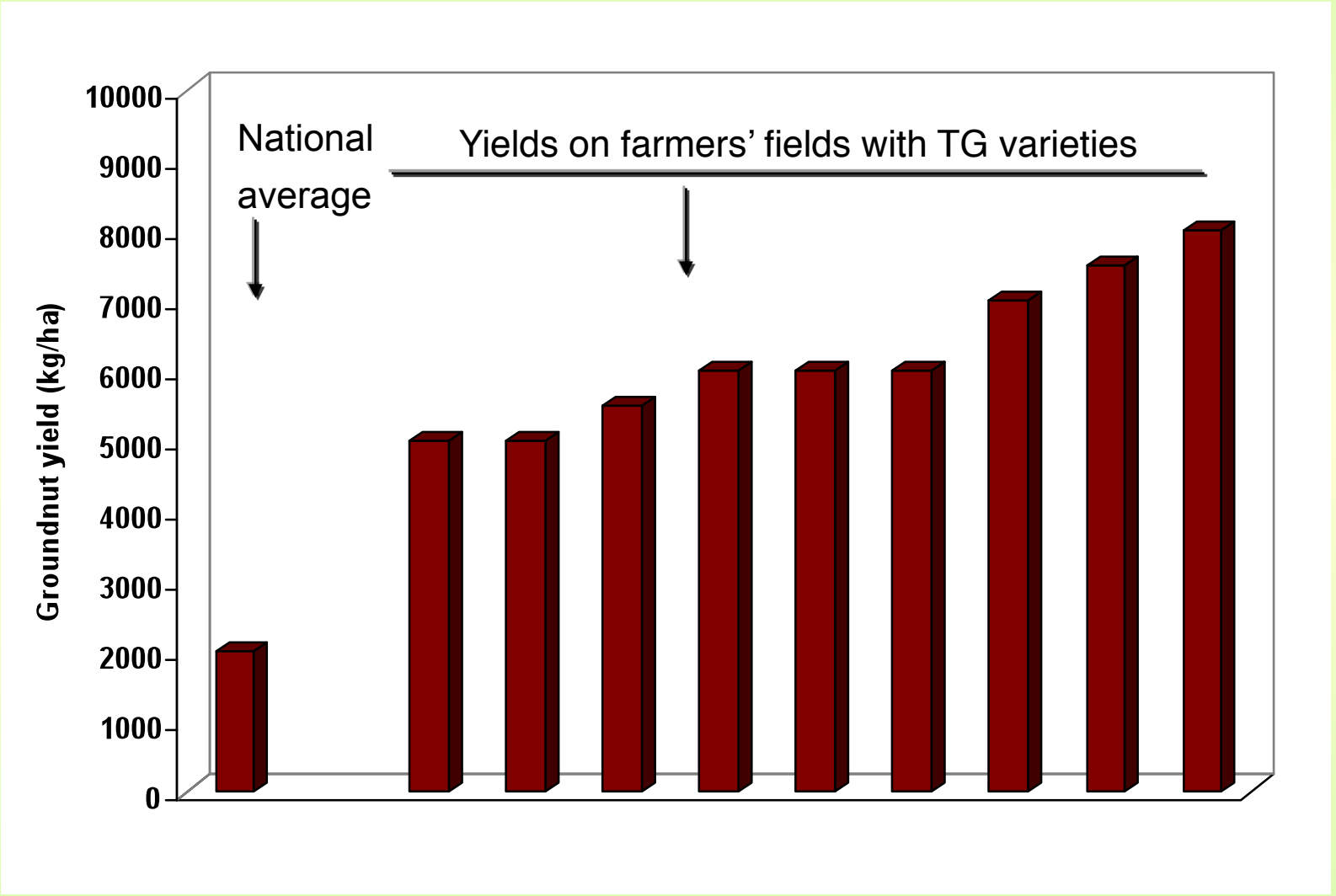
Bachau, Gujarat

Trombay groundnut varieties with high oleic acid



- High MUFAs leads to increased HDL cholesterol
- Decreased LDL cholesterol, triacylglycerol (TAG), lipid oxidation, and LDL susceptibility to oxidation
- Dietary MUFAs have been shown to elicit a smaller postprandial lipemic response with lower chylomicron remnant concentration
- Improves the blood lipid profile.
- Improves shelf life of oil

Realization of enhanced groundnut productivity….



TPG 41 Kehal, Maharashtra

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Kehal 5,500 kg/ha

Yield increase in agriculture produce

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Trombay Groundnuts & A.P. Farmer

TLG 45 Kehal, Maharashtra

TG Impact…

Realizing yield potential (kg/ha)

Year	TAG 24	TG 26
1997	5339	9458
1998	6484	
1999	4875	8780
2000		10542
2001	9280	9487
2001	10175	7000
2002	9052	7500
2003		9131

Field view of Trombay crop varieties

Mungbean: TJM 3

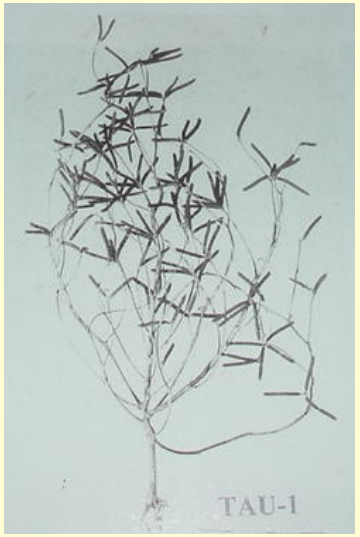
Soybean: TAMS 38

Groundnut: TAG 24

Mustard:TPM 1

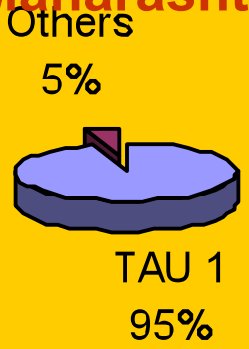
Most popular uridbean variety

TAU 1



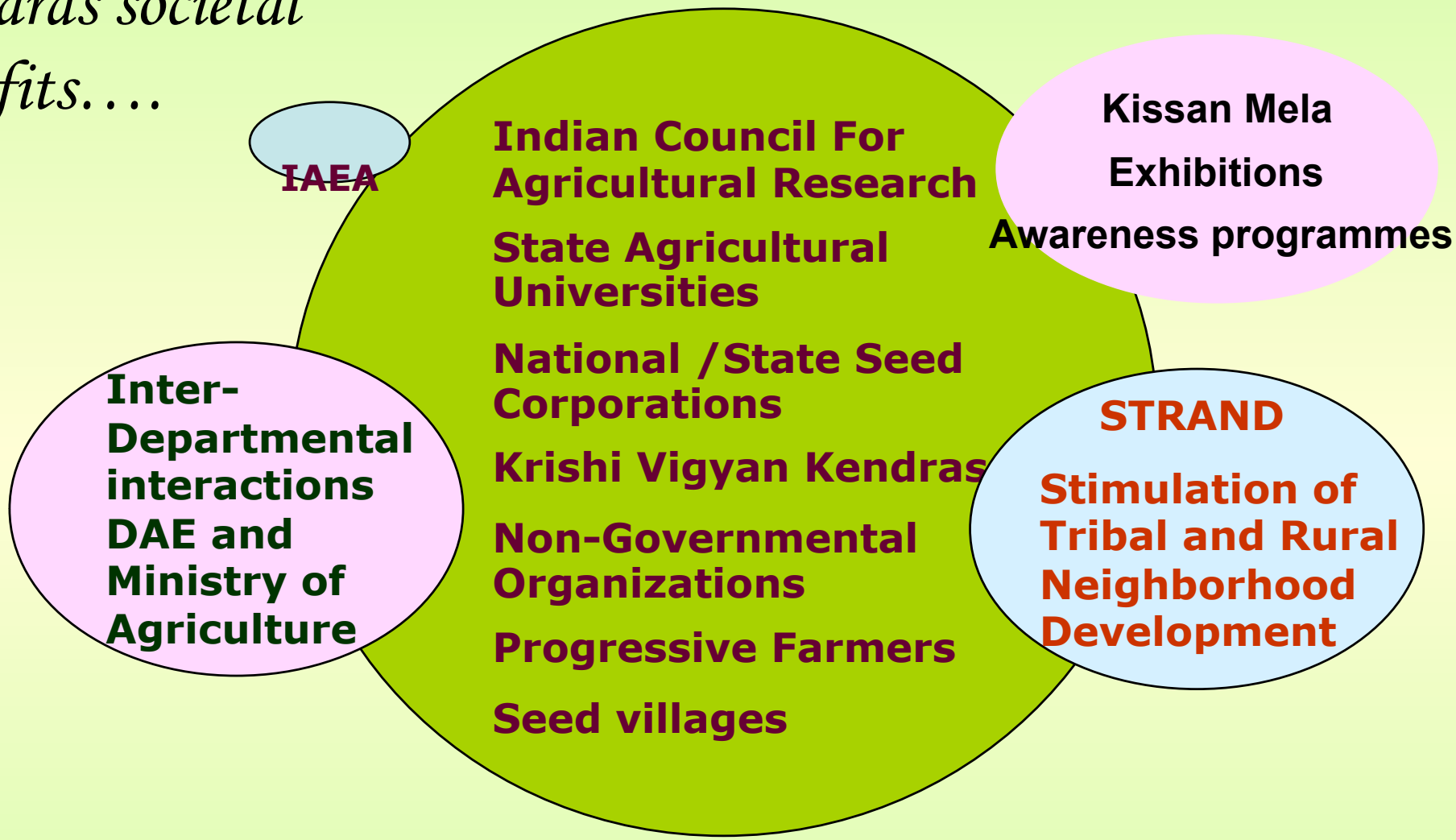
- Released in Maharashtra for *kharif*.
- High yielding and wider adaptability.
- Average productivity 800 –1000 kg/ha.
- DAC indent for breeder seed about 40%

