



Precision Farming  
**COFFEE**  
With Jain Technology™



**JAIN**®

**Jain Irrigation Systems Ltd.**

*Small Ideas. Big Revolutions.®*

# Precision Farming Coffee With Jain Technology™



Coffee plant is a woody perennial where the fruit yield depends on the balance between vegetative and reproductive growth. The coffee plant is believed to have originated in the Ethiopian High lands, in the county called Kaffa, hence the name. But the English word COFFEE is derived from the Italian CAFFE. In India Coffee was first grown in the 17th Century in the hills of Chickmagalur district. Even now, the coffee growing areas in India are restricted to a narrow belt in the States of Karnataka, Tamil Nadu and Kerala, on the Western Ghats and Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Sikkim, Tripura and West Bengal on the Eastern Ghats.

Brazil is the highest coffee producer, 35% of global production. India produces only 4% of world coffee.

Wherever in the world coffee is grown it is within 1000 miles of the equator, including both tropical and sub-tropical climates.

Though the genus coffee has numerous species ( Family Rubiaceae), only two, Arabica and Robusta are commercially significant. Arabica coffee grows best above 3000 feet altitude but is highly susceptible to pest and diseases. Robusta, is relatively drought resistant and is more resistant to pests. Robusta has high caffeine content, while Arabica has half caffeine content as of Robusta. Because of this trait, Robusta is used in most commercial coffee blends and in the production of instant coffee. Robusta grows in relatively lower altitudes.

India grows both Arabica (around 1/3 of production) and Robusta (around 2/3 of production) varieties of coffee. The total planted area of coffee covers around 380,000 hectares mainly in the traditional coffee growing states of Karnataka (58 %), Kerala (22 %) and Tamil Nadu (8 %). Non-traditional coffee growing areas are to be found in Andhra Pradesh, Orissa and North-East India. Major coffee growing districts include Kodagu and Chikmagalur in Karnataka and Wyanad in Kerala. The non-traditional areas grow some 15% of India's coffee.

The productivity of Arabica coffee is about 600 kg/ha and that of Robusta 1070 kg/ha ( source: Coffee Board).



## Soil and Climate

Coffee requires acidic pH soil with deep and friable profile.

**Table 1 : Conditions suitable for growing both Arabica and Robusta coffee.**

Soil and Climatic Factors for Coffee		
Factors	Arabica	Robusta
Soils	Deep, friable, rich in Organic matter , well drained and acidic (pH 6.0-6.5)	Same as Arabica
Slope	Gentle to Moderate	Gentle slopes to leveled fields
Elevation	1000-1500 m	500-1000 m
Aspect	North, East and North-East aspects	Same as Arabica
Temperature	15-25 oC, cool clime	20-30 oC hot humid clime
RH	70-80 %	80-90 %
Rainfall	1600-2500 mm	1000- 2000 mm
blossom showers	March-April (25-40 mm)	February-March (25-40 mm)
Backing showers	April-May (50-75 mm), Well distributed	March-April (50-75 mm), Well distributed

## Liming of soils and maintenance of pH.

To grow healthy coffee plants and to realize better crop yield, it is essential to maintain the soil pH around 6.1. The various plant nutrients in the soil would then be available to coffee plants. The acidity also determines the nutrient assimilation/mineralization in the soil. Due to the continuous application of acid forming fertilizers like ammonium sulphate, ammonium chloride and DAP and due to the leaching of calcium and magnesium elements in the soil, the soils tend to become more acidic. Therefore, to monitor the soil pH, soils have to be tested compulsorily once in 2-3 years. When the soil pH goes above 6.2 or comes below 6.1, the soil pH needs to be corrected. Highly acidic soils are harmful for the useful soil micro-organism and in such soils coffee plant is always tend to be stunted in nature. If the soils are alkaline (above pH 7.0), most of the essential plant nutrients are not available to the plants.

Whenever, the coffee soil pH falls below 6.1, it should be corrected by application of alkali forming soil amendments like agricultural lime(Calcium Carbonate), dolomite ( Calcium and Magnesium Carbonates). Liming of the coffee soils can be done anytime of the year except during monsoon period. November to February months is the ideal period for lime application. One should take care that adequate moisture is present in the soil for the best use of applied lime. If the recommended dose of liming material is more than 3.5 metric ton per hectare, in such case the dose has to be split into two equal parts and applied in 2 years.

