-: Cotton : -

Land and soil preparation

Deep plowing with tractors at intervals of two to three years in summer can reduce the incidence of perennial pests. Before the onset of summer or monsoon season, plow the land with a plow or tractor, prepare the plowed land. Mixing crop residues in the soil with a shredder or rotavator 15 cm in the furrow. Moisture can be stored by subsoiling to depth.

Selection of species

In organic farming, select native cotton or varieties which are low in nutrients and resistant to pests.

Improved varieties	Indigenous cotton hybrids	Cotton hybrids
Gujarat Cotton-10	Gujarat Cotton Desi Hybrid-7	Gujarat Hybrid Cotton-4
Gujarat Cotton-16	Gujarat Cotton Desi Hybrid-9	Gujarat Hybrid Cotton-6
Gujarat Cotton-18	Gujarat Cotton Indigenous Hybrid-11	Gujarat Hybrid Cotton-8
Gujarat Cotton-21		Gujarat Hybrid Cotton-10
Gujarat Cotton-23		Gujarat Hybrid Cotton-10

Planting

Planting can be done normally from the second week of June to the second week of July due to good rains. Where irrigation is available, advance planting can be done from the end of May to the first week of June. In areas where rainfall is high and there is a question of water logging in the soil, make sloping shifts and sow cotton seeds on the shifts.

Planting distance

In cotton plantations where irrigation is available, 120 cm between two furrows should be provided. And 45 cm between two plants in the furrow. to keep as much distance. While in non-irrigated area 90 cm between two furrows. And the distance of 30 cm between the two plants in the furrow has been found to be suitable.

Seed rate

It is advisable to sow at a depth of 4-5 cm keeping in view the moisture in the soil, seed rate should be 3.5 to 4.0 kg / ha.

Seed Treatment

Seeds should be treated with Azotobacter and Phosphate culture.

Thining and filling gaps

Where there are two or more plants, keep one plant and transplant, and where there is no seed germination, fill the gaps as soon as possible.

Compost

For high yielding hybrid varieties of cotton crop, it is recommended to apply 10 tons of organic manure / hectare.

Weeding and intercropping

In order to get higher yield of cotton, it is very important to keep the crop free from weeds for 50 to 60 days after the initial growth of the crop. In the initial stage, two to three weeds and intercrops should be done or intercropped as required 40 days after intercropping.

Irrigation

Irrigation should be provided as per the requirement if irrigation facility is available during the rainy season when the soil is dehydrated. The first irrigation should be given 20 to 25 days after the last rain. Cotton crop needs 2 to 3 irrigations at intervals of 20 to 25 days after rains. Irrigation in alternate furrows saves water. Irrigation area can be increased by drip irrigation in cotton. Mulching of organic crop residues or plastic cover can save irrigation water and control weeds.

Pest control

The following steps are recommended for integrated control of cotton pests.

1. Initially, to prevent damage from the cabbage caterpillar, the damaged sting should be broken and destroyed by hand with the caterpillar.

2. One week after the emergence of the crop, for the information of live caterpillars and military caterpillars, five pheromone traps per hectare should be placed and the lure in them should be changed every 15 days and the pest caught in the traps should be destroyed daily.

3. Chrysopa eggs / first stage caterpillars for sucking pests in early stage of cotton should be released three times in the number of 10,000 per hectare. Mix 40 gm of organic fungus Verticillium lecani in 10 liters of water and spray at weekly intervals.

4. Trichogramma wasp hacker released four times in a population of 1.5 lakh due to infestation of live caterpillars.

5. When the green caterpillar is in its infancy, HNPV Spray at the rate of 450 per hectare (LE). Bactericidal pesticide, Bt powder 1.5 to 2 kg per hectare mixed in water and spray.

6. Destroying damaged flowers, buds, stings as well as military caterpillar eggs and caterpillar mass from cotton crop by hand.

7. After 10 rows of cotton, 1 rows of maize / sorghum can protect the predators and parasites and by planting cotton around and in between Golgotha and Castor, effective control of green caterpillars and military caterpillars can be achieved and the number of predators and parasites can be maintained.

Disease control

Castor cake 500 kg per hectare. The effect of Sukara is less when applied in furrows before sowing.

