



**Jain™**  
**Tissue-Culture**

Better Yields. Greater Profits.

## JISL's Odyssey with Indian Agri Development

- 1963 : Marketed agri-inputs: fertilizers, pesticides, hybrid seeds, electric motors, crude oil for pump-sets, tractors & implements.
- 1978 : Collected papaya latex at guaranteed price enhancing farmer income under contract farming & processed it into refined papain solely for exports.
- 1980 : Promoted cost-effective, convenient PVC pipes as substitute for cement, asbestos and GI pipes for irrigation.
- 1987 : Pioneered small farm Drip Irrigation helping farmers save water, electricity, cultivation cost, and improve yield and quality of produce.
- 1989 : Commenced developing Demo R&D Farm for Hi-tech Agriculture.
- 1994 : Initiated, for the first time in the country, commercialization of Grande Naine tissue culture banana for higher productivity and reduced maturity period.
- 1995 : Completed Hi-tech Agri Institute for farm resource R&D, Demo, Training & Extension.
- 1997: Built various engineering structures for rainwater harvesting & soil conservation.

Created assured market for large number of onion growers at pre-determined price under contract farming.

- 1998 : Offered reliable market for mango/ banana / guava growers by commissioning cutting-edge Fruit Processing facility.
- 1999 : Commercialized successfully Grande Naine tissue culture banana.
- 2000: Finished a replicable watershed model that demonstrates wasteland transformation.
- 2002 : Began production of 'BioSamruddhi' organic manure which restores & improves soil fertility.
- 2004 : Established modern Virology & Bio-Tech labs. Embarked upon Jatropha 'Yadnya' as alternative farming system for Bio-diesel production.
- 2005 : Ushered production of bio-gas using farm residue as well as solid waste & effluent of Vegetable Dehydration & Fruit Processing Plants. Launched pilot-plant for Bio-oil & -diesel from non-edible vegetable

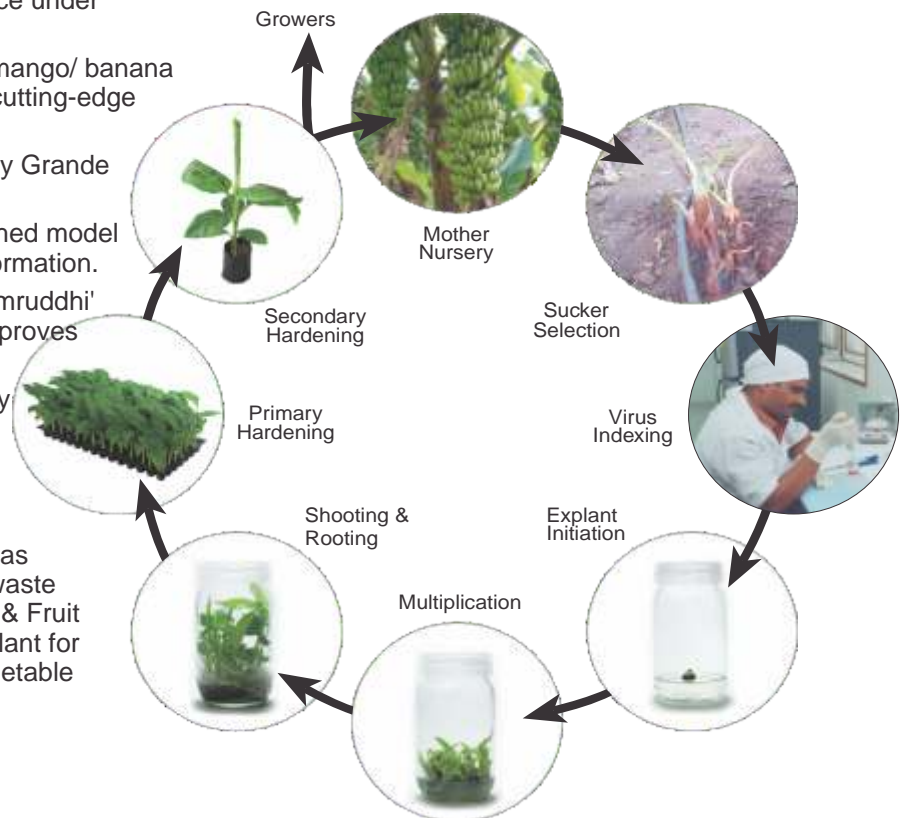
## Banana Tissue Culture

Application of Bio-tech for mass micro-propagation of high yielding (genetically true-to-type) elite clones to provide consistently uniform quality of disease-free planting material, the superior alternative for banana plantations.

## Jain Tissue Culture Process

### Step I : Mother Nursery

JISL is the only Company that maintains disease-free mother-plant nursery from elite clones with proven yield potentials. Sword suckers are collected from this mother nursery and screened by trained specialists. Screened suckers are then indexed to confirm that they are free from viruses. This unique arrangement guarantees the best start-up material for banana plantlet development. Own mother nurseries ensure traceability, quality control and reliability of start-up tissues.