In the case of soil pH above 6.2, then pH can be corrected by the application of acid forming fertilizers.

## Water conservation in Coffee Plantations

Traditional coffee plantations are all in high rain fall zones of the country. However, the erratic monsoon rains make it imperative for planters to bring in irrigation technology for Coffee. Planters generally take up various run- off control measures which also restricts soil erosion. In addition to this the top soil and the rich organic matter (tree leaves etc.) maintain a spong like texture on the surface soil that would help in storing moisture in the rhizo -sphere and other lower strata. They also act like a mulch protecting escape of moisture.

## Coffee Industry in India

Coffee industry in India is 190 year old. Next to oil, coffee is the largest traded commodity in the world. This perennial crop takes long to establish as productive: 8 years for economic yield in case of Arabica and 10-12 years for Robusta. Most (98 %) of the 250,000 growers in India are small holders, less than 10 ha holdings. Coffee production is labor intensive; 70% of cost of production is labor.

## Climatic effect

Coffee growth is affected by climatic and edaphic factors; light, temperature, rainfall, humidity nutrients and soil moisture and soil temperature.

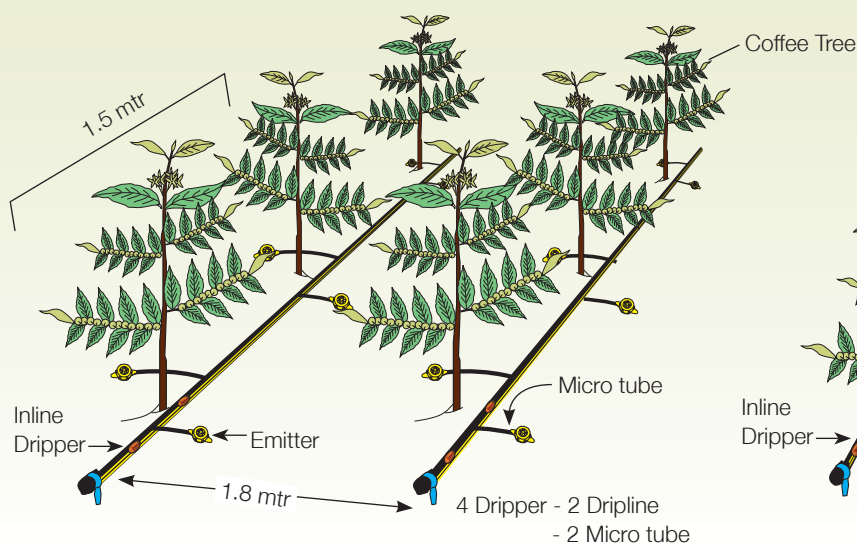
## Shade grown coffee

Indian coffee grows in a system with a 3-tier shade system. Planters take a lot of care in selecting the trees for each tier. The plantations are under the canopy of this shade trees.

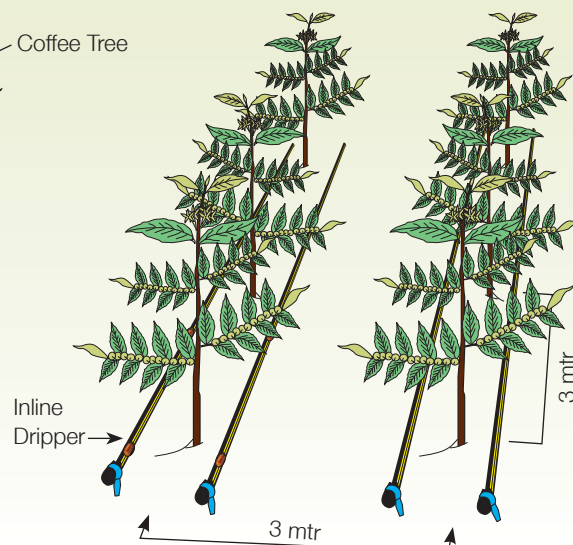
The lower shade tier is usually a nitrogen fixing species like *Erythrina* or *Gyricedia*. Both these can harvest nitrogen and improve soil fertility. The secondary tier is of trees like Silver oak, white or red cedar , those shed leaves in monsoon and provide an effective shade during summer months. They keep the soil and ambient temperature low ; a requirement for coffee. The tertiary tier is of hardwood trees, mostly adapted forest species. The 3-tier system helps in filtering harmful UV radiation and the filtered sunlight helps in caramelizing sugars in the coffee bean and give it the unique taste of shade coffee . On an average, there are 300-350 shade trees in an acre of coffee making it as one of India's largest man made forest growing. Because of this deliberate forest maintenance the coffee cultivation in India is least mechanized.