Area under cultivation in Maharashtra



Development and deployment through linkages

Towards societal benefits….



Popularization of Trombay crop varieties by *Kisan melas*

Breeder seed of Trombay groundnut varieties sold to seed agencies by Institutes/Universities during 1998-2008

Institute/University	Quantity (MT)	Value (US$)
BARC, Trombay	287.5	334,358
UAS, Dharwad	531.7	618,256
MPKV, Jalgaon	63.7	74,070
PDKV, Akola	25.5	29,651
OUAT, Bhubaneswar	42.4	49,302
JNKV, Khargone	2.8	3,256
MAU, Latur	8.5	9,884
JAU, Junagadh	6.3	7,326
NRCG, Junagadh	8.3	9,651
ICRISAT, Hyderabad	2.5	2,907
RAU, Hanumangarh	36.3	42,209
CSAUAT, Mainpuri	1.8	2,093
MPKV, Digraj	5.0	5,814
Total	1022.3	1,188,777

GOVERNMENT OF TAMILNADU

DEPARTMENT OF AGRICULTURE, CHEPAUK, CHENNAI - 5

CORRIGENDUM - I TO TENDER NOTICE

Tender reference No. POS.4/65530/12

Published on 31.07.2012

Pre-Bid Meeting scheduled to be convened on 08.08.2012 at 3.30 P.M. is rescheduled to 14.08.2012 at 3.30 P.M.

Further, date of opening of tender will be as per the details given below:

Details	Date and time of Opening
BLACKGRAM CERTIFIED SEEDS (T-9, ADT-4 & ADT-5)	30.08.2012 - 3.00 P.M.
BLACKGRAM CERTIFIED SEEDS (TAU-1)	30.08.2012 - 4.00 P.M.
GROUNDNUT CERTIFIED SEEDS (TAG-24, VRI-2, VRI-3 & TMV-7.)	30.08.2012 - 4.30 P.M.

DIPR/3505/TENDER/2012

Commissioner of Agriculture,
Chepauk, Chennai - 5.

MICROPROPAGATION OF BANANA

Banana is a globally important fruit crop which contributes 37% of the total fruit production in India. Edible bananas do not produce seeds. Hence tissue culture propagation of banana through shoot tip as well as floral aspices has been standardized to increase banana production.

Advantages

Disease free elite varieties. Rapid multiplication & Early harvesting. Uniform size and age of plants. High quality fruit bunches. Available throughout the year

J. Daniel Chellappa, BARC (jdanielchellappa@gmail.com)

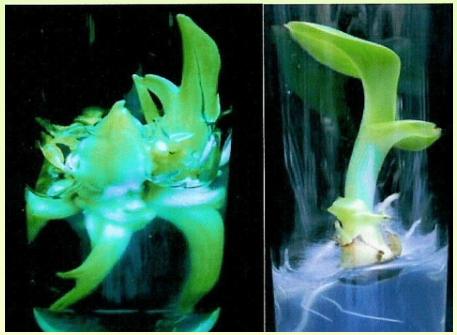
Plant Tissue Culture Research at BARC

Protocols for mass production in banana, pineapple & sugarcane

Technology for banana transferred to MSSC, Akola, Maharashtra and Krishi Vigyan Kendra, Pondicherry

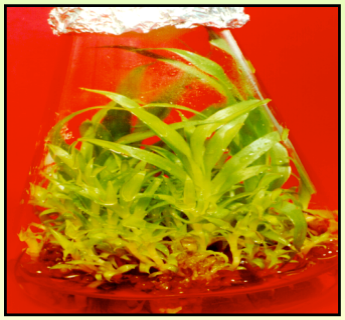
Clones of sugarcane are being evaluated at Marathwada Agricultural University Parbhani

Banana



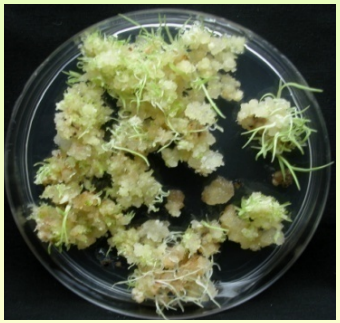
Hardening of plants in the greenhouse

Pineapple



Fruit bunch

Sugarcane



Multiple shoot culture

Pineapple fruit

Radiation Processing of Food

One Process :

Multiple Uses

Sprout Inhibition

Onion, Potato, Ginger, Garlic

Quarantine

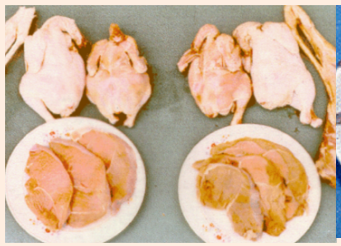
Fruits

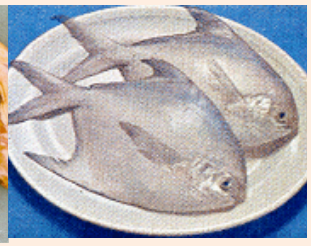
Insect Disinfestation

Cereals, Pulses, Dry Fruits

Shelf-life Extension

Chicken, Meat, Fish





Hygienization

Spices, Flesh Foods

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NPAs & SPIN-OFFs FOR SOCIETAL & RURAL APPLICATIONS

FOLDABLE SOLAR DRYER (FSD)

- Easily dismantled into a thin rectangular box for easy transportation & storage.
- Available in capacities of 10, 25 & 100 kg
- The solar radiations are absorbed by black metallic outer surface of dryer with maximum utilization of sunlight
- 5 times faster than conventional drying
- Hygienic and prevents infestation by insects, pests and micro-organisms
- No special skill required for fabrication and handling
- Used for drying of grapes, jack fruit pulp, ginger, green pepper, herbal medicines etc.

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FOLDABLE SOLAR DRYER

FSD Fabrication at AKRUTI-NIRMITEE Workshop

J. Daniel Chellappa, BARC (jdanielchellappa@gmail.com)

SOIL ORGANIC CARBON DETECTION KIT

Salient Features

- ✓ Farmer friendly and himself checks the percentage of organic carbon in his field
- ✓ Gives quick and reliable results
- ✓ Evaluates the impact of organic carbon amendments supplemented periodically
- ✓ Gives idea of amount of organic manure additions
- ✓ Economical & time saving

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VIBRO THERMAL DISINFESTOR (VTD)

- Simple electrically operated device
- Non - chemical alternative to fumigation and rapid
- Kills all developmental stages of insects in stored grain
- The treatment has no effect on germination of seeds as well
- Useful for farmers, merchants and exporters of food grains.
- Mobile and amenable for scale up

