GROUNDNUT

Groundnut is a one of the important oilseed crops of the country grown over an area of 5.40 million ha and production of 5.43 million tones with a productivity 910 kg/ha. Sustained groundnut production and higher profitability can be managed organically by on-farm management of resource with low external inputs. Based on eight years of experimentation under Network Project on Organic Farming the organic package has been developed.

Details of Varieties

Varieties	Zone/situation	Time of sowing	Duration (days)	Special features
GPBD-4	Zone 8 rainfed	June-July	105-110	Resistant to leaf spot and rust diseases. High yielding and higher oil content
JL 24	All zones	June-July	110-120	Big size pods.
TAG-24, DH-86	All zones	Dec-15 to Jan 15 (Summer)	90-95	Resistant to bud necrosis

Management practices: Inputs required per hectare

a) Seeds : GPBD-4 JL 24,TAG-24, DH-86	125.kg150 kg
b) Organic manures (equi to RDP)	
Enriched compost	3.00 t
Vermicompost	2.40 t
Green leaf manure	5.00 t
Neem cake	250 kg
Seed treatment with bio-fertilizers and bio-fungicides	
Rhizobium	1000 g
PSB	1000 g
Trichoderma harzianum	750 g

Sowing: Early sowing of *kharif* crops during June I FN. Apply FYM/compost and green leaf manures10-15 days before sowing and Vermicompost at the time of sowing. Treat the seeds with the *Trichoderma* @ 4-5 g/kg seed and biofertilizer. Sow the seeds at a spacing of 30cmx10 cm.

Gygpsum application: Apply gygpsum @ 500 kg/ha at 35-40 days after sowing, to the plant rows and earthing up will be done.

Weed management: Intercultivation at 25 and 40 DAS and hand weeding at 30 DAS.

Foliar Application: Foliar application of cow urine @ 10 % and Panchagavvya spray @ 3% as a source of nutrient and growth promoter at 45 and 60 DAS.

Plant protection measures

Setaria or bajra as intercrop at 7:1 and castor as trap crop for S. *litura* management.

Use of pheromone traps @ 5 per hectare for monitoring of *S. litura.*

Collection of eggmasses of S. *litura* in groundnut as they lay eggs on upper surface of leaves.

Neem seed kernel extract @ 5% or custard apple leaf extract @ 5% + *Nomuraea rileyi* 1011 conidia/ha @ 1 g/lit as a foliar spray at 45 and 60 DAS against management of defoliators.

Yield: 30-35 q/ha of pod yield and 35-40 q/ha of haulam yield will be obtained.

SOYBEAN – ORGANIC PRODUCTION

Soybean is an important oil seed crop of country grown over an area of 9.95 million with a production of 12.57 million tones with productivity of 1264 kg/ha. Based on eight years field experiments carried out at MARS, Dharwad, the package of practices for organic production of soybean has been developed.

Details of Varieties

Details of Varieties Varieties	**Zone/situation**	**Time of sowing**	**Duration (days)**	**Special features**
JS-335	1,2,3 and 8 *kharif*	May -15 to June end	85-90	Shattering resistant for 8-10 days after maturity resistant to bacterial pustules and leaf spot diseases.
JS 9305	1,2,3 and 8 *kharif*	May -15 to June end	80-85	Early maturing variety.
DSb 21	1,2,3 and 8 *kharif*	May -15 to June end	85-90	Resistant to rust disease

Production practices: Inputs required per hectare

a) Seeds	75 kg
b) Organic manures (Equi. RDP)	
Enriched compost	3.33 t
Vermicompost	2.66 t
Green leaf manure	5.33 t
Neem cake	250kg
c) Bio-fertilizers	
Rhizobium	1000 g
PSB	1000 g
Trichoderma harzianum	500 g

Sowing: Prepare land to a fine tilth by cultivating and harrowing. Optimum time of sowing is during May 15 to June end. Apply organic manures FYM compost and green leaf manures at 10-15 days before sowing. Sow the seeds at 30 cm x 7.5 cm spacing. Treat the seeds with *Trichoderma harzianum* @ 4g /kg seed followed by *Rhizobium* and *Phosphate solubilizing bacteria*. Apply vermicompost at the time of sowing in a row and sow the treated seeds on the same day. Sow the crop as early as possible from May-15th to June end. Delay in sowing cause reduction in yield due to attack of pest and diseases.

Weed management: Inter cultivation at 20 and 40 days after sowing (DAS) followed by two hand weeding at 25 and 45 DAS will effectively control the weeds.

Foliar Spray: Foliar application of cow urine @ 10 % and panchagavya @ 3% at 30 and 45 days after sowing improve the yield and quality of soybean. It helped to retain more flowers, better pod development and seed filling and induced resistance to diseases.

Plant protection measures

- Collection of eggmasses/early instar larvae from infected plants.
- Pheromone traps@ five / ha for monitoring of S. *litura.*
- Application of neem seed kernel extract @ 5% + *Nomuraea rileyi* 1011 conidia/ha (@ 1 g/l) as at 45 and 55 DAS against management defoliators.
- Botanicals @ 5% spray at 65 DAS as a bio-pesticide for defoliators and pod borer.

Yield: 20-25 q/ha

Note: The package may be updated as and when the location specific research is being carried and new technologies developed.

SORGHUM – ORGANIC PRODUCTION

Sorghum is an important cereal crop of Northern Karnataka. This is grown both during *kharif* and *rabi* seasons were as quality is good from rabi crop. The yield depend upon soil fertility, rainfall varieties, pest and diseases. Based on eight years experimentation under Network Project on Organic Farming the organic package has been developed. The organic practices were followed as per NSOP standards.

Details of Varieties

Varieties	**Zone/situation**	**Time of sowing**	**Duration (days)**	**Special features**
M-35-1	1,2,3 and 8 both rainfed and irrigated	September 15 to October 15	120-125	Tolerant to drought and resistant to shoot fly.
DSV-4	1,2,3 and 8 both rainfed and irrigated	September 15 to October 15	115-120	Resistant to charcoal rot disease.

Production practices: Inputs required per hectare

a) Seeds	7.5 kg
b) Organic manures	
Enriched compost	2.00 t
Vermicompost	1.70 t
Green leaf manure	3.30 t
Neem cake	250 kg
c) Bio-fertilizers	
Azospirillum	500 g
PSB	500 g

Sowing: From September second fort night to October second fort night is optimum for sowing. Apply organic manures mainly FYM/compost and green leaf manures 15 days before sowing. Before sowing soak the seeds in cow urine @ 25% solution, improves the germination and induce drought hardiness. The soaked seeds are treated with biofertilizers. Sow the seeds in 45 cm row spacing 15 cm apart to a depth of 5-7 cm.

Weed management: Intercultivation at 25, 50 and 60 DAS and hand weeding at 30 DAS to manage the weeds.

Foliar Spray : Foliar spray of cow urine @ 10% and Panchgavyya @ 3% spray at 30 and 45 DAS as a source of nutrients and growth promoters improve the yield and help to overcome the nitrogen deficiency.