Studies on growth of coffee have shown that annually there are two main phases of growth; phase I during March –July and phase II during August – October. The second phase is more pronounced. In a high production system the input management (water and fertilizer) has to take these growth phases into active consideration.

## Drip layout for Arabica Coffee



## Drip layout for Robusta Coffee



But in recent years, the rain fall quantum has declined; infiltration rates into the soil decreased and factors like deforestation, soil compaction etc. has resulted in less soil storage of moisture. Water is increasingly becoming limited for coffee growth. Planters are finding it difficult to keep the Coffee plants growing without irrigation.

### Coffee Irrigation

Because of drastic changes that occurred in the rain cycle over the years, irrigation is essential for coffee production. The Robusta area has been increasing ever since Arabica coffee began its decline due to increasing pest pressure. Robusta requires well timed systematic irrigation during the annual production cycle. In countries like India, Kenya, Ethiopia and Vietnam, coffee production thus depend upon irrigation for at least 4-6 months of the year. Countries in South and Central America, coffee is less depended on irrigation as their rain fall distributed throughout the year.

The irrigation requirement of coffee is very high; around 101 m<sup>3</sup> water per acre per season.

The stages of Coffee when Irrigation is critical are:

- Period of Flowering
- Period of Berry expansion
- Bean filling stage

### Benefits from Irrigation

- Enhances vegetative growth and increases the flower bunch points on the stem (Nodes)
- Increase bean yield
- Improves the soil ecology by enhancing microbial population
- Improves the rate of decomposition of soil organic material and thus maintains soil CN ratio
- Makes the soil micro climate ideal for coffee growth
- Improves nutrient up take by plants.
- In heavily water stressed situation helps the crop to survive and yield.

It is essential for Coffee plants to have adequate soil moisture continuously during the vegetative and fruit growth stages. It is also found that excessive water in the soil also is deleterious to coffee. In South Indian Plantations, this means that irrigation

becomes essential after September till May except for about 40 days in January-February when Coffee requires a stress period for inducing flowering.

### Suitable irrigation Systems for Coffee

Sprinklers and Rain guns have been adopted by large coffee estates for last two decades or so.

But as the technology got accepted several issues got to affect the increased adoption of Sprinklers. The main issues involved by these systems are;

- The concept of irrigation in Coffee plantations is to supply the water at proper time and in sufficient quantum. Because fruit set is fully depended on the timing and quantity of irrigation and uniformity of irrigation is critical.
- Sprinklers/Rainguns have large power requirements to operate.
- Shade trees act as obstruction to the pressurized water spray emanating from the nozzles resulting in non uniform water distribution.
- As water sources are fast depleting in plantations for want of adequate annual rain fall in the hills, large volumes of water required for an event of sprinkler irrigation are often not available in many estates.
- In this context drip irrigation is increasingly being adopted by Coffee Planters.
- Fertigation (application of fertilizer through irrigation water) is not possible through sprinklers but is part of drip irrigation system.

In this scenario drip irrigation method is found to be absolving many of the issues listed above. **Drip system with its, Lower energy requirement, higher water use efficiency, lack of any effect due to wind and above all allowing for fertigation, a more efficient fertilizer use, is the best method available.**

Both in line and on line drippers are suitable. But for large gardens, inline drip lines are more practical.

For Arabica coffee single drip line per row of coffee is suitable.