(JISL - Jain Irrigation Systems Ltd.)

## Jain Tissue Culture Process

### Step II : Production

- Environment : Micro-propagation clean room conditions as per international standards of class 100 - 10,000 are maintained to achieve excellence.
- Explant Initiation : Suckers from mother nursery are sterilized. Aseptically dissected shoot tips (undifferentiated) are inoculated onto specially formulated nutrient medium for proliferation of shoot buds under controlled clean room conditions.
- Multiplication : Proliferated shoot buds in clumps are individually transferred to & nourished in multi-media to form shoots. The clumps of shoots are induced again & again to obtain required number of plantlets of desired parameters. This eliminates morpho-genetic variation in the plantlet population.
- Shooting & Rooting : Multiplied shoots are individually separated and graded for quality. Individual shoots are then transferred to another nutrient medium for shoot elongation and root development. Fully developed plantlets are sent for primary hardening in specially designed greenhouses.



### Step III : Primary Hardening : Greenhouses

- Optimum micro-climatic conditions (relative humidity, air circulation, light intensity and temperature) are maintained.
- In-vitro produced plantlets are removed from the glass jars, washed and graded for quality.
- Graded plantlets are planted into protrays filled with soilless peat mix growing media.
- These plantlets are then hardened under controlled micro-climatic conditions in specially designed poly tunnels on benches.
- 6000 sq. m. of computer controlled greenhouses help in bringing out healthy primary hardened plantlets.
- Highly stringent hygienic conditions as well as controlled micro-climate in the primary hardening facility are religiously maintained for achieving quality of plantlets.



## Jain Tissue Culture Process

### Step IV : Secondary Hardening : Shadehouses

- In-house designed shadehouses are provided with raised beds, proper drainage, micro irrigation and fertigation arrangements for individual plants in poly-bags and misting system for micro-climate control.
- Sprawling secondary hardening complexes spread over 40 acres support timely and year-round availability of plants.
- Continuous R&D in respect of potting mix not only ensures health of the plantlets while in the shadehouse but also helps faster growth and quick failsafe emergence of the plants when transplanted in the fields.



### Step V : Field Delivery

Fully hardened plants having minimum 5 leaf stage in poly-bags are despatched through custom-built 2-3-tier trucks having arrangement of water sprinkling during transit till farmers receive them.

### Step VI : Field Support

Qualified and experienced agronomists provide consistent support to the farmer in irrigation scheduling, fertigation, agronomy, plant protection and harvest.

All these services combined with the tailor-made drip irrigation systems designed and supplied by the company help in achieving enhanced productivity and higher returns.

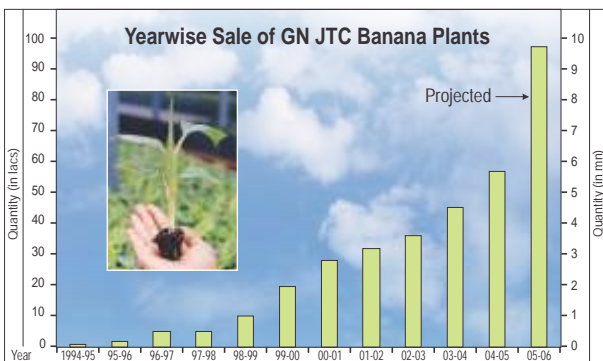


### Jain Tissue Culture Development Location

Jalgaon district, "The Banana Bowl of India", is eminently suited for Banana Tissue Culture development because it has over 48000 ha under Banana cultivation which contributes 16% to the total Banana production of India.

Jalgaon has been traditionally growing Dwarf Cavendish varieties. This is mainly on account of conducive climatic conditions, disease-free soil profile for plants as well as dry, non-conductive environment for pests and insects. The area is known to be free from frequent viral incidence. The average yield of non-tissue cultured banana plants is 12 kg/plant. Even this yield is much higher than the state average of 10 kg/plant and national average of 8 kg/plant.

Intensive trials were carried out at Hi-tech R&D farms to determine agronomic practices and growth parameters for the select promising varieties from amongst Shrimanti, Basrai, Williams, Zeleig, Robusta and Grande Naine (GN).



### Selection of GN for Jain Tissue Culture

- GN scored over other varieties by virtue of its suitability, adaptability, higher productivity, long, straight, cylindrical, and well-shaped fingers, and, more importantly, longer shelf life.
- GN is internationally a preferred table-variety and has high fresh-fruit export potential.
- GN processed products have ready acceptance in advanced markets due to better color and storage stability.
- GN has higher survival rate upon planting, much more uniform maturity, & shorter harvesting period.

### GN Jain Tissue Culture Protocol Development

The standardization of GN Banana JTC protocol, hardening processes under controlled and semi-controlled conditions, the study and observation of morphological characters, agronomical practices suitable for higher productivity, water requirement under Drip Irrigation, Fertigation etc. took as much as 5 years of R&D efforts.