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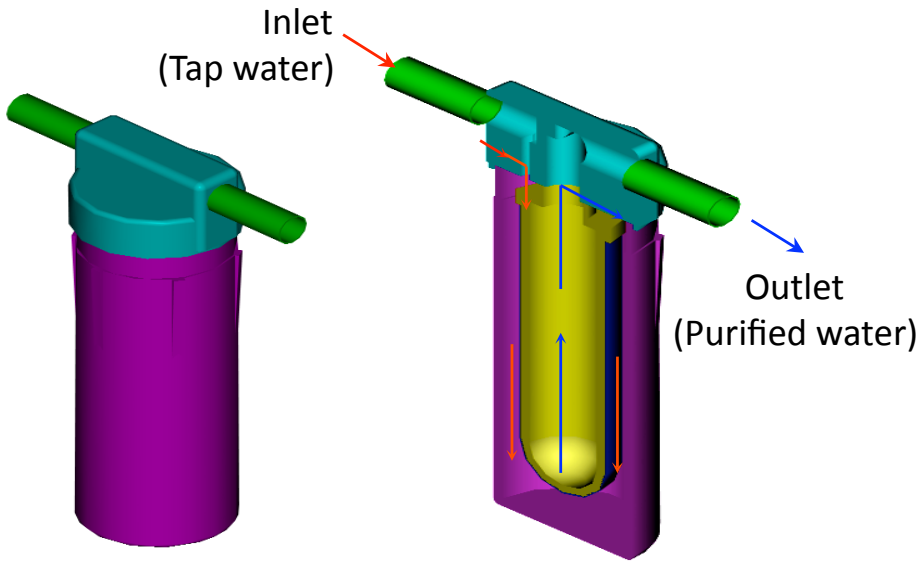
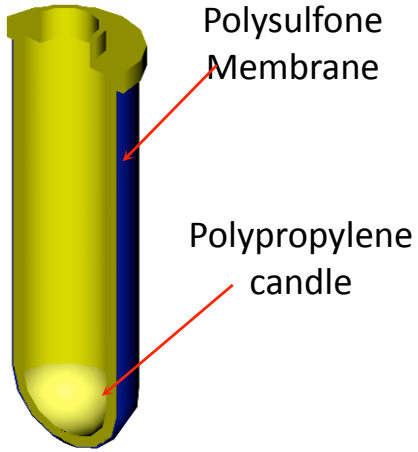
(jdanielchellappa@gmail.com)

ON LINE DOMESTIC WATER PURIFIER
BASED ON ULTRAFILTRATION POLYSULFON MEMBRANE





Salient Features

- No electricity and no chemical required
- Removes bacteria to the extent of > 99.99% (4 log scale)
- Removes microorganism, colour, odour, suspended solids and organics
- No dead bacteria in product water
- 40 litres of pure water per day at about 5 psig head
- Pressure head 5 to 35 psig

Membrane Assisted Process know-how for removal of :

- Fluoride
- Arsenic
- Iron

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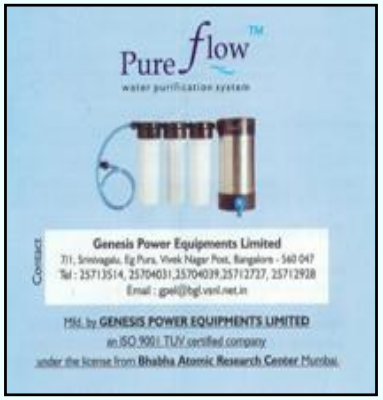
DOMESTIC WATER PURIFIERS FROM INDUSTRY

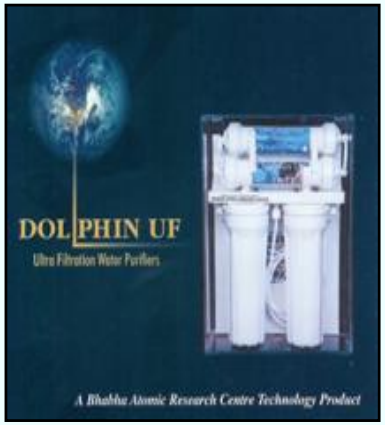
Ardee Hi –Tech. Pvt. Ltd.,
Visakhapatanam,A.P.

Rupali Industries,
Bhandup, Maharashtra



Genesis Power Equipments Ltd.,
Bangalore, Karnataka

Alfatech Engineers Pvt. Ltd., Thane, Maharashtra



Filfab Corporation,
Jaipur, Rajasthan

Natural Appliances,
Neemuch, M.P.

Aum Technologies, Navi
Mumbai, Maharashtra

M/s. Chemco Plastic Industries
Pvt. Ltd., Mumbai, Maharashtra

M/s. Sonadka,
Mumbai, Maharashtra

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FDK - Fluoride detection kit for groundwater

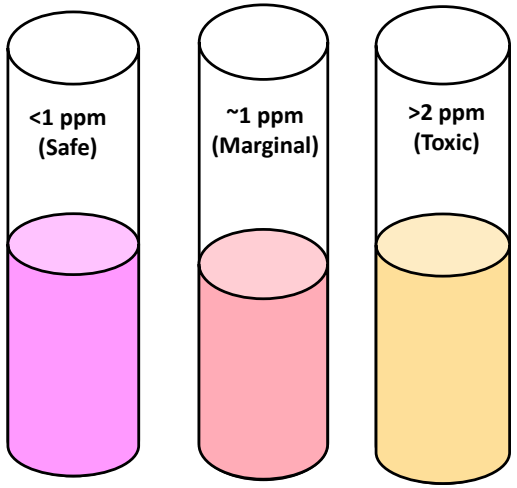
LTEK System, Nagpur

M/s Plasti Surge Industries Pvt. Ltd, Amaravati

M/s Orlab Instruments Pvt. Ltd., Hyderabad

Features

- **Instantaneous color development**
- **Stability of color developed**
- **Distinct colors corresponding to three different fluoride levels**
- **Long shelf life of the kit**
- **Cost effective**



Detection

- **Add 1 ml of the FDK reagent to 4 ml of ground-water sample in a test tube**
- **Identify the colour developed**

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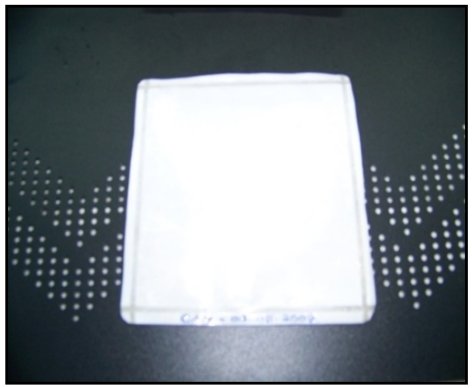
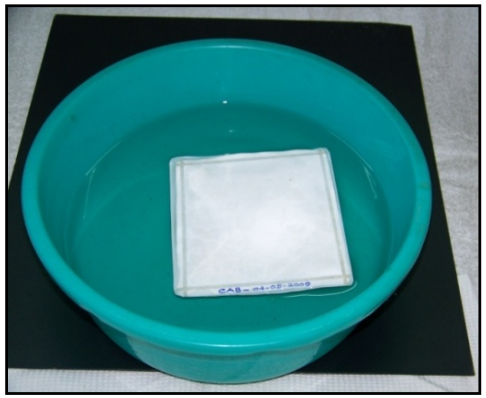
DIP-N-DRINK MEMBRANE POUCH

Technology Transferred to M/s Superklean Environmental Engineers Pvt.Ltd,Mumbai

- Based on osmosis process
- Provides safe, sterile drinkable solution from any biological contaminated water sources
- Wide applications during flood relief situations and other disaster management conditions like Tsunami, earthquakes and other emergency conditions
- Portable and does not require external energy driven system
- Very useful at remote locations where natural water sources are contaminated
- Biodegradable and easily disposable

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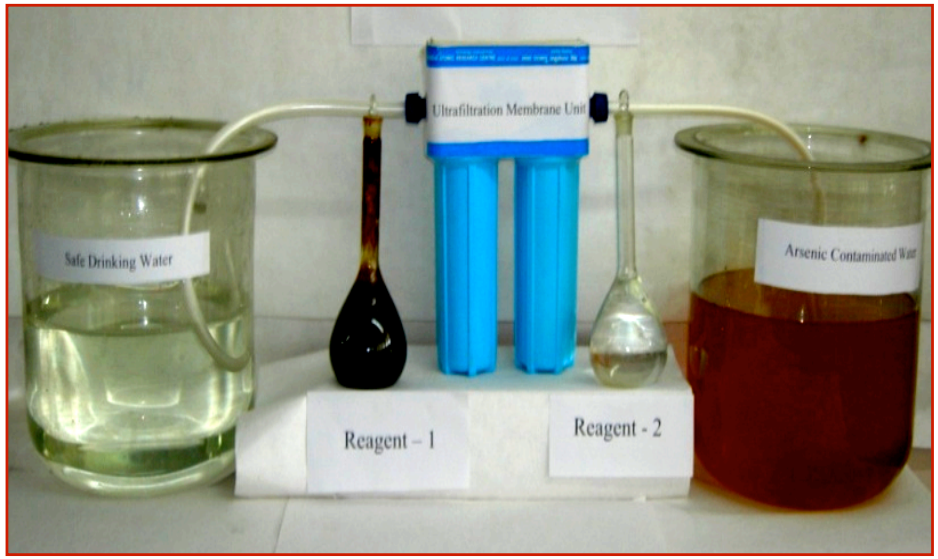
MEMBRANE - ASSISTED REMOVAL OF As AND Fe FROM DRINKING WATER