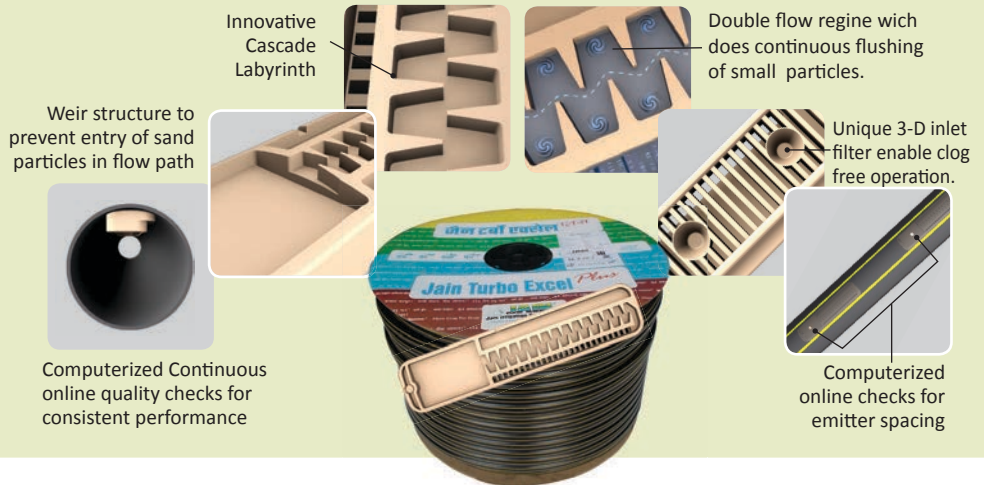
For Robusta, there should be two drip laterals one on either side of the tree.

# ONE STOP SHOP for Your



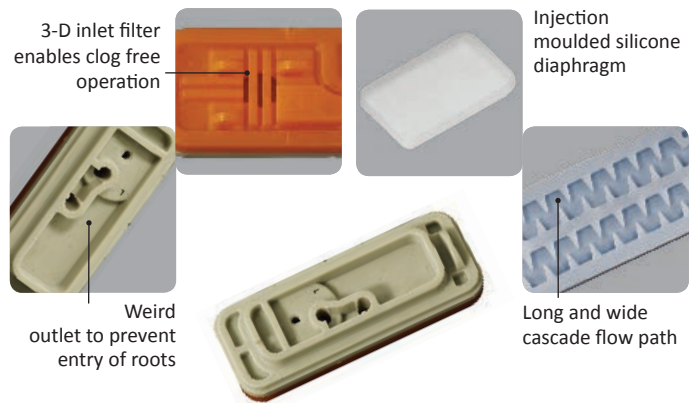
## Jain Turbo Excel® and Jain Turbo Slim

- ◆ Five Star rated dripline from worlds reknowned institute IRSTEA (Cemagref), France.
- ◆ Available discharge rates - 0.85, 1.2, 1.6, 2.1, 4 lph @ 1kg/cm<sup>2</sup>.
- ◆ 12, 16, 20, 25 mm nominal diameter.
- ◆ Dripper Spacing 15, 20, 30, 40, 50, 60, 75,90 cms.



## Jain Turbo Top®

- ◆ Available discharge rates – 1.1 & 1.7 lph
- ◆ Injection moulded silicone rubber compensates with pressure and discharge gives uniform performance.
- ◆ Anti Syphone feature (optional) prevents suction of sand and silt particles inside the dripper.
- ◆ Cascade labyrinth gives strong, self-cleaning turbulence.
- ◆ Available in 16 & 20mm nominal diameter. (12, 16 & 20 mm in Thin Wall option)
- ◆ Suitable for surface as well as subsurface installations.