The production graph from inception till date bears testimony to our sincere and persistent efforts for perfecting the entire production protocol for optimal yields and maximum returns to the farmer.

We take care of JTC plants as if they are test-tube babies. No wonder, when brought up well by the farmers, JTC plants become market leaders.



### Support Facilities for Jain Tissue Culture Unit

- Independent R&D Lab: Continuous improvements in micro-propagation protocols for enhanced quality and research into system development for new crops.
- Virology Lab: Virus indexing of carefully selected sword suckers, tissue cultured plantlets and the hardened plants of green houses and shade houses.
- Biotech Lab: Analysis of genetic traits in planting materials and seeds for higher productivity and disease resistance.
- Analytical Lab: Physical, chemical and microbiological analysis of leaf, soil, potting media, nutrients, water and other agri-inputs.



### Benefits of Jain Tissue Culture Banana Plants

- Jain Tissue Culture, JTC, plants are disease-free, vigorous, uniform & possess high field adaptability.
- Low mortality of JTC plants in the field is ensured by fully hardened saplings in poly-bags.
- JCT banana plant variants/off-types are observed to be between 0.3 - 1%.
- Three harvests of JTC banana in 30 months ensure higher benefit-to-cost ratio for the farmer.
- Yield ranges depend upon optimal agronomic practices, local agro climatic conditions and adoption of modern irrigation systems. The highest recorded average yield is 45 kg/plant.
- JTC bananas fetch premium in marketplace.
- Farmers are able to recover full value of JTC saplings through sale of daughter suckers.



### Jain Tissue Culture : Better Yield - Dos & Don'ts

- Select loamy, well-drained and organically rich soil with pH 6-7.5.
- Prepare pits of 1.5' x 1.5' x 1.5'. Fertilize crop with basal dose before planting. Use 25 kg organic manure per plant in two split doses at planting and at bed preparation.
- Avoid planting during cold weather (below 15°C), extreme summer (above 40°C) or heavy rainy days.
- Use 6' x 6' or 6' x 5' or 7' x 5' or 8' x 5' row to row and plant to plant spacing respectively keeping in view the climate and soil conditions.
- Avoid mainly Papaya, Chilli, Brinjal and Cucurbit family (Pumpkin, Ridgegourd, Snakegourd, etc.) crop cultivation near banana field.
- Provide wind-break (e. g. Sesbania plants) against the direction of prevailing wind.
- Avoid over or under irrigation.
- Obtain advice for irrigation and fertigation schedules. Drip-irrigate the plant at field capacity every day. For efficient and uniform irrigation use



- Apply additional quantity of water during cold spells to avoid injury from chilled weather.
- Nourish with 200-220 g of N, 65-70 g of P<sub>2</sub>O<sub>5</sub> & 300-400 g of K<sub>2</sub>O per plant up to 300 days as per growth. Also use micro- and macro-nutrients viz. Zn, Fe, Bo and Mg, S, Ca separately as required
- De-sucker periodically until the plants are 5 months old in the field.
- Protect fruit bunches from heat by dry leaf cover, & from pests and diseases with skirting poly-bags.
- Leave one healthy sucker for next ratoon, on the side opposite to the flower / bunch after the bunch reaches 70% growth.
- Prop suitably the banana plants bearing heavy bunches to prevent their fall.
- Uproot and burn plants affected by viral or bacterial diseases immediately when symptoms are observed first time.
- Manage pest, fungal & bacterial diseases with permitted insecticides, fungicides & bactericides.

### Emerging Products from Jain Tissue Culture

- Red Banana, Nendran, Sabri, Rasthali, Malbhog & Ney poovan JTC Banana protocols established.
- Micro-propagation protocols for Australian Teak (*Acacia mangium*) and Sugarcane standardized.
- Micro-propagation protocol for Physic Nut (*Jatropha curcas*) nearing standardization.
- Micro-propagation protocol for onion as well as banana hybrids under field-testing.





JISL pioneered mass micro-propagation and commercial cultivation of an exotic banana variety, Grande Naine (GN), in India. JISL's Banana TC unit currently produces and markets over 10 m (100 lac) GN banana plants per year. As such, this production unit is probably the largest Banana TC facility in India. The wide sales and service network and team of dedicated agronomists have so far intensively covered Maharashtra. They have also penetrated Gujarat, Madhya Pradesh, Chattis Garh and Karnataka. Uttar Pradesh, Tamil Nadu and Andhra Pradesh are also racing towards accepting JTC banana. Even Punjab, Tamil Nadu, Mizoram and Goa have opened their JTC banana account. R&D trials, meticulous documentation, established sales and service procedures and practices for satisfaction of the farmer, and built-in quality consciousness amongst the associates are but some of the factors which have gained JTC facility the rare distinction of being the only unit in the country to have been accredited with ISO-9001: 2000 QMS certificate by RWTUV, Germany.



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