Arsenic removal from drinking water

Iron removal from drinking water

- ✓ Simple and rapid
- ✓ Adoptable at both domestic and community level
- ✓ Capability of high decontamination
- ✓ Product water not only free from arsenic but also free from secondary contaminants like iron, manganese and microorganisms.
- ✓ Can operate without electricity

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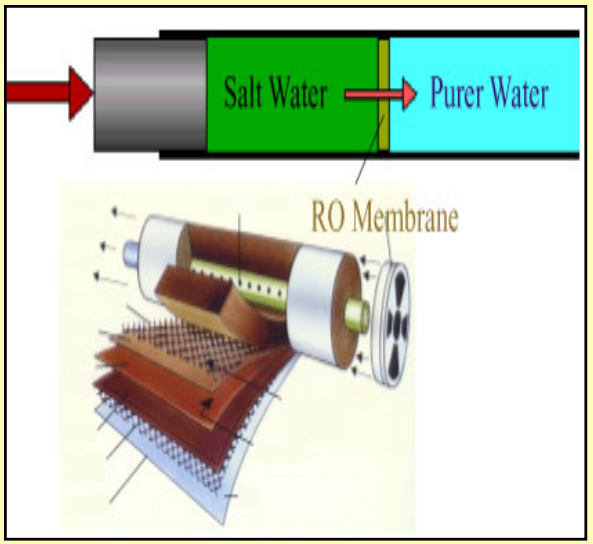
COMMUNITY MODELS AND TECHNOLOGIES



Back washable spiral ultrafiltration technology for domestic & industrial water purification

Preparation of composite polyamide reverse osmosis (RO) membrane for brackish water desalination

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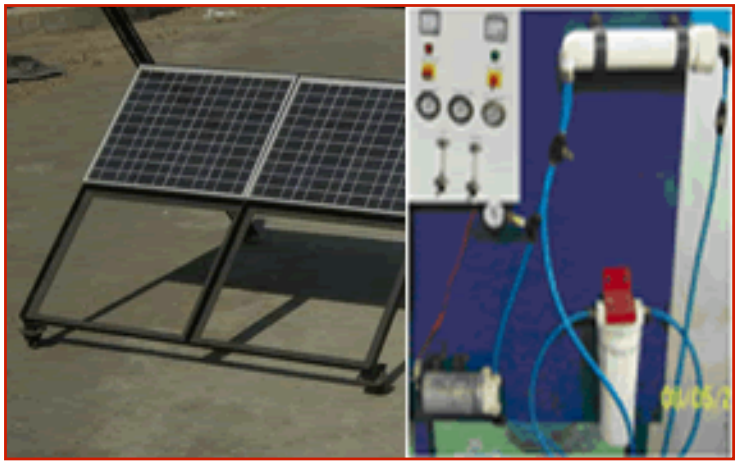
SOLAR ENERGY DRIVEN PORTABLE DOMESTIC BRACKISH WATER REVERSE OSMOSIS (BWRO) TECHNOLOGY



✓ **Capacity of 10 litres/hr (lph)**
✓ **Desalinate contaminated water of salinity 1000 - 3000 ppm (mg/lit) to provide drinking water of 50-300 ppm**

Salient Features

- **No need of grid electricity or battery**
- **Compact and light weighted. Can be used as mobile units.**
- **The solar power unit is a one time investment.**
- **No day- to - day maintenance**
- **No chemicals required**
- **Product water is devoid of extra salinity, toxic elements, pathogens & turbidity**

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TELE ECG

- Hand held, low cost compact instrument
- Transfer of ECG data with the help of mobile phone via bluetooth
- Application in rural health programmes
- Technology transferred to M/s.Chess Medicare Pvt Ltd., Mumbai

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11.01.2013 16:13


11.01.2013 16:49


VectoBac®
11.01.2013 16:12

APPLICATION OF RADIATION TECHNOLOGY IN AGRICULTURE

- GENETIC IMPROVEMENT OF CROP PLANTS
- STUDIES ON FERTILIZER USE EFFICIENCY
- CONTROL OF INSECT PESTS
- MONITORING OF PESTICIDE RESIDUES
- PRESERVATION OF AGRICULTURAL PRODUCE

MUTATION BREEDING

FREQUENCY OF NATURAL VARIABILITY: 1 / 1,000,000

FREQUENCY OF INDUCED VARIABILITY: 10,000 / 1,000,000

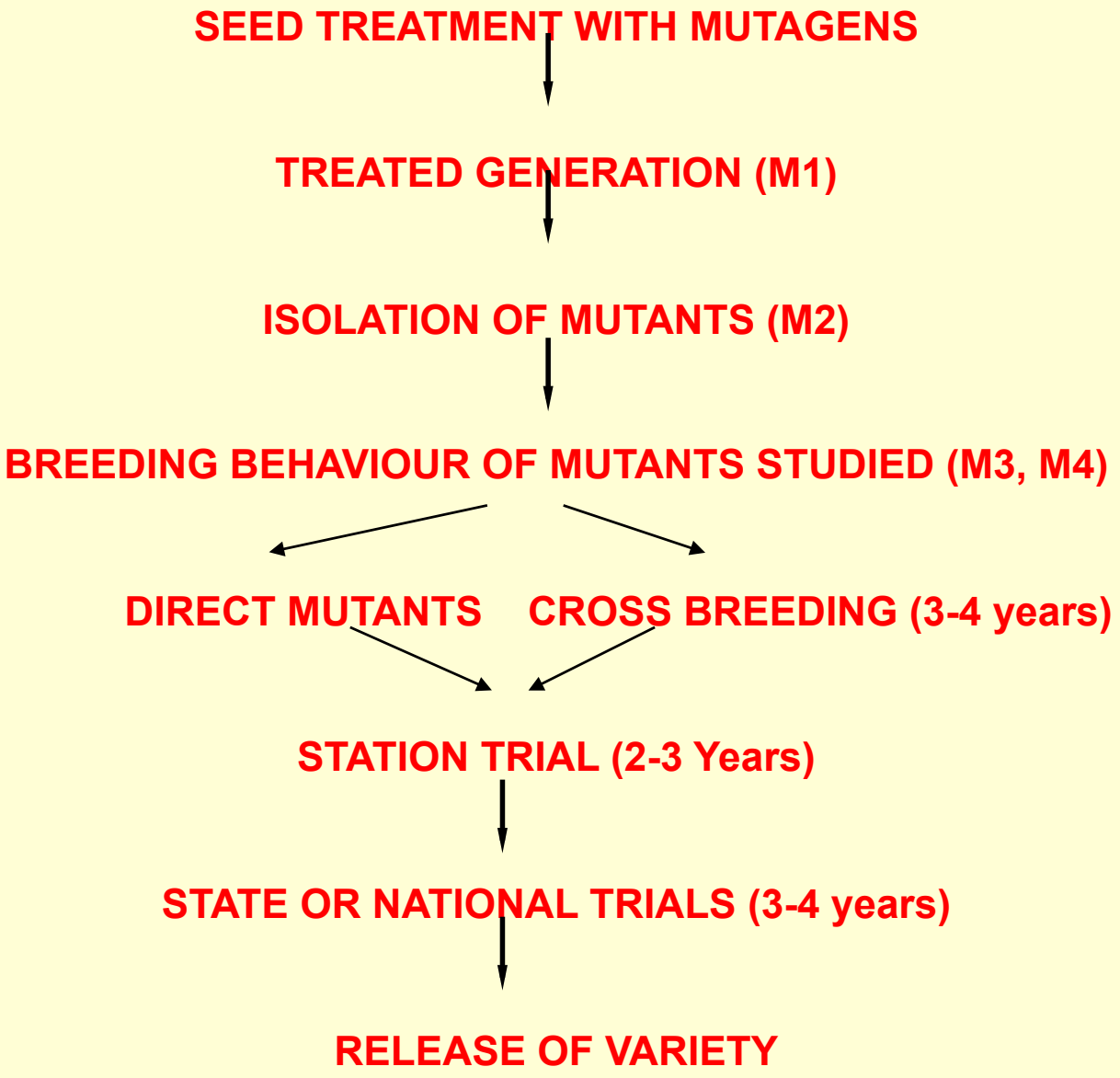
MUTATIONS CAN BE INDUCED BY CHEMICAL AND PHYSICAL MUTAGENS (RADIATION).