-: Wheat : -

Land and soil preparation

In sandy, loamy or alluvial soils. Planking should be given two or three times to make the soil smooth and level.

Names of species

Timely sowing

- **Squadrons**: G.W.U. 366, G.W.U. 322, G.W.U. 496, Lok 1, G.W.U. 503, G.W.U. 190, G.W.U. 273.
- **Duram (Kathia) varieties**: G.W.U. 1139, G.W. 1255 RPP.8498

Late sowing

- G.W.U. 173, G.W.U. 11 and Lok 1

Crop planting time

- **Timely sowing**: 15th November to 25th November
- **Late sowing**: By 10th December

Planting distance

- **Timely sowing**: 22.5cm between two rows
- **Late sowing**: 18 cm between two rows

Seed rate

- **Timely sowing**: 120 to 125 kg per hectare
- **Late sowing**: 125 to 150 kg per hectare

Seed Treatment

Apply Azotobacter and phosphate culture 30 g / kg. of seed before sowing.

Compost

Apply 10 to 12 tons of compost per hectare while preparing land. In peanut-wheat cropping system, apply 2.5 tons of manure per hectare in groundnut and 24 tons per hectare in wheat.

Irrigation

The crop needs a total of 8 to 10 irrigations. The first irrigation should be given immediately after planting and the second irrigation should be given in 5 to 6 days for good growth. Third irrigation should be given on 21st to 22nd day after planting and every subsequent irrigation should be given at intervals of 8 to 10 days according to the copy of the land. Use drip method if possible. In case of low availability of irrigation water, emergency watering conditions such as crown root (18 to 20 days after sowing), foot (35 to 40 days after sowing), gab (50 to 70 days after sowing), flower (75 to 80 days after sowing) , Milk grains (95 to 95 after sowing)

Weeding

Hand weeding 2 to 3 times as required

Main pests and control of crops

- To control the weeds, to give light irrigation in short term so that the soil does not become too dry.
- For weevil control apply castor meal at the rate of 1 ton per hectare in the soil 2 to 3 days before sowing.
- Planting of crops like Golgotha or coriander as a cage crop around or around the field can control pests like mollusks.
- Birds feed on such caterpillars by planting belakhada in standing crops

Crop disease and control

- **Timely sowing**: Disease resistant varieties such as G.W.U. 366, G.W.U. 322, G.W. 486, Lok 1, G.W.U. 11, G.W.U. 273
- **Late sowing**: Leaf resistant varieties for brown ocher like G.W. 173, G.W. 11,Lok-1.

Pruning and storage

Irrigated crops are ready for harvest in 95 to 115 days and (depending on the variety planted). Harvesting by hand thresher or combine harvester when mature. For home use, mix 100 kg of seeds with castor oil and 2 kg of dried leaves of neem in the shade of and store in a barrel

.-: Non-drinking wheat: -

The Bhal area is the area around the Gulf of Khambhat. The land in this area is 12 feet above sea level. Before reaching the bays of Bhogavo, Bhadar, Lilka, Ghelo, Khari, Sabarmati and Mahi Khambhat from this area, its water returns to this area during the monsoon season as almost all the rivers are less than 1 meter deep. The soil in this area is flat and saucer shaped, the water that flows back into this area stays on the soil during the monsoon season. Due to this situation, farmers in the area can harvest in winter due to the moisture stored in the soil.

Improved quality	A202, A624 and Gujarat Wheat-1
Seed rate	60 kg Per ha.
Seed treatment	Azospirillum culture and PSB
Sowing distance	30 cm
Sowing time	The last week of October to the first week of November
Organic manure	10 tons / ha for organic manure.
Limited irrigation	21 days after sowing

-: Paddy: -

Land and soil preparation

As the paddy crop needs more water, it does not come with more drained soil. Paddy crop grows well in medium loamy or black soils. The black soil which can store more moisture to the paddy crop, is more suitable. In low rainfall areas where waterlogged low lying alluvial soils, paddy can be grown well. Flattening the soil and then filling it with water so that planting will be convenient for the plants to get hurt and prevent the wastage of water going down into the soil. Apply 10 tons of manure per hectare in the soil 15 days before planting and apply 50 to 60 kg green manure.

Selection of species

For higher production of paddy, low yielding varieties should be selected which are adapted to the soil, climate and rainfall conditions of the area. Medium late or late maturing varieties should be selected for early maturing and irrigated area for inadequate irrigation facility or rainfed area.