Plant protection measures

- Neem seed kernel extract @ 5% spray at 25 DAS help to manage shoot fly and sucking pests.
- To manage aphids foliar application of *Verticillium lecanii* @ 2 g or Botanical mixture @ 10% spray or NSKE5% as foliar spray.

Yield : 12-15 q/ha grain yield and 4 tonn/ha fodder yield can be obtained.

Note: The package given may be updated with the development of new technologies and location specific information available.

WHEAT RAINFED – ORGANIC PRODUCTION

Wheat is an important crop of Northern Karnataka. Three species *viz*., *Triticum astivum, Triticum durum* and *Triticum dicoccum* are grown extensively in the state. Based on eight years experimentation under Network Project on Organic Farming the organic package for rainfed durum wheat has been developed.

Details of Varieties

Details of Varieties Varieties	**Zone/situation**	**Time of sowing**	**Duration (days)**	**Special Features**
DWR-2006	1,2,3 and 8 under rainfed	October month	105-110	Resistant to leaf blotch disease.
Bijaga yellow	1,2,3 and 8 under rainfed	October month	105-110	Resistant to leaf blotch disease.

Production practices: Inputs required per hectare

a) Seeds	50 kg
b) Organic manures	
Enriched compost	2.00 t
Vermicompost	1.70 t
Green leaf manure	3.30 t
Neem cake	250 kg
c) Bio-fertilizers	
Azospirillum	500 g
PSB	500 g
d) Trichoderma	250 g

Sowing: October is suitable for sowing. Before sowing soak the seeds in water for 2-3 hrs and treat the seeds with Trichoderma @ 4 g/kg seed and Azospirillum and *Pseudomonas fluorescence* biofertilizers. Apply organic manures 15 days before sowing and sow the seeds in 30 cm rows.

Weed management: Intercultivation at 20 and 40 DAS and hand weeding at 30 and 50 DAS will help to manage weeds.

Foliar Spray: Foliar application of Panchgavya @ 3% spray and 10% cow urine at 30 DAS and at boot leaf stage as a source of nutrient and growth promoter enhance yield of wheat.

Plant protection measures

- Use rust resistant varieties.
- To manage aphids and sucking pests use NSKE @ 5% or botanical mixture @ 10% spray or *Verticillium lecanii* @ 1g of water as a bio-pesticide.

- For management termites apply Calatrophis leaves to soil at the time of sowing.

Yield: 12-15 q/ha grain and 28-30 quintals of bhusa (fodder) can be obtained**.**

Note: The package given may be updated with the development of new technologies and based on location specific information available.

COTTON – ORGANIC PRODUCTION

Cotton is an important commercial crop of Karnataka. Yield is mainly depend upon on duration of crop, rainfall, varieties and pest and disease management. Jayadhar cotton the herbaceum group is extensively grown as a relay intercrop in chilli and as a sole crop under rainfed situations.

Details of Varieties

Varieties	Zone/situation	Time of sowing	Duration (days)	Special Features
Jayadhar	Zone 3 and 8	July, August sole crop August - September Intercrop	200 days	Suitable for intercropping and for rainfed situations. Drought resistance variety. Resistant to pest and diseases.

Production practices: Inputs required per hectare

a) Seeds	3 kg
b) Organic manures	
Enriched compost	3.30 t
Vermicompost	2.70 t
Green leaf manure	5.30 t
Neem cake	250 kg
c) Bio-fertilizers	
Azospirillum	500 g
PSB	500 g

Sowing: Apply all the organic manures 15 days before sowing. Soak the seeds in 25% cow urine solution and air dried. Before sowing treat the seeds with biofertilizers. Sow the seeds at a spacing of 60cm x 30 cm during July-August as sole crop. Dibble two cotton seeds per hill between two chilli plants in a row in a intercropping system.

Weed management: Intercultivation at 25, 35 and 50 DAS and hand weeding at 30 and 55 DAS.

Foliar spray : Use of Panchgavya @ 3% and cow urine @ 10 % spray at 60 and 75 DAS as a source of nutrient and growth promoter.

Plant protection measures

- Use marigold and bhendi as trap crops for management of bollworm and shoot weevil.
- Maize as border crop
- Use of pheromone traps @ 5 per ha for monitoring of *H.armigera.*
- Yellow sticky trap for management of whiteflies @ 10 /acre.
- Botanical @ 5% spray at 30 and 60 DAS as a biopesticides for sucking pest management.
- Release of trichocard @ 1 card/acre at weekly interval 8-10 times after square formation.

□□Neem seed kernel extract @ 5% spray at 90 and 105 DAS as a bio-pesticide for bollworm management.

Yield : As a **Sole crop 10-12 q/ha as intercrop 5-6 q/ha.**

CHILLI

Chilli is an important commercial crop of Northern Karnataka, grown over an area of 2 lakh/ha. The chilli is extensively grown as a sole crop, relay intercrop with cotton, onion, garlic and coriander. The crop is extensively grown in Haveri, Dharwad, Gadag, Belagavi, Bellary, Koppal and Raichur districts of Karnataka. It is mainly grown as dry chilli and has export potential as whole chilli, chilli powder and oleorecin. Based on eight years experimentation under Network Project on Organic Farming the organic package has been developed.

Details of Varieties

Varieties	Zone/situation	Time of sowing	Duration (days)	Special Features
Byadagi Kaddi Byadagi dabbi Dyvanur	Zone 3 and 8 rainfed	June -July	180-200	Special features suitable for rainfed situations drought to lerant fruit are 12-15 cm in length, less pungent, dark red colour, high in oleo-resin content, wrinkles on the surface and good keeping quality.

Production practices: Inputs required per hectare

a) Seeds	3 kg
b) Organic manures	
Enriched compost	4.20 t
Vermicompost	3.30 t
Green leaf manure	6.70 t
Neem cake	250 kg
c) Bio-fertilizers	
Azospirillum	250 g
PSB	250 g
Trichoderma	10 g

Seed bed preparation: prepare 15 raised beds of size 7.5 m length x 1.20 m width x 10 cm height. Add 50 kg FYM and 25 kg VC to the beds. Sow the seeds at 8 cm rows and water the beds once in two days and stop watering 2-3 days before planting. Plant the seedlings after one month in well prepared field.

Planning : Apply all the organic manures 15 days before sowing. Seedlings are planted at row spacing of 60cm x 60cm during June-July.

Weed management: Intercultivation at 30, 45 and 60 DAS and hand weeding at 35 and 50 DAS.

Foliar spray : Spray Panchagavvya @ 3% and cow urine @ 10% at 45, 60 and 75 DAS as a source of nutrient and growth promoter helps for flowering and pod development.