NO DIFFERENCE IN THE NATURE OF SPONTANEOUS AND INDUCED MUTATIONS

MUTATION BREEDING IS MOST USSEFUL WHEN THE AIM IS:

- **ENHANCE GENETIC VARIABILITY**
- **RECTIFY ONE/TWO TRAITS IN ADAPTED CULTIVAR**
- **MUTATION INDUCTION FOR PHYSIOLOGICAL/BIOCHEMICAL TRAITS**

MUTATION BREEDING: METHODOLOGY



OTHER APPLICATION OF RADIATION TECHNOLOGY IN AGRICULTURE

- **Control of insect pests - sterile insect technique, pheromones and biopesticides**
- **To study fertilizer use efficiency and micronutrient uptake using radioisotopes**
- **Monitoring of pesticide residues**

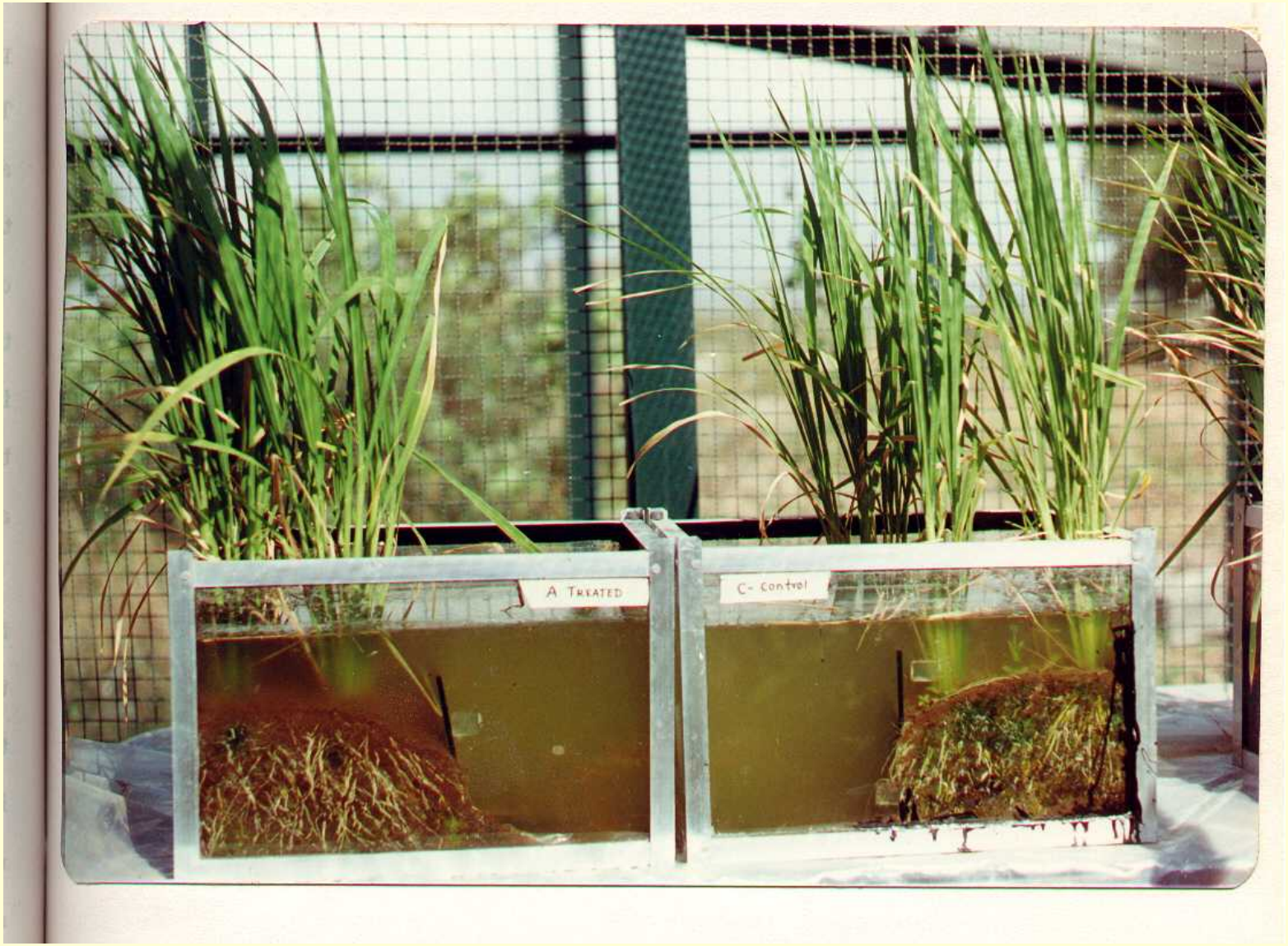
COCONUT RED PALM WEEVIL

POTATO TUBER MOTH

Application of Radio Tracer Technique

- Pesticide Biodegradation.
- Nutrient Uptake in Plant.
- Fundamental Research and Understanding Different Biochemical Pathways.

RADIOLABELLED PESTICIDES



Plant Biotechnology

BANANA, PINEAPPLE, SUGARCANE, TURMERIC, GINGER AND GRAPES

Multiplication protocols standardized and plants field tested

BANANA MICROPROPAGATION TECHNOLOGY TRANSFERRED TO USER AGENCIES

MSSC, Akola and
Kamaraj Krishi Vigyan Kendra, Pondicherry.

TRANSGENICS FOR DISEASE RESISTANCE AND EDIBLE VACCINES

RADIATION PROCESSING OF FOOD & AGRICULTURAL COMMODITIES

Post-harvest Food Losses (%)

COMMODITY GROUP	COUNTRY	
	INDIA	USA
GRAIN & GRAIN PRODUCTS	20-30	32
VEGETABLES	30-50	25
FRUITS	30-50	23
MEAT POULTRY & FISH	20-30	16

International Trade

QUARANTINE REGULATIONS OF IMPORTING COUNTRIES

Agricultural Pests & Insects

Parasites & Pathogens

Noxious Weeds

Methods of Food Processing

Conventional

- Sun-drying
- Salting
- Pickling
- Fermentation
- Thermal processing
- Refrigeration
- Fumigation

Emerging

- Radiation processing
- High pressure
- High voltage pulses
- High electromagnetic fields
- Lasers
- Combinations

Fumigants

- **ADVANTAGES**
  - Reasonably effective
  - Logistically feasible
  - Relatively cheap
- **DISADVANTAGES**
  - Residue forming
  - Unsafe to workers
  - Unsafe to environment
  - Can not penetrate deep in to fruit tissue
  - Require long exposure time
  - Effectiveness depends on environmental conditions
  - Development of resistance
  - Gradual phase out

Radiation Processing of Foods

One Process :

Multiple Uses

Sprout Inhibition

Onion, Potato, inger,Garlic

Quarantine

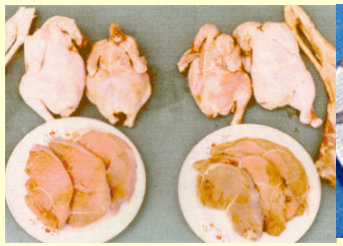
Fruits

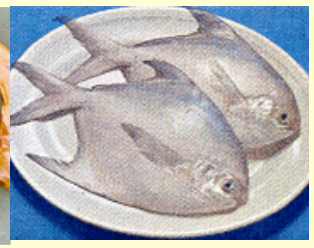
Insect Disinfestation

Cereals, Pules, Dry Fruits

Shelf-life Extension

Chicken, Meat, Fish





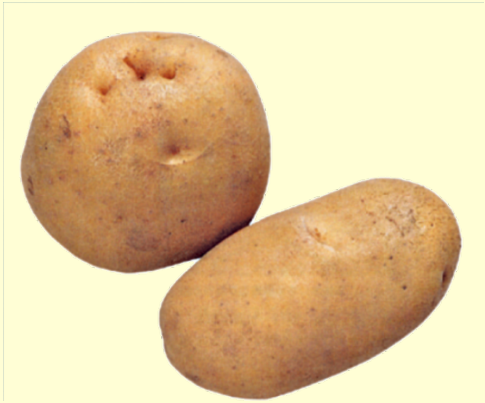
Hygienization

Spices, Flesh Foods

Sprout Inhibition by Radiation

Sprout Inhibition Dose
(0.03 – 0.15 kGy)