The paddy crop is recommended to be grown in different climatic conditions depending on the ripening days of the variety.

(1) Early maturing varieties (80 to 100 days): SK-20, GR-3, GR-4, GR-6, GR-7, GR-12,Gurjari, IR-28, GAR-2 and GAR-3.

(2) Medium late maturing varieties (100 to 120 days): GR-11, Jaya, IR-22, GR-103, GAR-13, GAR-1 (Fragrant), Stem, SLR-51214 (Alkali Resistant Varieties).

(3) Late maturing varieties (130 to 140 days): Non-fragrant: Masoori, Fragrant: GR-101, GR-102, Narmada and GR-104

Seed rate

Clean, pure, plump and certified seeds should be used for planting. 20-25 kg of fine grained variety for planting paddy. For coarse grained variety 25-30 kg seed rate is required per hectare. For drilling paddy seed rate is 50 to 60 kg per hectare.

Seed Treatment

- Before sowing the seeds, soak the light, fluffy and diseased seeds floating in 3% salt solution (300 g salt in 10 liters of water), while the plump seeds sitting below should be washed two to three times with clean water and dried in the shade.
- 3 kg / ha. organic fertilizer Azotobacter culture for 25kg of seed treatment at the time of sowing

Sowing

In drilling paddy when there is good rainfall worthy of sowing, sow at a distance of 30 cm between two rows. For transplanting paddy, plant 4 to 5 leaf (21 to 24 day old) seedlings.

Nursery

To plant Nursery in one tenth of the area where paddy is to be planted, i.e. 10 Gunthas of land is sufficient for planting 1 hectare of paddy.

• 1 meter wide, 10 meters long and 15 cm in Nursery making a cushion of the same size of height makes it suitable for farming.

• Apply 20 kg manure per bed and 2 kg castor oil before dipping in the soil.

• Nursery should be planted in late May and late in the first fortnight of June.

- Sprinkle 250 to 300 gms of seeds per bed or cover the mattress beds by planting shallow furrows at a distance of 10 cm.
- After sowing the seeds for 24 hours in the cushion bed fill with water2 cm. After that keep watering in Nursery to maintain constant moisture.
- In Nursery, when there is a water shortage, the salts of the soil come up and the paddy stalks become pale and yellow. This is called "Kolat", which is due to iron deficiency. To control it, drain the water in Nursery two to three times and then keep it filled with water.
- It usually becomes cultivable when it grows from 4 to 5 leaves in 22 to 24 days. Planting older seedlings yields less feet and has a sweeter effect on overall yield.

Replanting

The first fortnight of July is the ideal time for paddy harvesting. 20 cm between two rows of paddy. And keep a distance of 15 cm between two plants and plant 2-3 seedlings per station. Chipadar Dharu with 4 to 5 leaves is considered excellent for planting. When planting Dharu, cut off the top part of the leaf and plant.

In case of untimely rearing of paddy or shortage of labor at the time of planting timely sowing of paddy is not possible. Good yield of paddy can be obtained by sowing with sprouted seeds of paddy.

Fertilizer management

- Apply 10 tons of manure per hectare in paddy.
- 2 tons of castor cake or 2 tons of vermicompost can be given instead of manure.
- Apply green flax seed 50 to 60 kg per 3 hectare.
- Prior to planting, apply Dip roots of transplant in to the solution of Biofertiliser such as Azotobacter / Azospirillum and Phosphobacter. Soak for 30 minute.
- 6 to 7 tons of Azolla or 10 kg Blue-green algae can be given per hectare.
- Apply Biofertiliser like Azotobacter or Azospirillum and Phosphobacter (1 ml 108 living cells) at the rate 2.5 lit with 300 kg compost per hectare 30 to 40 days after planting.
- Sea-weed (Gracilaria species) 25% to be sprayed three times at 15 days interval after planting.

Irrigation management

The following points need to be kept in mind regarding irrigation in paddy.

- During the initial life span from planting there is a special need for water, fill with water 2 to 3 cm..
- Emergency conditions such as foot stage, life span and grain filling stage are 3 to 4 cm. Fill with as much water as possible.
- Before early onset, i.e. for early maturing and medium late maturing varieties, drain and drain once in 30 to 35 days, whereas for late maturing varieties, between 35 to 40 days and between 40 to 50 days, twice in five days. Drainage increases productivity.