Plant protection measures

- Barrier crop of maize or jowar 4-6 rows all along the border of chilli field to prevent sucking pest like thrips and mites and encourage natural enemies.
- Plant one row of marigold for every 15 rows of chilli as trap crop for *H.armigera* management.
- Use Pheramone traps @ 5/ha for monitoring of *H.armigera.*

- Foliar spray NSKE 5% or *verticillium lecanii* @ 2g/l + cow urine 10% at 30 and 45 days after transplanting (DAT) for management of sucking pests.
- Use yellow sticky traps @ 10/acre for management of sucking pests.
- NSKE 5% or botanical @ 5% spray or chilli+garlic extract @ 2% at 60 and 90 DAT as a biopesticide to control fruit borer.
- For management of anthracnose and fruit rot foliar spray of *Pseudomonas fluorescence* @ 5 g/l of water.

Yield: 7.**5-10 q/ha dry chilli yield.**

POTATO

Potato is a one of the important commercial crops of Karnataka. It is being grown in Northern Karnataka during *Kharif* season and it can also be grown during of *rabi* season if assured irrigation is available. Based on eight years experimentation under Network Project on Organic Farming the organic package has been developed.

Details of Varieties

Varieties	Zone/situation	Time of sowing	Duration (days)	Special Features
Kufri Jawahar	Zone 8	June month	60-75 days	Medium size round tubers. Resistant to late blight disease.

Production practices: Inputs required per hectare

a) Seeds/tubers	1000 kg
b) Organic manures	
Enriched compost	4.20 t
Vermicompost	3.30 t
Green leaf manure	6.70 t
Neem cake	250 kg
c) Bio-fertilizers	
Azospirillum	1kg
PSB	1kg
Trichoderma	4 kg

Tubers selection : Use disease free certified seeds for planting. Use tubers with viable sprouting buds and big tubers can be cut in to pieces with at least two buds which weighs 35-40 g.

Sowing: Prepare land to fine tilth by deep ploughing and harrowing**.** Apply all the organic manures 10-15 days before sowing. Apply vermicompost +250 kg neem cake at the time of planting. June is suitable for *kharif* planting. Prepare land into ridges and furrow with 60 cm rows and plant seed tuber at 20 cm apart on the ridge. After 30 days earthing up can be done this increase the number of tubers and protect the tubers from disease.

Weed management: Intercultivation at 20 and 45 days after planting (DAS) and 2 times hand weeding at 25 and 50 DAS.

Foliar spray : Foliar application of cow urine @ 10% panchagavvy @3% at 30 and 45 days after planting.

Plant protection measures

- Dip the tubers for 10 minutes in a *Trichoderma* solution prepared in 50 litre of water with 4 kg of *Trichoderma.*
- Release of Trichocard @ 1 card/acre @ weekly interval 3 to 4 times after noticing the shoot borer incidence @ 25/ha for mass trappinp set up shoot borer pheromone traps.
- Mechanical removal of infested shoots.
- Use of wettable sulphur @ 3g/lit if mite infestation is noticed.
- NSKE @ 5% spray at 45 DAS as a biopesticide
- Neem seed kernel extract or botanicals @ 5% or *Nomuraea rileyi* @ 1 g /ltr of water for management of *Spodoptera litura*.

Yield: 50 q/ha

CHICKPEA – ORGANIC PRODUCTION

Chickpea is an important pulse crop of Northern Karnataka. The *Desi* type chickpea contribute to around 80% and the *Kabuli* type around 20% of the total production. India is the largest producer of this pulse contributing to around 70% of the world's total production.

Details of Varieties

Varieties	**Zone/situation**	**Time of sowing**	**Duration (days)**	**Special Features**
Annigeri-1,	Zone 3 and 8	October-November	90-95	Resistance to drought
JG-11	Zone 3 and 8	October-November	90-100	Bold seeded resistant to wilt and high yielding

Production practices: Inputs required per hectare

a) Seeds	50 kg
b) Organic manures (Equi. RDP)	
Enriched compost	1.00 t
Vermicompost	8.0q
Green leaf manure	1.70 t
Neem cake	250kg
Trichoderma	2.50 g
c) Bio-fertilizers	
Rhizobium	1000 g
PSB	1000 g

Sowing: Prepare land to a fine tilth, apply, FYM /Compost and green manures 15 days before sowing and apply vermicompost at the time of sowing to seed row. Soak the seeds @ 25% cow urine solution for two hours, air dried and treat them with biofertilizers before sowing. Sow the seeds at 30 x 10 cm row the spacing.

Weed management: Intercultivation at 30 and 45 days after sowing (DAS) and hand weeding at 35 DAS will help to manage the weeds efficiently.

Clipping : At 35 – 40 DAS clip the apical vegetative shoot to increase branching.

Foliar spray: Foliar spray of cow urine 10 % and panchagavvya @ 3% at 30 and 45 DAS as a source of nutrient and growth promoter.

Plant protection measures

- Intercropping of coriander at 4:1 row ratio help to reduce pod borer.
- Monitoring of *Helicoverpa* by pheromone traps @ 5/ha.
- For attraction of birds, sprinkle puffed rice or cooked rice with turmeric powder in the morning or evening hours.
- Use Ha NPV @ 250 LE/ha +Neem Seed Kernel Extract @5% or chilli + garlic extract @ 2% at 30 and 45 DAS for management of pod borer.
- Barrier crop of sorghum all along the border of chickpea reduce rust incidence.

Yield: 12-15 q/ha

MAIZE

Maize is a one of the most important coarse cereal food and fodder crop .In India, maize is grown over an area of 8.33 million ha with an annual production of about 16.68 million tonnes and an average productivity of about 2002 kg ha-1. In Karnataka, maize occupies an area of 1.07 million ha with an annual production of about 3.03 million tonnes and an average productivity of 2833 kg ha-1. In the state it is grown under rainfed as well as irrigated conditions. Based on eight years experimentation under Network Project on Organic Farming the organic package has been developed.

Varietals details :

Varieties/hybrids	**Zone/situation**	**Time of sowing**	**Duration (days)**	**Special Features**
EH-434042 (Arjun) or other hybrids	3 and 8 rainfed/irrigated	June-July	110-115	High yielding

Production practices: Inputs required per hectare

a) Seeds	15 kg
b) Organic manures	
Enriched compost	4.20 t
Vermicompost	3.30 t
Green leaf manure	6.70 t
Neem cake	2250 kg
c) Bio-fertilizers	
Azospirillum	1000 g
PSB	1000 g

Sowing: Prepare land by ploughing and harrowing to a fine tilth Apply FYM/compost and green leaf manures 15 days before sowing and in corporate into the soil**.** Apply half of the vermicompost at the time of sowing to seed row. Soak the seeds in water for 8 hrs air dry and treat them with biofertilizers. Sow the seeds by hand dibbling at a spacing of 60 cm x 30 cm during June 1st FN. Apply remaining half dose of the vermicompost at 30 days after sowing (DAS) and ensure sufficient moisture at the time of application.

Weed management: Intercultivation at 20 and 40 DAS two and hand weeding at 25 and 45 DAS will manage weeds efficiently.

Foliar Spray : Panchagavvya @ 3% and cowurine @ 10 % spray at 30 and 45 DAS as a source of nutrient and growth promoter.