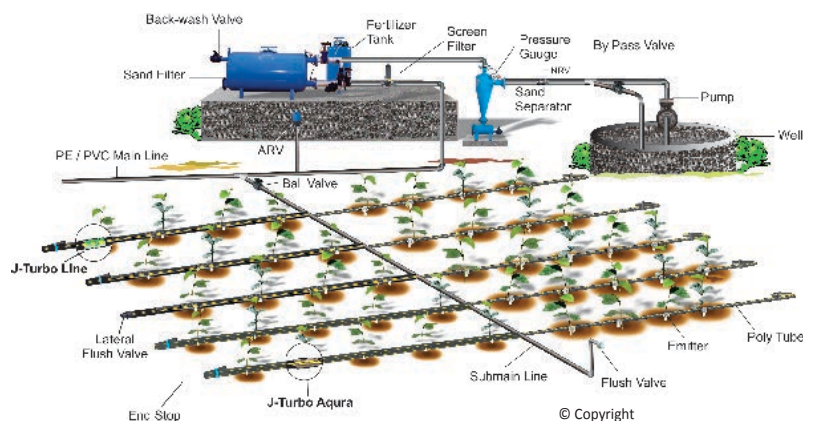


## Why Jain Drip Irrigation ?

Water is not the only need of the plant. To uptake this water efficiently, it requires proper air-water balance within the root zone. Drip irrigation, with its low application rate, prevents the saturation of water within the root zone and continuously maintains field capacity. This provides a favorable condition for the growth of the plant. Drip irrigation also helps to use fertilizer efficiently. With drip irrigation water can be provided at frequent intervals which helps maintain required soil moisture level within the vicinity of the plant roots. Jain is the pioneer of drip irrigation. Ours is the only company in the world, which fulfills your entire irrigation system requirement under one roof.

## Characteristics of drip irrigation

1. Water is applied at a low rate to maintain optimum air-water balance within the root zone.
2. Water is applied over a long period of time.
3. Water is applied to the plant and not to the land.
4. Water is applied at frequent intervals.
5. Water is applied via a low pressure network.



# Micro Irrigation Needs

## J-Turbo Line® Super



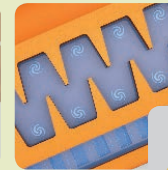
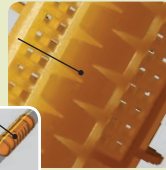
- Available discharge rates (at 1kg/cm<sup>2</sup>)  
12mm - 2.2, 4 lph  
16mm - 4, 8 lph  
20mm - 2.2, 4, 8 lph
- Available in 12, 16 & 20 mm nominal diameter.
- Suitable for surface as well as subsurface installations.

Straight and wide labyrinth design makes the dripper truly clog resistant.

Computerized online checks for emitter spacing

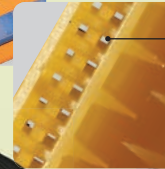


Hydrodynamic through bore design provides least obstruction to flow.



Hydrodynamically designed cascade tooth structure helps to create double flow regime for continuous flushing of dirt.

High precision inlet filters on opposite side prevents entrance of fine particles



Laser Drilled Multiple Outlet Holes



## Turboline PC®

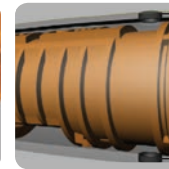
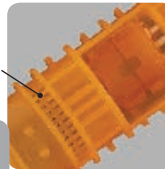


- Available discharge rates - 1.4, 1.8, 2.6 & 4.0 lph within pressure regulation range of 0.7 to 3 kg/cm<sup>2</sup>.
- Injection moulded silicone rubber compensates with pressure and discharge gives uniform performance
- Application on undulating land/ Terrains/ Steep slopes.
- Available in 16 & 20 mm nominal diameter.
- Suitable for surface as well as sub-surface installation.
- Application where ever longer lateral length is necessary.
- Conforming to IS 13488, ISO 8261 Standard.

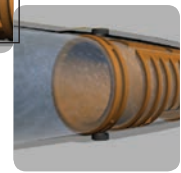
Diametrically placed multiple inlet filters



Injection moulded silicone diaphragm



Dual outlets to break vacuum & prevents soil suction



Smooth hydrodynamic design minimizes frictional losses & helps for longer lateral running length.



## Largest Choice ! Customized Irrigation Solution

### Online Dripper & Spray Heads



### Jain Filtration Equipment



### Jain Fertigation Equipment



### Jain Rainport / Micro Sprinkler



### Jain PVC/PE Pipes & Fittings



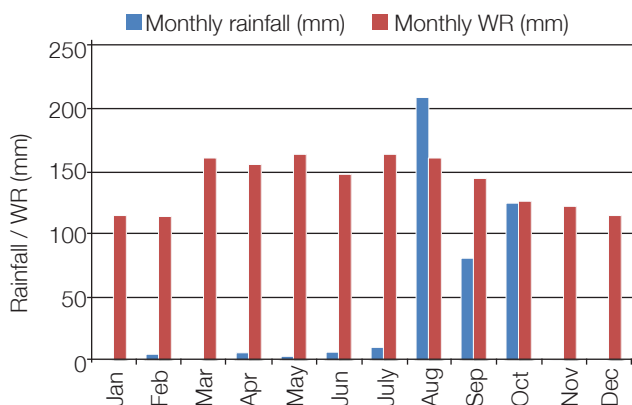
### Automation Equipment



## Water Requirement Of Coffee

Water requirement of Coffee is met by the monsoon rains in India. However, for a period of 6 plus months including the critical periods (March-May and September-December) rain fall is low and Crop water requirement has to be met by irrigation.