Radiation inactivates DNA in germination centres of tubers and bulbs



Delay in Ripening

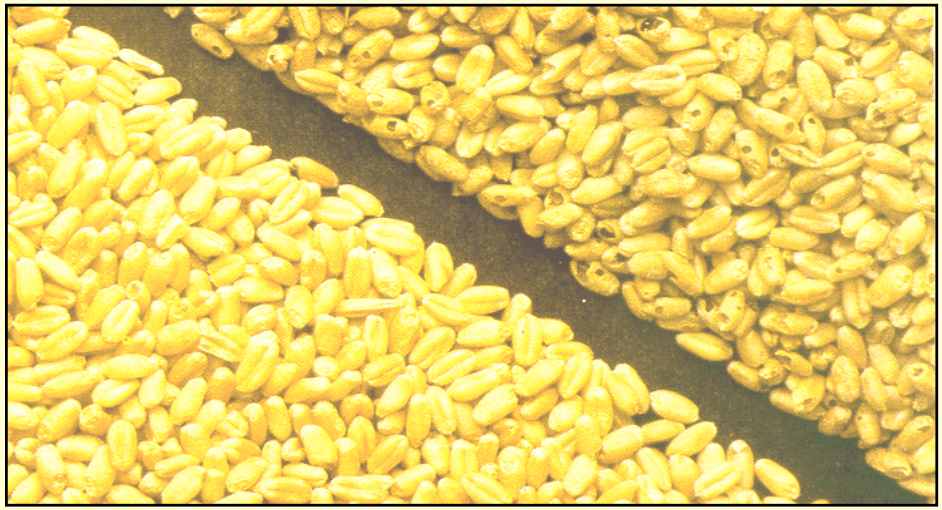
Dose for delayed ripening
(0.25 – 0.75 kGy)

Radiation inhibits formation of the ripening hormone ethylene

Insect Disinfestation

Insect disinfestation dose
(0.25 – 1.0 kGy)

Radiation inhibits hatching of eggs and all developmental stages of storage insects by inactivating DNA



Pasteurization & Hygienization of Food

Shelf-life improvement	**:**	**1.5 – 3 kGy**
Elimination of pathogens	**:**	**3 – 7 kGy**
Hygienization of spices	**:**	**10 kGy**
Sterilization	**:**	**> 10 kGy**

Radiation inactivates DNA of spoilage and disease causing parasites and micro-organisms

Sterilized Meat Products

Radappertisation (sterilisation) results in shelf-stable meats, without undue loss of nutritive value.

Technology Development

- Base-line studies on the commodity
- Appropriate packaging
- Dose optimization
- Storage under prescribed conditions
- Assessment of desired effects
- Assessment of functional properties
- Assessment of nutritional quality
- Sensory evaluation
- Consumer acceptance
- Regulatory approval
- Economics of the process

Processing by Ionizing Radiation

- **ADVANTAGES**
  - Highly effective
  - Non residue forming
  - Safety of workers & environment
  - Can be applied to pre-packed commodities
  - Can penetrate deeper in to tissues
  - Cold process
- **LIMITATIONS**
  - All commodities may not be amenable
  - Capital intensive
  - Detection of treatment difficult
  - Consumer perception

The Technology

RADIOISOTOPES

RADIONUCLIDE	Co-60	Cs-137
TYPICAL SOURCE FORM	Metal	Cesium chloride pellets
HALF-LIFE	5.3 years	30 years
SPECIFIC ACTIVITY	1 – 400 Ci/G	1 – 25 Ci/g
Gamma energy	1.17 - 1.33 MeV	0.66 MeV
Dose rate* (10 kCi)	0.953 kGy/h	0.221 kGy/h

*At a distance of 30 cm from the source in a material of 20 cm thickness

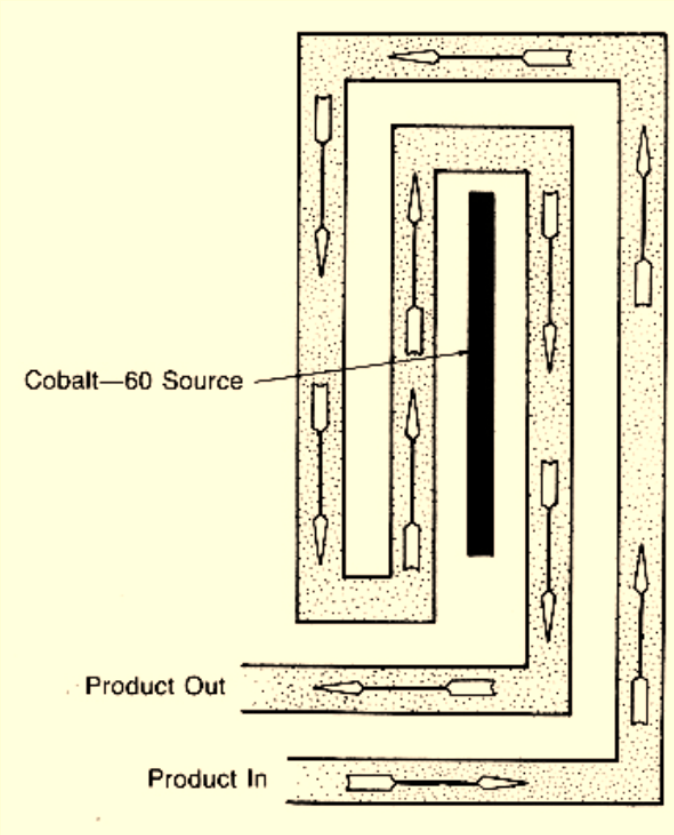
MACHINE SOURCES

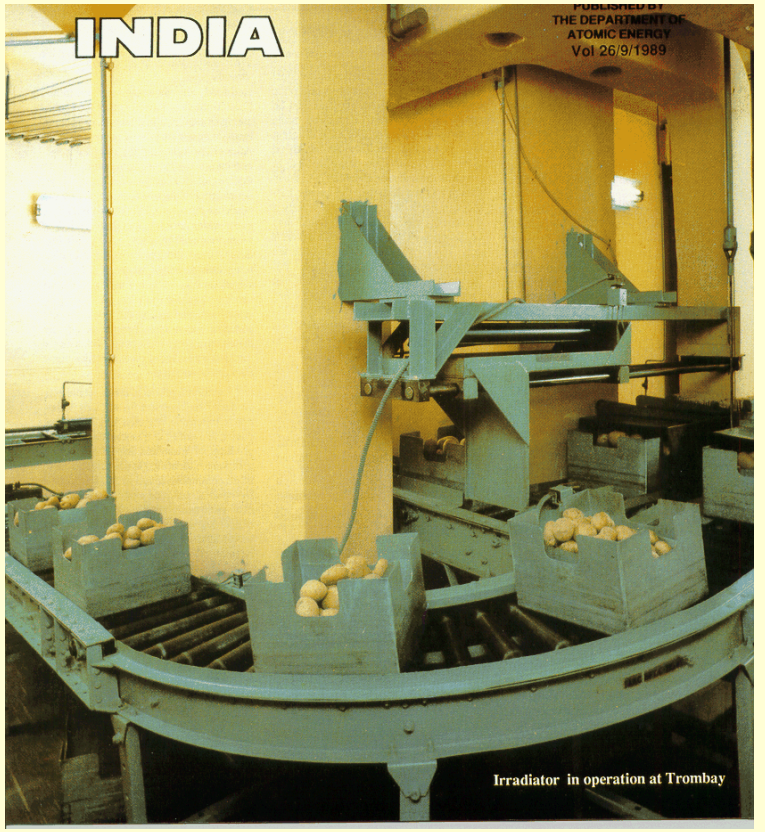
MODE	E-B	E-B X-RAYS
POWER	VARIABLE	VARIABLE
ENERGY	10 MeV (Max)	5 MeV (Max) May be upgraded to 7.5 MeV
PENETGRATION	3-4 cm (Water equivalent)	30-40 cm

Choice of Source

- Product type/product mix
- Product density/bulk density
- Dedicated/multi-product requirements
- Dose range to be covered
- Throughput required
- Required conveyor speed and dwell time