Plant protection:

- Plant NB 21 grass on the bunds as a trap crop for management of stem borer of maize.
- Release of *Trichogram* **@** 50000/ha (1 card/ha) at weekly interval 3 to 4 times to control stem borer.
- *N. rileyi* @ 1g/l spray or HaNPV 250LE/ha for management of cob borer
- Neem seed kernel extract @ 5% or Botanicals @ 10% spray at 45 and 60 DAS as a bio-pesticide to control aphids and stem borer.
- To control armyworm spray NSKE 5% and *Nomuraea rileyi* @ 1 g /l of water.

+Yield : 30 - 35 q/ha grain yield and 5.0 tonne of fodder yield.

Rice

Paddy is grown under irrigated and rainfed condition in an area of 13.8 lakh hectare in North Karnataka. Its productivity is 24.2q/ha with a production of 33.30lakh tonne. Paddy is grown under channel, tank and lift irrigation over an area of 38,000ha in North-East Transition and dry zones (Region 1, Zone 1 & 2). In this region, major Rice growing talukas are Manvi, Raichur, Bidar, Bhalki, Aurad, Aland, Chincholi, Yadgiri, Sedam and Chittapur. Paddy is grown in North-East and Northern dry zones (Region 2, Zone3) as irrigated crop over an area of 61,000ha covering district such as Raichur, Bellary, Belagum and Bijapur.

During *kharif* season drill sown Paddy is grown under rainfed condition in the regions receiving heavy south-west monsoon in central parts of Northern Transition region 4 (Zone 8). The annual production of drill sown paddy is 2.1lakh tonne from an area of 1.3lakh ha in Shiggaon, Dharwad, Hirekerur, Belagum, Bailhongal talukas.

Paddy is grown as major crop in heavy rainfall (malnad) region (Region 5, Zone 9) over an area of 1.37lakh ha under rainfed condition during *kharif* season. It is also as an important food crop in coastal region (Region 6, Zone10), grown as rainfed crop in 2.1lakh ha area. Depending upon irrigation availability paddy is also grown under *rabi* and summer condition.

Varieties	Zone and situation	Sowing Time	Duration (days) and characteristics	Remarks
Kharif				
Jaya	1,2,3,8,9 rainfed & irrigated	End of June	140-150, long and bold seed 125-130, medium and small seed	Resistant to blast disease
Rasi	1,2 & 8 rainfed & irrigated	-do-	125-130,Suitable for drill sown condition	Resistant to blast disease
Vani	1,2 & 3,irrigated	-do-	140-145, long and small seed	-
Sona	1,2 & 3, irrigated	-do-	140-145, long and small seed	-
Prakash	1,2 & 3, irrigated	-do-	145-150, long and small seed	-
IR-20	1,2 & 3, irrigated	Before 15th July	130-145, medium and small seed	Tolerant to BLB, GLH & Tungro disease
Pushpa	1,2 & 3, irrigated	-do-	125-135, long and small seed	-
Madhu	1,2 & 3, irrigated	-do-	120-125, medium and small seed	Shattering of seeds
Mangala	1,2, 3, 8 & 9, rainfed & irrigated	Mid of August	105-130, medium and small seed	Tolerant to blast disease
BPT-5204	1,2,3, irrigated	End of June	140-165, long and small seed	-
Telhumsa	1,2,3, irrigated	July	120-125, medium	-

			and small seed	
Mandya Vani	1,2, 3 & 8, irrigated	Up to 15th July	130-135, long and small seed	-
Karna (KMP - 39)	1,2, 3, 8 & 9, rainfed & irrigated	Up to 15th July	130-135, long and bold seed	It is suited for Cauvery basin. Tolerant to pests
JEB - 24	1 & 2 irrigated	Mid of August	165-175, suitable for seed drill sowing	-
Avinash (Gama-318)	3 & 8, rainfed & irrigated	May-June	135-145, medium and bold seed	-
MTU-1001	8,rainfed	May-June	130-135, medium and small seed	
Pragathi	1,2 & 3, irrigated	Up to July	130-135, medium and small seed	-
Mandya Vijay	8, irrigated	Up to June	140-145, medium and small seed	-
Jyoti	8, irrigated	Up to June	125-130, long and bold seed	Resistant to blast, moderately susceptible to BPH
Amrut	8,rainfed	May-June	105-110, Medium and bold seed, suitable for drill sown condition	Resistant to blast and brown leaf spot. Escapes drought.
Abhilash	8 & 9, rainfed	May-June	155-165, long and bold seed, suitable for drill sown condition	-
Intan	8 & 9, rainfed	May-June	160-170, long and small seed, suitable for drill sown condition	Susceptible to blast disease and
Hemavati	9, rainfed	May-June	160-170, medium and small seed, suitable for drill sown condition	-
KHP-2	9, rainfed	May-1st week of June	145-150, medium and small seed, suitable for drill sown condition	Tolerant to blast. Recommended for malnad region except Kodagu district.
IET-7191	9, rainfed	May-1st week of June	150-155, long and bold seed, suitable for drill sown condition	Tolerant to blast to some extent & susceptible to brown leaf spot
Mahaveer	10, rainfed	May-1st week of June	110-115, long, small and red seed , suitable for drill	Resistant to gall midge. Red seeded.

			sown condition	
Shakti	10, rainfed	May-1st week of June	120-125, long and bold seed, suitable for drill sown condition	Resistance to gall midge
Phalguna	10, rainfed	May-1st week of June	135-140, medium and small seed, suitable drill sown condition	Resistant to gall midge
KKP-6	10, rainfed	May-1st week of June	135-140, long and bold seed, suitable for drill sown condition	Withstand water logging for 1 week
Getu	10, rainfed	May-1st week of June	130-140, long and bold seed, suitable for drill sown condition	-
IET-7564	8, rainfed	May-June	100-105, long and small seed	
IET-13549 (Scented Mugad)	8, rainfed	May-June	130-135, long and small seed and scented variety	Resistant to pest and disease. Scented rice. Gives higher yield. Suitable for drill sowing

Rabi (Irrigated)				
Phalguna	10	Up to last week of October	125-140, long and small seed	Resistant to gall midge
Jaya	10	--do--	120-145, long and bold seed	Resistant to blast disease
Jyoti	10	Up to last week of October	100-105, long and bold seed	-
Shakti	10	--do--	120-125, long and bold seed	Resistant to gall midge
Summer (Irrigated)				
Rasi	8	Up to last week of January	120-125, medium and small seed	
Jyoti	8	--do-	125-130, long and bold seed	-
Shakti	10	--do-	120-125, long and bold seed	Resistant to gall midge
Mukti	10	--do-	125-130, red seed	Red seeded
Jaya	1,2,3 &10	--do-	120-145,long and bold seed	-
Madhu	1,2,3,8 &9	--do-	120-125, medium	Shattering of seeds

			and small seed	
Vani	1,2,3	--do-	140-145,long and small seed	-
Sona	1,2,3	--do-	140-145,long and small seed	Difficult for threshing
Prakasha	1,2,3	-do-	145-150, long and small seed	-
IR-20	1,2,3,9 &10	-do-	120-145, medium and small seed	Resistant to BLB, GLH & Tungro disease
Pushpa	1,2,3,9	-do-	125-135, long and small seed	-
Mangala	1,2,3,8 &9	-do-	105-130, medium and small seed	Tolerant to blast disease
Praghati	1,2,3,	--do-	130-135, medium and small seed	-
Mandyavani	1,2,3,	--do-	130-135, long and small seed	-

Special characteristics:

- These varieties respond well for normal to high dose of fertilizers
- Normally varieties take 7-15 days more duration during summer compared to *kharif.*
- In irrigated regions dwarf varieties gives higher yield without lodging under high soil fertility condition.