Fig. 1. Coffee water requirement (mm) from January to December and the rainfall (mm).@@



@@ Estimated WR for Wynad, in Western ghats.

## Water requirement Mature yielding coffee

$$ET = E \times 0.7 \times 0.95 \times 1 \text{ (mm)}$$

- where E= Class Pan Evaporation
- 0.7 = Pan coefficient
- 0.95 = Crop factor for full leaf cover
- 1.0 = Canopy factor at full leaf cover

At peak

$$\text{WR for Robusta at } 3 \times 3 \text{ m} = 36 \text{ l/bush}^{**}$$

$$\text{WR for Arabica at } 1.8 \times 1.5 \text{ m} = 10.8 \text{ l/bush}$$

\*\* The WR changes with Pan Evaporation of the location.

Blossom Irrigation at 1 inch (as recommended)

$$\text{Robusta} = 222 \text{ l/bush}^{***}$$

$$\text{Arabica} = 67 \text{ l/bush}$$

\*\*\* in drip irrigated gardens, continue dripping for 4-6 hours to completely soak the root system without allowing for run off.

## Coffee fertigation

Coffee is a perennial with an annual cycle of flowering and fruiting. It also exhausts soil of nutrients. Coffee soils are highly organic due to the continuous decomposition of leaf matter available in their ecologies.

The processing of Coffee beans also returns large quantity of fruit skins and pulp obtained during the processing. For example, it is estimated that processing of 6000 kg fruits to get one ton of coffee beans, returns 15 kg N, 3.7 kg P, and 37 kg of K to the soil if it is properly composted and recycled.

However, use of only organic manure, dung or slurry or compost alone can not provide for high productivity of coffee.

According to the COFFEE GUIDE, 2000, published by Coffee Board, a ton of clean coffee of Arabica variety (6000 kg mature fruit) removes 40 kg N, 7 kg P and 45 kg K and a ton Robusta variety (5000 kg mature fruit) removes 45 kg N, 9 kg P & 58 kg K.

The COFFEE Guide, 2000, also recommends 20:20:20 kg NPK per acre for yields of 1 t per acre. For areas where yield exceeds 1.5 t/acre, the dose should be 30:30:30 kg/acre.

For every 100 kg clean coffee increase in yield a matching 10:7:10 kg of NPK /acre is to be added.

Frequent Soil and leaf analysis for nutrient status is part of a coffee plantation management. The target leaf nutrient contents are given below.

**Table 2: Target leaf nutrient content in Coffee for high production**

LEAF NUTRIENT TARGETS FOR COFFEE			
N	2.6 -3.0 %	B	31-50 ppm
P	0.14 - 0.17 %	Zn	> 15 ppm
K	1.9 -2.5 %	Mn	< 200 ppm
Ca	1.2 -1.5 %	Aluminium	< 120 ppm
Fe	43- 60 ppm		

**Table 3: Fertilizer Requirement for young bushes (up to 4th year)##**

Coffee fertilizer requirement (young bush)				
Variety & age	NPK Dose	FERTILIZERS (g/plant/yr)		
		Urea	DAP	MOP
Arabica 1yr	20:10:20	35	22	33
2 yr	20:10:20	35	22	33
3 yr	25:15:25	41	33	42
4 yr	25:15:25	41	33	42
Robusta 1 yr	38:28:38	59	61	63
2 yr	38:28:38	59	61	63
3 yr	38:28:38	59	61	63
4 yr	40:30:40	61	65	67

## These yearly doses can be fertigated in May (50%) and August (50%).

**Table 4: Fertilizer requirement for mature yielding coffee**

Coffee –Arabica (5yr plus)				
Bearing bush	Recommended NPK	FERTILIZERS (kg)		
		UREA	DAP	MOP
Yield level (kg/acre)				
1000	120:90:120	180	196	200
500	70:50:70	104	119	116