THE PROCESS





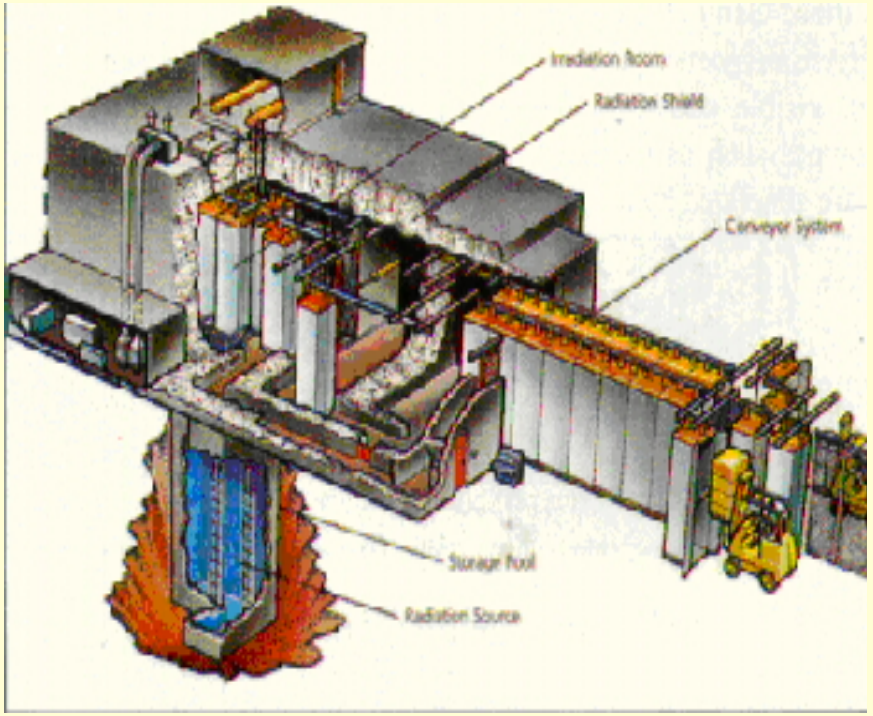
Food is pre-packed & put in the carriers

- It is positioned around the source rack
- Meat is exposed to gamma radiations emitted by the source
- Never comes in contact with radioactive material

Types Of Sources

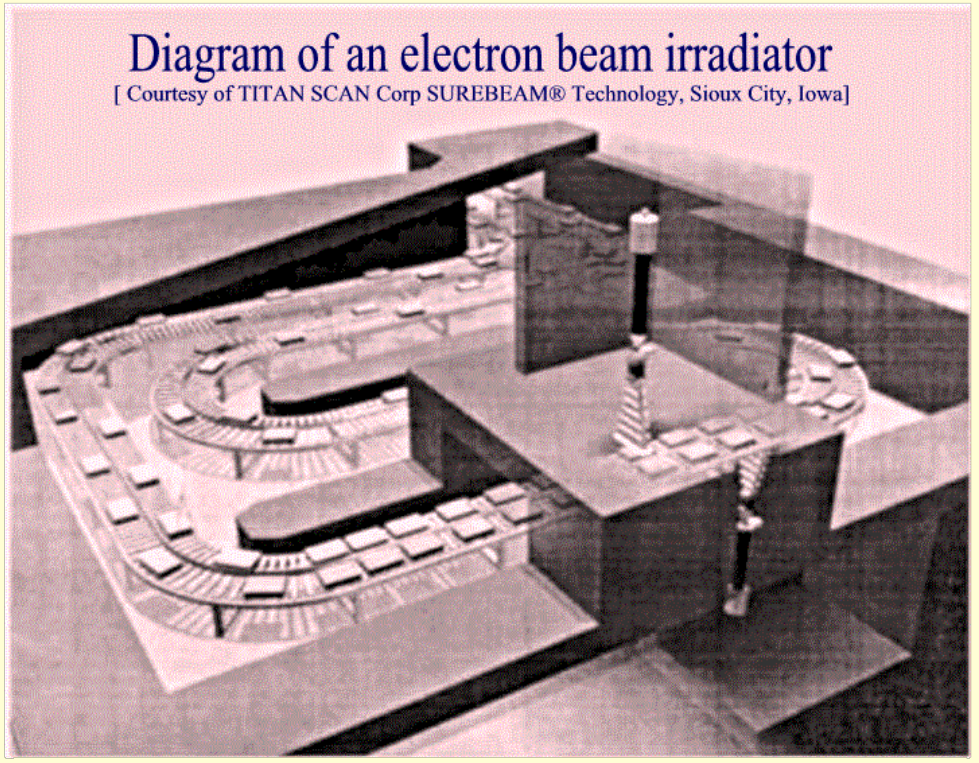
Gamma sources:

- **Co60 and Cs137**
- **Electron beam 10 MeV**
- **X-Rays 5 MeV**



EB Machines - Scope

- **LOW DOSE-HIGH THROUGHPUT APPLICATIONS**
  - Bulk irradiation of grains and cereals and their ground products
- **HIGH DOSE-HIGH THROUGHPUT APPLICATIONS**
  - Bulk or packaged irradiation of spices and frozen/ground meat
- **VERY HIGH DOSE APPLICATIONS AT LOW TEMPERATURES**
  - Ambient stable sterilized foods



Endorsement of Radiation Processing Technology by World Bodies

1980 WHO\FAO\IAEA JECFI CONCLUDED THAT IRRADIATION OF ANY COMMODITY UP TO AN OVERALL DOSE OF 10 kGy PRESENTS NO TOXICOLOGICAL HAZARDS AND INTRODUCES NO SPECIAL NUTRITIONAL OR MICROBIOLOGICAL PROBLEMS

1983 CODEX ALIMENTARIUS COMMISSION ADOPTED JECFI RECOMMENDATIONS

1992 EXPERT GROUP OF WHO ENDORSED THE CONCLUSIONS OF JECFI (WHO 1994)

1997 ENDORSED THE SAFETY OF USING DOSES HIGHER THAN 10 kGy (WHO 1999)

2003 ADOPTION OF REVISED CODEX STANDARD

Radiation Processing of Food
Food Items Approved in India

NAME OF FOOD	PURPOSE	Dose (kGy*)	
		Min	Max
Onion	Sprout inhibition	0.03	0.09
Potato		0.06	0.15
Ginger, garlic		0.03	0.15
Shallot (Small onion)		0.03	0.15
Mango	Disinfestation (Quarantine)	0.25	0.75
Rice, Semolina(rawa), Whole wheat flour (atta) and maida	Insect disinfestation	0.25	1.00
Raisins, figs and dried dates		0.25	0.75
Pulses		0.25	1.00
Dried sea-foods		0.25	1.00
Meat and meat products including chicken	Shelf-life extension and pathogen control	2.50	4.00
Fresh sea-foods	Shelf-life extension under refrigeration	1.00	3.00
Frozen sea-foods	Pathogen control	4.00	6.00
Spices	Microbial decontamination	6.00	14.0

*Gray (Gy) is SI unit of energy absorbed (1 Joule/kg) by food from ionizing radiation ; KiloGray (kGy = 1000 Gy)

Labelling of Radiation Processed Foods

PROCESSED BY IRRADIATION METHOD

DATE OF IRRADIATION_____

LICENCE NO. _____

PURPOSE OF IRRADIATION _____

LOAN LICENCE NO._____

PLACE OF IRRADIATION _____

BATCH NO. / LOT NO. _____

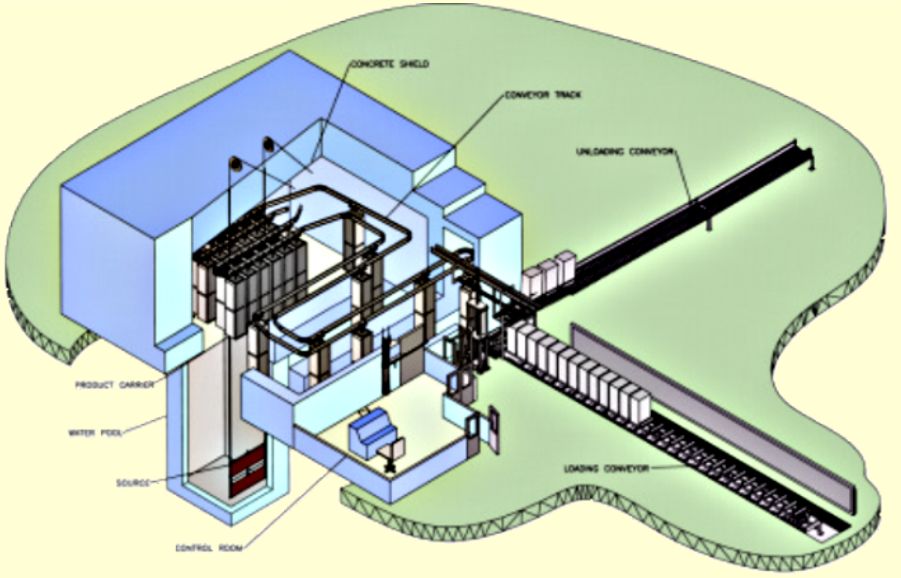
ADDRESS OF LOAN LICENSEE _____

Radiation Processing Facilities Around the World

S. No	Country	No. Irradia-tors	Food Commodities	Estimated Qty. (Tonnes)
1	Belgium	1	Spices, dehydrated vegetables, etc.	15,000
2	Canada	1	Spices	3,000
3	China	11	Spices, vegetable seasonings, Chinese sausage, garlic, apple, potato, onion, rice, tomatoes etc.	1,40,000
4	France	5	Spices. vegetable seasonings, herbs, poultry dried fruit, frozen frog legs, shrimps, etc.	25,000
5	India	2	Spices, onion, other agricultural commodities	1000
6	Indonesia	2	Spices, rice	4,015
7	Israel	1	Spices,condiments, dry ingredients	1,000
8	Japan	1	Potato	20,000
9	Korea, Rep.	1	Garlic powder, spices, condiments	1,700
10	Mexico	1	Spices, dry food ingredients	4,600
11	Netherlands	1	Spices, frozen products, poultry, dehydrated vegetables, egg powder, packaging material	30,000
12	South Africa	4	Spices, shelf-stable food, fruits	11,492
13	USA	10	Spices, poultry, fruits, vegetables	40,000