Hybrid Rice:

- In short duration it gives 15-20% higher yield compared to high yielding varieties
- Resistant to disease
- KRH-2, an important paddy hybrid released from Karnataka.
- Seed rate for transplanting -15kg/ha
- Spacing-20x10cm
- Transplant only one seedling/hill or 5 seedlings/sq. ft.
- During milling use special rubber shell
- Store hybrid rice for 3 to 4 months to avoid sticking and odour after cooking

Materials required for sowing		**Per hectare**
Seeds	Transplanting	62kg
	Drill sowing	80-100kg
Organic manures	Green leaf manures or	5-10t
	FYM	5-10t

Main field:

***DAS:** Days after sowing

Seed bed preparation (For all zones)

Selection of good seed material:

- Salt water treatment (1:4)
- Remove immature and chaffy seeds
- Select only bold seeds and wash thoroughly with clean water and dry under shade

Note: Salt water treatment is not required for certified seeds

Dry Nursery

- Area - 750 sq meter for one hectare
- Prepare 75 beds of 7-7.5 m long, 1.2-1.5 m width and 10 cm high.
- Apply 25 kg FYM or compost
- Sow treated (recommended) seeds uniformly in the raised beds.

Wet Nursery

Area required for wet nursery as same as dry nursery.

Steps involved in raising wet bed seedlings are as follows:

- The seed bed area is puddled and leveled.
- Irrigate the seed bed and drained off excess water
- For each 100 m^2 area of nursery bed, provide biofertilizer and manures which give 1 kg N, 0.4 kg P_2O_5 and 0.5 kg K_2O along with 250kg FYM .The fertilizers are mixed with soil before sowing. Double the P_2O_5 application in locations where cool temperatures retard the growth of seedlings.
- Sow (broadcast) pre-germinated seeds (soak the seeds for 24 hours, incubate in warm moist conditions for 36-48 hours until germination) on a drained bed at the rate of 50 - 70 g (unsoaked weight basis) per square meter depending upon the size of the seed.
- Keep the beds moist for the first few days. Do not flood the beds.
- When the seedlings are about 2 cm high, keep the beds submerged in a shallow layer of water.
- Top dress the seed beds with 0.3 kg to 0.6 kg N per 100 square meter area 6 days before transplanting.
- Seedlings will be ready for transplanting at 20-25 DAS

Preparation of transplanting (main) field

- Three weeks before transplanting incorporate 5-7 tonne of FYM or compost or 1 tonne of poultry manure per hectare or
- Incorporate 10 tonne of green leaf manure three weeks before transplanting.
- Provide drainage channel for salt affected soil.
- After fertilization avoid moving of water from one field to another.

Transplanting:

- Spacing: 20x10cm (50 hills/ sq.meter) 2-3 seedlings per hill
- Short duration variety: 15x10cm (67 hills/ sq. meter)
- In Tungabhadra command area, for transplanting of long duration varieties such as sona masuri under delayed condition (August 15-30^{th}) select the seedlings which are 45 days old and transplant about 3 to 4 seedlings per hill to get higher yield.

Sowing of Paddy using drum seeder

- Followed under late sown conditions especially in the month of July when rainfall is sufficient enough to make puddling.
- Use pre-germinated seeds for sowing
- Seed rate - 40 kg/ha

Nutrient Management in Paddy

Organic farming:

Use of green leaf manures

Drill sown paddy:

- Sow sunhemp green manure seeds @10kg/ha mixed with paddy seeds.
- Carry out hodta operation (Planking) in standing water after 40 DAS for *in situ* incorporation of sunhemp in the soil which will decompose easily and early and add to organic matter to the soil maintaining the sol fertility.

OR

- *Ex situ* incorporation of green leaf manuring of Eupatorium/parthenium/cassia and other weeds green material @ 5 t/ha in between the two paddy rows by carrying out hodta operation.
- Provides only 50% nutrients to maintain good yield.

Transplanted paddy:

Sow green manure seeds of *Sesbania rostrata* (@ 25kg/ha) along with the application of entire P_2O_5 recommended for paddy, eight weeks before transplanting of paddy, then *in situ* incorporate the green manure crop by carrying out hodta operation (Planking) seven weeks after sowing. Transplant paddy seedlings after one week of incorporation along with the application of 50% recommended nitrogen for paddy.

Note: Increase the yield level by providing recommended dose of nitrogen or maintain same yield level without nitrogen application

Use of Biofertilizers

Biofertilizers are ready to use live formulates of such beneficial microorganisms which on application to seed, root or soil mobilize the availability of nutrients by their biological activity in particular, and help to build up the micro-flora and in turn the soil health in general. Bio-fertilizers are eco friendly and are environmentally safe. They form not only part of integrated nutrients but are of low cost. The bio-fertilizers used for rice crop are *Azospirillum*, Phosphobacteria, Blue green algae, azolla and Mycorhiza.

Rhizobium

- These bacteria are capable of forming nodules on leguminous crop plants.
- Fixes atmospheric nitrogen by symbiotic relationship with legumes.
- Each Rhizobium species form nodules on particular group of leguminous crop plants these are called as cross inoculation group of rhizobia. Some of the cross inoculants released from University of Agricultural Sciences Dharwad are SB-120 for Soybean, GB-1 for Redgram and GR-2 for Bengalgram.

Azotobacter

- It has the ability to fix atmospheric nitrogen in crop plants.
- It can be used for monocots and for crops like Sorghum, Wheat, Maize, Finger millet, Cotton, Sugarcane and Vegetable crops.
- Apart from its Nitrogen fixation it produces some nutrients and growth hormones and provides to the crop plants.

- It increases the germination per centage and also helps in plant growth and development.
- It protects crop plants from pathogens.

Azospirillum

It is also an important nitrogen fixing bacteria. It is mainly used in monocots such as Sorghum, Wheat, Maize, Cotton, Sunflower and Sugarcane. It fixes 25-30 kg nitrogen/ha and also helps in crop growth by providing plant hormones. By using *azospirillum* species such as ACD-15 and ACD-20 which are released from University of Agricultural Sciences Dharwad, we can reduce the quantity of nitrogen by 25 per cent.