**Table 5: Fertilizer requirement for mature yielding coffee**

Coffee –Robusta (5yr plus)				
Bearing bush	Recommended NPK	FERTILIZERS (kg)		
		UREA	DAP	MOP
Yield level (kg/acre)				
1000	120:90:130	180	196	200
500	70:50:80	104	119	134

**However, in actual case, every planter uses his own fertilizer doses, mostly influenced by local fertilizer supplier and a host of consultants who roam around the estates.**

Because of the above, in this brochure, fertigation schedule is given as % of N P and K where any specific fertilizer quantity that a planter wants to apply can be accommodated. Jain Irrigation is also conducting experimental trials in collaboration with the Central Coffee Research Institute in Balehanoor, to standardize the doses and the schedule.

**Table 6 : Fertigation schedule for mature yielding coffee##**

Months	N %	P %	K %
1 January	0	0	0
2 Feb 15th / March / April	25	40	15
3 May	15	30	15
1st Fortnight of JUNE	20	0	15
4 July	0	0	0
5 2nd fort night of August	15	0	15
6 Sept /Oct /Nov/Dec	25	30	40
	100	100	100

## Schedule is given in % nutrient, because the total quantum of fertilizer applied by planters vary from estate to estate. The same schedule is under experimentation in the fertigation experiments at CCRI

## Bush management

### Training

When the coffee plant reaches a height of 75 cm (Arabica) or 110 cm (Robusta) it is topped. This will allow for lateral spreading of the branches and increase the bearing area. Based on the soil fertility and plant vigour, a second topping is also practiced sometimes.

### Pruning

Pruning of coffee is done immediately after harvest. Pruning involves ;

**Centring** : Removal of the vegetative growth up to 15 cm radius from the centre and up to the first node of all primary branches.

**Desuckering** : removal of orthotropic branches arising from the main stem.

**Handling** : Removal of small sprouts arising from the leaf axils which if allowed grow towards the inner side of the canopy and cause shade and become unproductive wood.

**Nipping** : growing tip of primary branches are nipped to allow secondary and tertiary branches.

### Soil management

**Digging**: In a new clearing, the field is thoroughly dug to a depth of 35-40 cm towards the end of monsoon. Digging is discontinued once the coffee canopies have closed in.

**Soil stirring**: In established plantations, soil stirring is done towards the beginning of the dry period to control weeds and conserve moisture.

**Trenching**: Trenches or pits (50 cm wide and 25 cm deep) are dug or renovated in a staggered manner between rows of coffee along the contour during August- October.

**Mulching**: Mulching young coffee clearings helps to maintain soil temperature and conserve moisture. It also resists soil erosion.

### Weed management

During the monsoon weeds are slashed back. A second weeding is done towards the end of monsoon.

### Plant protection

#### Insect pests

1. White stem borer: Infected plants wilt and leaves become yellow. Control: Provide good shade; burn the infested plants; swab with heptachlor (50WP @ 2kg in 100 liter water).
2. Shoot hole borer: Infected plants dry up. Control: Prune and burn the affected branches.
3. Mealy bug: one of the serious pest; infection starts in few isolated bushes but spreads to others quickly. Control: Prune affected bushes; spray Folithion 50EC @ 300 ml OR Lebaycid 1000 @ 150 ml in 200 liter water.

#### Diseases

1. Leaf rust: Pale yellow spots on the lower surface of leaves; turn to orange yellow powdery mass; infected plants defoliate. Control: Spray Bordeaux mixture (0.5%) four times a year; pre-blossom, pre monsoon, mid monsoon, and post monsoon.

2. Black rot: Blackening and rotting of the affected leaves, twigs, berries. Control: Proper shade regulation, centering and handling of the affected bushes to prevent secondary spread, Spray 15 Bordeaux mixture.
3. Root diseases: Affected plants show gradual yellowing of leaves followed by defoliation and death of above ground parts. Control: Uprroot the affected plants and burn, dig trenches of 60 cm depth and 30 cm width to isolate the affected bushes, keep fallow for 6 months, apply organic manure 15 kg/pit.

### Harvest

Coffee berries should be picked as and when they become ripe to get quality coffee. Arabica comes to harvest early, fruits taking 8-9 months for full development from flowering. Robusta takes 10-11 months.