Major Gamma-irradiation Facilities in India

- **Food Package Irradiator, FTD, BARC**
- **ISOMED, BRIT, BARC**
- **Shri Ram Applied Research Centre Irradiator, New Delhi**
- **Radiation Processing Plant, Vashi, Navi Mumbai**
- **KRUSHAK, Lasalgaon**



Radiation Processing Plant

Vashi, Navi Mumbai

Radiation Processing Plant
Vashi, Navi Mumbai

- MEDIUM & HIGH DOSE APPLICATIONS
  MICROBIAL DECONTAMINATION
- OPERATIONAL SINCE JANUARY 2000
- PRESENT LOADING 300 kCi
- PRESENT CAPACITY 10 TONS/DAY
- DESIGNED CAPACITY 30 TONS/DAY
- QUANTITIES PROCESSED 3000 TONS
- COMMODITIES PROCESSED

  CHILLI POWDER, CURRY POWDER, KALONJI, OTHER SPICES

  DEHYDRATED ONION

  PET FEED

  HERBAL PRODUCTS

  PACKAGING MATERIALS

KRUSHAK
Lasalgaon

Krushi Utpadan Sanrakshan Kendra (KRUSHAK) Lasalgaon

- **LOW DOSE APPLICATIONS**

  SPROUT CONTROL, INSECT DISINFESTATION FOR QUARANTINE & STORAGE OF AGROPRODUCTS
- **OPERATIONAL SINCE JULY 2003**
- **CURRENT LOADING 30 kCi**
- **CURRENT CAPACITY 4 TONS/H ONION**
- **DESIGNED CAPACITY 10 TONS/H**
- **QUANTITY PROCESSED 70 TONS**
- **COMMODITIES PROCESSED**

  ONION

  CEREAL, PULSES AND THEIR PRODUCTS

  WHOLE TURMERIC, RAISINS, MANGO

Potential for Commercialization

- IMPROVE FOOD SECURITY & SAFETY
- ENHANCE EXPORTS
- PREVENT USE OF CHEMICALS HARMFUL TO HUMAN HEALTH & ENVIRONMENT
- FACILITATE DISTRIBUTION FROM PRODUCTION CENTRES TO CONSUMPTION CENTRES
- CUT DOWN CYCLES OF GLUT & SCARCITY
- BETTER RETURNS TO FARMERS
- PRICE STABILIZATION

Radiation Processing Of Food & Agricultural Commodities: Demand Projection For Irradiators

COMMODITY	VOLUME @1% OF THE ANNUAL PRODUCTION (MILLION TONS)	REQUIRED DOSE	NUMBER OF IRRADIATORS (COBALT-60, 300 kCi) REQUIRED
GRAINS	2	0.25	30
FRUITS & VEG	0.9	0.25	15
SPICES	0.03	10	15
SEAFOOD & MEAT	0.1	3	15

Indigenous Capability in EB Technology

- 2 MeV ILU-6 facility at Vashi, Navi Mumbai
- 500 keV facility at Vashi, Navi Mumbai
- 500 keV DC Accelerator at CAT, Indore
- 10 MeV, 10 kW linac accelerator at CAT, Indore
- 10 MeV, 10 kW linac accelerator at Kharghar, Navi Mumbai

Linkages

- Ministry of Food Processing Industries
- Ministry of Agriculture and Co-operation
- Ministry of Health & Family Welfare
- Agricultural Universities – Collaborative R&D under BRNS
- Farmers' Co-operatives – MOUs for use of KRUSHAK and setting up plants
- Industry – MOUs with private entrepreneurs for setting up plants
- NGOs - Public awareness and use of the technology

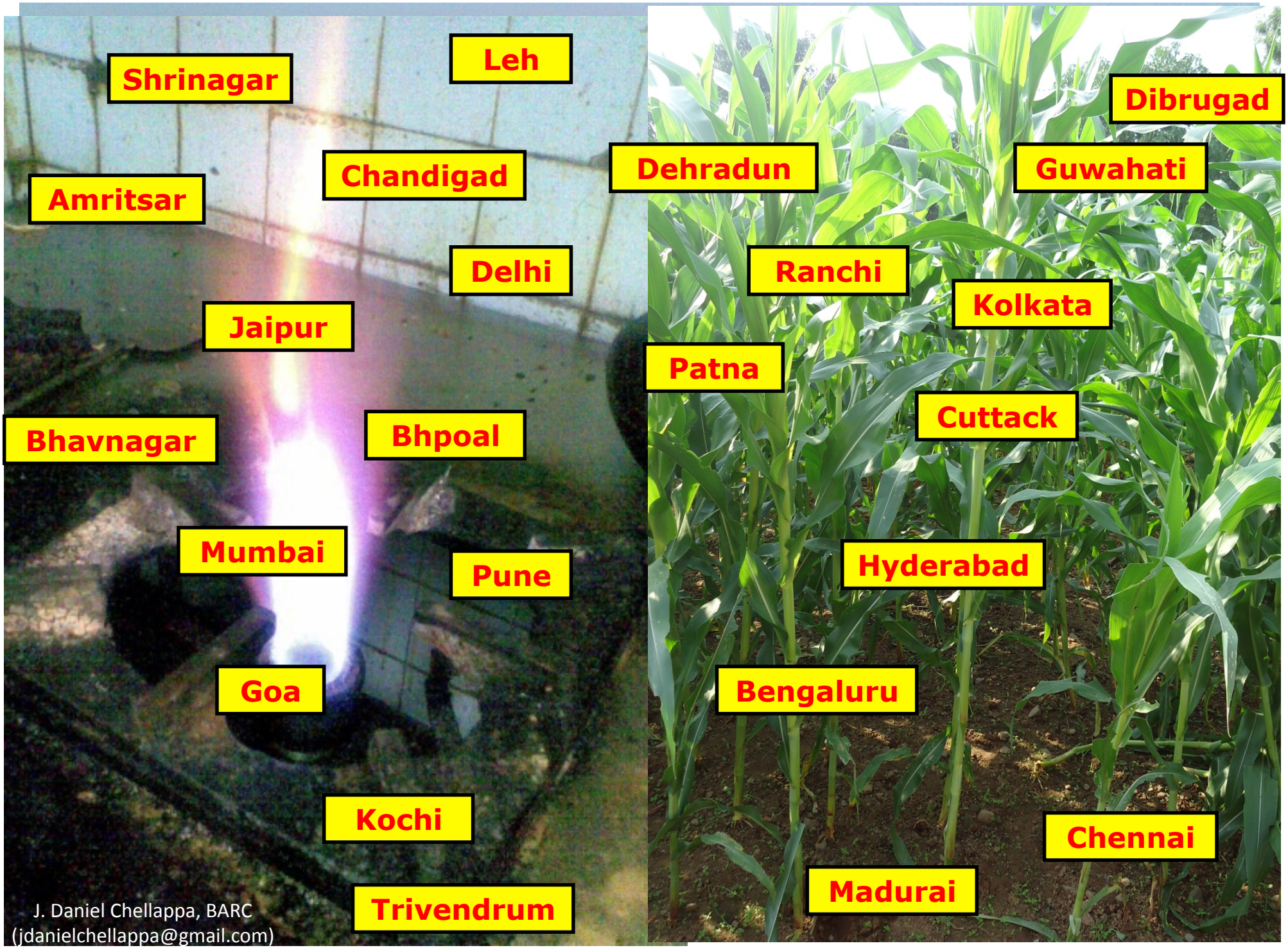
Thank You

Mungbean TARM-1

- Resistance to Powdery Mildew disease
- Tolerant to Mungbean Mosaic Virus disease
- Released for Maharashtra, MP, AP, TN, Gujarat, Orissa, Kerala and Karnataka
- Average yield 1,200 kg/ha

BARC's Solid Waste Management Technology.ppt

J. Daniel Chellappa, BARC (jdanielchellappa@gmail.com)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Dibrugad
Guwahati
Ranchi
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Patna
Cuttack
Hyderabad
Bengaluru
Chennai
Madurai
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