Acetobacter diazotrophicus

It fixes atmospheric nitrogen in sugarcane crop and present in root system, leaves and stem of the sugarcane crop. These are also present in sweet sorghum and sugar beet. It fixes on average 150-160kg nitrogen in sugarcane.

Phosphate solubilisers

This type of biofertilizers solubilises phosphates in the soil and render them in available form for low land and upland rice. Bacteria like *Bacillus megatherium var phosphaticum, Bacillus polymixa, Pseudomonas fluorscens, Pseudomonas striata* fungi like *Pencillium digitatum, Aspergillus niger, Aspergillus awamori* were found to have a strong phosphate dissolving ability. It can be used for almost all crop plants. Application of phosphobacteria with rock phosphate gives same effect as that of super phosphate.

Plant growth promotion by biofertilizers

Some microorganisms such as *Pseudomonas, Azospirillum* and *Azatobacter* produces growth promoting hormones such as Indole acetic acid, gibberellins etc. which helps in plant growth and development. Thee microorganisms also provide disease resistance to the plants.

Application of Bio-fertilizers to rice

Seed treatment: 1000 g of *Azospirillum* culture is to be mixed with water to prepare a solution and the seeds required for one hectare are soaked in the solution over night before sowing in the nursery bed.

OR

Prepare slurry of *Azospirillum* 600 g + phosphobacteria 600 g with one litre rice gruel and mixed with 25 kg of rice seeds and ensure uniform seed coating. Dry in shade and sow the seeds within an hour of treatment

Seedling treatment: Prepare slurry by mixing *Azospirillum* @ 1 kg in 40 liters of water and dip the root portion of rice seedlings in this bacterial suspension for 15-30 minutes and then transplant the seedlings in the field.

Soil application

- *Azospirillum* and phosphobacteria each at 2 kg/ha are to be mixed with 50 kg of well powdered decomposed FYM/compost.
- Apply the mixture of biofertilizers to the rice before transplanting.

Blue Green Algae (BGA).

It is another type of biofertilizer which fixes nitrogen and provides to the crop plants. It requires pH of 6.5 to 7.5 for better growth and development. Apart from its nitrogen fixation it improves physical and chemical condition soil. It excretes organic acids that render phosphorus solubilisation. It reduces 25 percent of the recommended dose of nitrogen.

Method of application in Paddy crop

- Puddle the land by repeated ploughing for 2 - 3 times.

- Prepare beds of size 10 x 10 m in a ploughed land bund on all sides and let water into the field to a height of 10 cm and maintained for 2-5 cm depth.
- Sprinkle 10 kg of dried algal inoculum for one hectare field.
- At the time of application, a thin film of water is to be maintained.

Azolla

Azolla fixes atmospheric N in symbiotic association with the blue-green alga, *Anabaena azollae*. Of seven species of Azolla, *A. pinnata* is commonly found in India. It usually floats on the surface of idle water bodies such as ponds, canals, ditches and channels. Its occurrence was observed mostly during winter to early part of summer.

Azolla can be multiplied by constructing nurseries with 10 cm deep standing water and adding superhphosphate (@ 8 kg P2O5/ha) in small plots. Inoculation with Azolla @ 8 kg/sq.m. Azolla to be used immediately after harvest. It can be applied as green manure prior to rice planting or can be grown as dual crop with rice. Incorporation of fresh *Azolla* at 5 t/ha just before planting or its inoculation at 1 t/ha at planting and its incorporation after one month gave yields identical with application of 30 kg N/ha.

It could also be used as both green manure and dual crop with rice, but dual cropping (inter-cropping) was more practicable and economical. Inoculation of fresh *Azolla* at 0.5-1.0 t biomass/ha before 15-20 days of planting for green manuring and after 7 days of planting for dual cropping is recommended. Dual cropping up to 3-4 weeks was beneficial for rice. Split application of superphosphate at 8-10 kg P_2O_5/ha and carbofuran at 75-90 g/ha ensured rapid fern growth. Phosphorus need of *Azolla* could be met from recommended dose of P for rice by applying half the dose of P during *Azolla* cultivation. Green manuring supplied 20-40 kg N/ha and dual cropping 20-30 kg N/ha. Using *Azolla* as green manuring or dual cropping was on par with application of 30 kg N/ha through chemical fertilizer and increased grain yield. Inoculum of 100-300 g/m^2 for *Azolla* multiplication and 0.5-1.0 t/ha for green manuring or dual cropping has been recommended. Higher levels of inoculum helped in rapid *Azolla* growth and inoculum up to 3.0 t/ha could be used without any adverse effects on rice yield, provided water level is not high enough to allow rice leaves to be covered by *Azolla*

Nutrient content in *azolla*

Sl. No.	Plant nutrients	Quantity (%)
1.	Nitrogen	4.0-6.0
2.	Phosphorous	0.4-0.9
3.	Potash	3.0-6.7
4.	Calcium	0.4-1.0
5.	Magnesium	0.5
6.	Manganese	0.11-0.16
7.	Iron	0.06-0.16
8.	Mineral ash	9.0-10.0
9.		5.0-6.0
10.	Fat	5.0
11.	Crude nitrogen	24.0-26.0
12.	Crude fibre	9.0

Uses:

- Azolla excretes organic nitrogen in water during its growth and also immediately upon trampling. Fern fronds are soft and rapidly decomposed.
- It absorbs traces of potassium from irrigation water.

- Azolla provides nitrogen, potassium and organic carbon etc.
- It prevents weed growth in rice field water.

Mycorrhiza:

- It occurs naturally in low land and upland rice. It mobilizes the phosphorus required by rice.
- It also provides nutrients such as iron, zinc, copper, manganese etc.
- It can be used for almost all crops especially horticultural crops, chilli, tomato etc.
- Endomycorrhiza are obligate symbionts and have not isolated in pure culture and can be maintained only on live plants inoculated with spores of a species and collecting the pieces of roots with soil. The root biomass heavily infected by a specific mycorrhizal fungus serves as the inoculum for subsequent plots.
- It is used in chilli, tomato seed beds @ 2kg /sq.meter.