The fruits are hand picked in India; the first picking consists of selective picking of ripe berries and is called fly picking. Thereafter there would be 4-5 main pickings at 10-15 days interval followed by the final harvest.

### Shade vs Sun (open land) Coffee

The Arabica coffee, generally inhabits as the middle tier of the forest, halfway between the brushy ground cover and the taller trees. The coffee tree requires some but not too much direct sunlight; two hours a day seems ideal. The lacy leaves of the upper levels of the rain forest originally shaded the coffee tree. In many parts of the world, including Central America, Mexico, Colombia, Ethiopia, and other regions, Arabica coffee is traditionally grown in shade. However, in other parts of the world -- Hawaii, the Sumatra, Jamaica, and many other places -- coffee is not grown under shade because the weather is too rainy and wet and the coffee bushes need all the sun they can get. In Yemen and Brazil -- coffee is traditionally grown in sun (not under shade trees).

There is a tendency now of growers in regions where shade growing is traditional to replace shade-grown coffee groves with new hybrid trees that grow well in sun and bear quickly and heavily. This trend is slowly coming to the South India also. The crop husbandry of the sun grown coffee and the varieties those perform well in these conditions need to be researched and standardized. One thing, nevertheless clear, with shade trees disappearing from the Coffee environs more mechanization in Coffee growing is possible including the introduction of mechanical harvesters.







## The Company

Jain Irrigation Systems Ltd. (JISL) derives its name from the pioneering work it did for the Micro Irrigation Industry in India. However, there is more to Jain Irrigation than Irrigation. Now Jain Irrigation is a diversified entity with turnover in excess of USD One Billion. We have a Pan-India & Global presence with 28 manufacturing bases spread over 4 continents. Our products are supplied to over 116 countries with able assistance from more than 6700 dealers and distributors worldwide.

Jain Piping Division is the largest producer of Thermoplastic piping systems for all conceivable applications with pipes ranging from 3 mm to 1600 mm in diameter and in pressure ratings ranging from 1.00 kgf/cm<sup>2</sup> to 16 kgf/cm<sup>2</sup> and above. JISL has a production capacity of over 5,00,000 M.T. per annum or 5000 km/day

JISL is the only manufacturer to own DSIR approved R&D setup with state-of-the-art facilities.

The pipes are manufactured conforming to IS, DIN, ISO, ASTM, TEC and other customised specifications.

The Piping Division includes Plumbing Systems, PE Pipes, PVC Pipes and Fittings catering to the urban and rural infrastructure needs of the country apart from irrigation needs of the farmers.

Micro-Irrigation Division manufactures a full range of precision-irrigation products, provides services from soil survey, engineering design to agronomic support and nurtures a sprawling 2300 acre Hi-Tech Agri Institute. It undertakes turnkey projects for total agricultural development. The division's pool of over 800 agri scientists, technologists and technicians are well equipped to render consultancy for

complete or partial project planning and implementation e.g. Watershed or Wasteland and/or Crop Selection and Rotation.

Tissue Culture Division grows Grand Nain Banana plantlets and has established vast primary and secondary hardening facilities and R&D labs.

Agricultural and Fruit processing wastes are converted into Organic Manure. Neem-based pesticides are also formulated. Both are critical inputs for Organic Farming.

Agro Processed Products Division processes tropical fruits into Purees, Concentrates & Juices. The Dehydration facility dehydrates Onions & Vegetables.

Plastic sheet division's globally marketed products help conserve forests by providing alternatives to wood in the home building market.

Solar Energy Heating, Lighting Equipments, Solar Pump and Bio-Energy sources are new additions.

In a nutshell, the Corporation is the only 'one-stop-shop' encompassing manufacturing and marketing of hi-tech agricultural inputs and piping services as well as processing of agri produce. No wonder, it has distinguished itself as a leader in the domestic as well as global markets.

The corporate product range improves productivity and adds value to the agri-sector. Conservation of scarce Natural resources, protection and improvement of the environment emerge as a blessed outcome.

The Corporation has pioneered and raised a new Micro Irrigation industry in India and thereby helped harbingers a Second Green Revolution.

The reward has been over millions of smiling farmers and scores of customers in 116 countries.

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