Fertilizer management:

Reasons for loss of nitrogen:

1. Leaching
2. Deep percolation
3. volatilization ammonia
4. Denitrification losses

Time of application of nitrogen:

- Go for spilt application of nitrogen to increase its availability at different crop growth stages, to get uniform growth and to avoid nitrogen losses.
- Paddy requires nitrogen at two different growth stages *viz.*, vegetative stage and before panicle initiation stage
- Quantity and time of application depends on soil fertility status and varietal requirement.
- Provide enough nitrogen at the time tillering

Points to be consider for quantity and time of application of nitrogen

- Apply during initial stage of crop growth to get more tillers
- Application of nitrogen after tillering leads to good seed setting in the emerging panicle.
- Application of nitrogen at later stages and before panicle initiation stage increases the nitrogen content in seeds but not the yield level. Hence late application of nitrogen is not recommended

Quantity of nitrogen:

Kharif crop - 100kg N/ha

Nitrogen management:

Quantity and time of nitrogen application depends on soil characteristics, irrigation management, climate, and method and time application. Points to be considered for nitrogen management are:

- Nitrogen should be available to the crop at almost all growth stages.
- Getting more yield from the available nitrogen

Quantity and method of nitrogen application depends on the following points

1.	At the time of transplanting	During last ploughing incorporate nitrogen need to be given at the time of transplanting
2.	Method of top dressing	24hours before topdressing drain out the field.24 hours after topdressing

		irrigate the field.
3.	Number of top dress	3 and 6 weeks after transplanting and 1 week before panicle initiation.
4.	Quantity of nitrogen at each topdressing	25kg/ha
5.	Low nitrogen status in the soil	Provide more nitrogen at the time of transplanting
6.	High nitrogen status in the soil	Provide less nitrogen at the time of transplanting and go for top dressing with remaining nitrogen
7.	Sand mixed soil	Don't apply excess nitrogen at any stage
8.	Low tillering varieties	Apply less nitrogen at initial crop growth stage.
9.	Short duration varieties	Apply more nitrogen at initial crop growth stage
10.	Long duration varieties	Top dress more nitrogen
11.	Cool climate at initial crop growth	-----do----
12.	Symptom of occurrence of bacterial leaf blight	Frequent top dressing
13.	Transplanting of aged seedling	Transplant at closer spacing and provide more nitrogen at the time of transplanting
14.	Form of application of nitrogen	Ammonium sulphate or urea form

Nitrogen management in paddy with leaf colour chart (LCC)

Yellowing of leaves in paddy indicates the deficiency of nitrogen, but it is difficult to decide the quantity of nitrogen to be applied based on the extent of yellowing. Leaf colour chart developed by International Rice Research Institute can be utilized for efficient nitrogen management in paddy. The actual requirement of nitrogen by the crop can be correctly assessed by leaf colour chart, as the native soil supply of N, supply through organics, irrigation water, soil organisms and N losses through leaching, evaporation, weeds etc. will be considered in N- management through leaf colour chart.

The leaf colour chart consists of 6 -7 green strips, 1^{st} strip with light green colour and the last strip (6^{th} or 7^{th}) with dark green colour, and in between strips (2^{nd} to 5^{th}) are with varying intensity of green colour. Time of nitrogen application is decided by LCC score.

Use of leaf colour chart

1. Select fully opened disease free new leaf i.e. third leaf from the top as index leaf in paddy plant for assessing the leaf colour and ten leaves to be selected from ten plants in the filed.
2. Match the colour of the selected leaves by keeping the middle of the leaves on the colour strips of leaf colour chart and assess the colour intensity (LCC value) during morning hours (8-10 am).
3. Assess the intensity of leaf colour each time at a particular time by a particular individual.

4. Take average of two if the leaf colour matches between two colour strips of the chart.
5. Commence the assessment of the leaf colour with LCC at 14 DAT in transplanted rice or 21 DAS in direct seeded rice and continue up to flower initiation/heading at an interval of 7-10 days
6. Critical LCC value varies with the type of paddy genotypes. LCC critical value is 3.0 in low N response cultures. In Karnataka for drill sown paddy (Intan variety) the critical LCC value is 3 and for Abhilash variety the LCC value is 4.
7. Assess the average LCC values of 10 leaf samples. When the average LCC value of ten leaves or when the LCC values of five or more leaves found below the critical LCC limit fixed for that genotype, then top dress nitrogen depending on the crop growth and stage as indicated in the following table

Quantity of nitrogen to be top dressed to paddy crop when assessed average **LCC value is below the critical LCC value (Karnataka)**

Crop stage	Duration(days after planting/sowing)			Quantity of nitrogen (kg/ha)	
	Short duration (100-115days)	Medium duration (125-135days)	Long duration (145-165days)	Summer	*Kharif*
Transplanted paddy					
Initial growth period	14-28	14-42	14-63	30	20
Grand growth period	29-48	43-70	64-85	45	30
Lag growth period	49-flowering stage	71-flowering stage	86-flowering stage	30	20
Drill sown paddy					
Initial growth period	21-34	21-56	21-70	30	20
Grand growth period	35-55	57-84	71-90	45	30
Lag growth period	57-flowering stage	85-flowering stage	91-flowering stage	30	30

Phosphorus management in paddy

The texture of the soil is important while considering phosphorus application. Recovery of phosphorus from added fertilizer is much less in heavy soils than in light soils. For example: in black clay soils the recovery is 20 to 40% compared 60 to 80% recovery in red sandy soils. It is now known that the phosphorus status of soil should be built up to a particular level to achieve higher yields. At least 35 kg P_2O_5 per ha should be available in soil to get profitable returns to

fertilizer application in rice. If soil analyses shows below this level, the phosphorus fertilizer requirement is calculated as given below:

Potassium management in paddy

Identify the need to apply potassium to a field from the soil test results. If there is a need, then potassic fertilizer is to be applied as basal application. The split application of potassium is recommended when

- The soils are very low in potassium
- If the soil is too light to hold the potassium against leaching
- If the potassium fixation power of the soil is very high as indicated in the soil test report
- Top dressing of potassium if needed is applied at the panicle initiation stage

Water management

- Maintain water to an extent of 2.5cm height in the field during first 10 days of transplanting and afterwards increase the height up to 5cm through out the crop growth. Drain out the impounded water from the fields 10 days earlier to harvesting.
- Maintain the water level to an extent of 5cm during panicle initiation to panicle emergence stage.
- For drill sown rice care should be taken to drain out excess rain water during first 10-15 DAS and the water level in the field should not be more than 2.5cm height during tillering stage.
- In drill sown rice carry out hodta operation (Planking) in standing water at 40 DAS, and impound sufficient rain water through the crop growth period. This prevents growth of weeds thus reduces its competition with crop.

Harvesting:

- At the time of harvesting the upper portion (90%) of the spikelets should be straw coloured. But 3-4 grains in the lower portion of the panicle are still greenish.
- Take up threshing operation when the moisture content in the grain is 15 percent.
- Do not dry the grains at each time more than 4 - 6 hours otherwise grains will shrivel and break.

Some suggestions:

- Do not use the seeds for sowing from the crop which was affected by blast disease.
- Burn all the residues of paddy crop which was affected by blast disease. This prevents the spread of disease to the subsequent crop.

Yield levels

Zone 1 and 2

Sl. No.	Variety	Grain Yield (q/ha)	Straw yield (q/ha)
1.	Jaya	75 - 85	110 - 130
2.	Telahamsa	50 - 65	60 - 80
3.	Sona, vani, Prakash, IR - 20	63 - 70	80- 90
4.	Madhu, Pushpa, Mngala, Mandyavani, Pragathi	50 - 63	60 - 80
5.	Sonamasuri	75- 80	110- 120
6.	JEB - 24	50 - 60	60 - 75
7.	Drill sown paddy varieties	25 - 30	45 - 55

	(rainfed condition)		

Zone - 3

We can expect on an average 50-55 q of grains and 60-80 q of straw yield from different varieties.

Explanation	Grain yield (q/ha)	Straw yield (q/ha)
Zone - 8		
1. Short duration varieties	60-70	75-90
2. Medium duration varieties	75-85	115-130
Drill sowing		
a.	20-30	30-45
b.	30-40	55-70
c.	40-50	80-100
Zone - 9		
Kharif		
1. low land	50-55	100-110
2.	40-55	60-85
3. delayed monsoon	40-45	60-70
4. Mountain region - drill sowing	30-35	40-45
Summer	35-40	
Zone - 10		
Kharif		
1.	30-37	40-45
2.	50-62	75-95
3.	45-55	70-85
Rabi		
1.	45-55	55-70
2.	37-50	45-65
Summer		
1.	50-62	65-80
2.	50-62	65-80

Low cost Paddy cultivation practices:

- Transplant the varieties such as Jaya, Vani, Sona and Prakash before 20 th of July.
- Transplant IR - 20 before 5 th of August
- Varieties such as Madhu, Pragati and Pushpa should be transplanted after 20 th of August.
- Mangala can be transplanted upto September 7.
- Summer Paddy should be transplanted before the end of February.
- Avoid transplanting of more than 25 days old seedlings
- Avoid transplanting at the depth more than 5 cm deep
- Incorporate FYM and compost 3 weeks before transplanting
- For late duration varieties maintain 50 hills per sq. m and for short duration varieties it is 67 hills per sq. m

Intercropping in Paddy:

Note:

Ratooning in Malnad region

- Inton and I.E.T - 7191 varieties are suitable for rationing
- Go for rationing only good main crop was harvested
- Harvest the crop 8-10 cm above ground level and after harvesting leave the land 8-10 days for drying
- Take up planking (hodta) 15 days after irrigation
- At this stage topdress 50 kg Nitrogen through any source
- Take up plant protection measures similar to that of main crop
- Ratoon crop will be ready for harvest at 135 days. We can obtain 25 q tield per hectare

GINGER

Ginger is a tropical plant adapted for cultivation even in regions of subtropical climate such as the high ranges. It prefers a rich soil with high humus content. Being an exhausting crop, ginger is not cultivated continuously in the same field but shifting cultivation is practised. The crop cannot withstand waterlogging and hence soils with good drainage are preferred for its cultivation. It is shade tolerant / loving crop with shallow roots and therefore suitable for intercropping and as a component in the homesteads where low to medium shade is available.

Preparation of land

Clear the field during February-March and burn the weeds, stubbles, roots etc. *in situ.* Prepare the land by ploughing or digging. Prepare beds of convenient length (across the slope where the land is undulating), 1 m width, 25 cm height with 40 cm spacing between the beds. Provide drainage channels, one for every 25 beds on flat lands.

Varieties

Dry ginger type: Cultivars: Maran, Wayanad, Manantoddy, Himachal, Valluvanad, Kuruppampady. *Improved varieties:* IISR-Varada, IISR-Rejatha and IISR-Mahima.
Green ginger type : Rio-De-Janeiro, China and Wayanad Local
Dual purpose type: Athira (tolerant to rhizome rot and bacterial wilt).
Rio-De-Janeiro and Karthika (tolerant to rhizome rot and bacterial wilt).

Planting material

Ginger rhizomes are used for planting. For selection and preservation of seeds, adopt the following methods:

- Mark healthy and disease free plants in the field when the crop is 6-8 months old and still green.
- Select best rhizomes free from pest and disease from the marked plants.
- Handle seed rhizomes carefully to avoid damage to buds.
- Soak the selected rhizomes for 30 minutes in a solution of mancozeb and malathion to give terminal concentration of 0.3 per cent for the former and 0.1 per cent for the latter.
- Dry the treated rhizomes in shade by spreading on the floor. Store the treated rhizomes in pits dug under shade, the floor of which is lined with sand or saw dust.
- It is advisable to spread layers of leaves of *Glycosmis pentaphylla* (panal). Cover the pits with coconut fronds.
- Examine the stored rhizomes at monthly intervals and remove the rhizomes that show signs of rotting.
- This will help to keep the inoculum level low. Provide one or two holes for better aeration. Treat the seed rhizomes similarly before planting also.

Season and method of planting

The best time for planting ginger is during the first fortnight of April, after receipt of pre-monsoon showers.

- For irrigated ginger, the best suited time for planting is middle of February (for vegetable ginger).
- Plant rhizome bits of 15 g weight in small pits at a spacing of 20 cm x 20 cm to 25 cm x 25 cm and at a depth of 4-5 cm with at least one viable healthy bud facing upwards.

- Seed rate 1500 kg ha-1
-

Manuring :
Apply manures and fertilizers at the following rates:
FYM 30 t ha-1
N:P2O5:K2O @ 75:50:50: kg/ha/year

Full dose of P2O5 and 50 per cent of K2O may be applied as basal. Half the quantity of N may be applied 60 days after planting. The remaining quantity of N and K2O may be applied 120 days after planting.

Mulching
Immediately after planting, mulch the beds thickly with green leaves @ 15 t ha-1. Repeat mulching with green leaves twice @ 7.5 t ha-1 first 44-60 days and second 90-120 days after planting. Grow green manure crops like daincha and sun hemp in the interspaces of beds, along with ginger and harvest the green manure crop during second mulching of ginger beds.

Aftercultivation
Remove weeds by hand weeding before each mulching. Repeat weeding according to weed growth during the fifth and sixth month after planting. Earth up the crop during the first mulching and avoid water stagnation.

- Select sites having proper drainage.
- Select seed rhizomes from disease free areas.
- Treat seed rhizomes with 0.3 per cent mancozeb.
- When incidence of rhizome rot is noted in the field, dig out the affected plants and drench the beds with cheshunt compound or 1.0 per cent Bordeaux mixture or 0.3 per cent mancozeb.
- Inoculation with native arbuscular mycorrhiza, *Trichoderma* and *Pseudomonas fluorescens* at the time of planting is recommended as a biocontrol measure.
- For controlling the leaf spot disease, 1 per cent Bordeaux mixture, 0.3 per cent mancozeb or 0.2 per cent thiram may be sprayed.
- For control of nematode in endemic area, apply neem cake @ 1.0 t ha-1 at planting followed by application of neem cake @ 1.0 t ha-1 at 45 days after planting (DAP).

Harvesting:
1) For green ginger, harvesting is done 210-215 days after planting.
2) For curing purpose, harvesting is done 245-260 days after planting when the leaves start yellowing and pseudo stem begins to dry.
3) The rhizomes are lifted either with digging fork or using *kudali* and are cleaned-off the roots and adhering soil particles.
Yield:
10-15 tons/ha green ginger (Green rhizomes). If there is a market glut at the time of harvesting, irrigation is continued instead of harvesting at an interval of 8-10 days. At the end of April sprouting is seen. Manures and fertilizers arc applied as per recommendations and harvesting is done in the month of August, Inthis case, average yield obtained is about 30 to 40 t/ha.
Yield of Cured Ginger - 15-20 % of fresh produce.