Weed management

Paddy crop should be kept weed free for 15 to 45 days after planting. Intercropping and weeding 2-3 days after transplanting. Maintaining adequate amount of water reduces weed infestation.

Disease and pest control

Paddy crops are mainly affected by blight, leaf blight, malignant blight, leaf spot disease, stem rot, reddish brown grains and nutrient deficiency diseases.

(1) Dryness caused by germs: In this disease, the top of the leaf dries out and the plants and thorns also dry out slowly. The disease is exacerbated by excessive application of nitrogenous fertilizers

(2) When the thorns come out, lumps like yellow chickpeas are formed instead of grains. Later turned into a black powder. Insect infestation in paddy crop is mainly leaf-rolling caterpillars, weevil caterpillars and suckers.

(3) Gabhamarani caterpillar: 5-30 days after planting the yellow of the plant dries which is called dead heart. When the thorns are dry, the thorns do not turn white and the grains do not fill

Measures for disease and pest control

- Choosing healthy seeds of disease free area.
- Selection of immune varieties.
- To keep the sheds of the field free from weeds and clean.
- Deep tillage in summer to keep the soil warm and crop rotation prevents stem rot disease.
- 10 ml per liter of water Pseudomonas species helps in controlling fungal and bacterial diseases of paddy.
- Replanting of paddy early (in the first week of July) where possible can reduce the damage caused by sucking.
- For control of caterpillar larvae, apply five Trichogramma cards per hectare (one lakh wasps per card) three times at an interval of 15 days after 20 to 25 days of planting.
- At the time of transplanting of paddy, cutting off the top of the leaf and planting will destroy the mass of eggs laid by the female moth at the top of the leaf, thus preventing its infestation from advancing in the field planted.
- Wide planting of paddy plants can also reduce the incidence of the disease.
- To control the larvae destroy the eggs laid on the leaves after planting. Arrange a light cage at night in the field to destroy the ants. Infestation information can be obtained by setting 5-7 pheromone traps per hectare and changing the lure in 15 to 21 days.
- In case of infestation of paddy caterpillars fall into the water along with the beetle by passing a rope through the field.
- Removing weeds in the field after harvesting can destroy dormant military caterpillars Keeping water after harvesting where there is a water system destroys the cocoons.
- Destroying diseased crop residues after harvest. If possible, the fungus is destroyed by burning a dry straw bed on the grass.
- Burning and destroying diseased plants.
- For military caterpillars, make heaps of grass at night and destroy them with caterpillars in the morning. Also, by digging a trench one foot deep around and the farm, the caterpillar cannot enter it.
- Spraying of lemon extract solution in 5% (50 ml / 10 liters of water) controls brown, white and green tadpoles of paddy.
- Sucking is controlled by spraying 40 gm of Beveria bassiana in 10 liters of water.

-: Chickpea: -

Soil preparation

Apply 8 to 10 tons of manure per hectare and prepare the soil. In areas like Ghed and Bhal where monsoon water fills up, sow immediately after the water dries up.

Time and quality of planting

Sow irrigated chickpeas Gujarat-1 and JG-16 (Saki-9516) as per the onset of cold season between 15th October to 15th November. Non-irrigated Gujarat Chana-2 and Gujarat Junagadh Chana-2 should be sown after water drying. It is recommended to plant Kak-R in chickpeas. Plant only high yielding varieties recommended by the Agricultural University.

Seed rate and spacing

Non-irrigated native chickpea at a distance of 30 to 40 cm between two furrows with 60 kg seed rate. If large seed variety like Gujarat-II is to be sown, 80 to 100 kg / ha. distance 10 to 15 cm.. Sow irrigated chickpeas at a distance of 35 cm between two rows.

Seed Treatment

Apply Rhizobium and Phosphate culture to the seed at the time of sowing

Organic manure

Apply 10 tons of manure per hectare while preparing the soil.

Irrigation

In Gujarat, chickpeas are mainly grown in rainfed areas. Irrigation crops are harvested where irrigation facilities are available. For this, first water the chickpeas after weeding. The second watering should be given at 20 to 25 days of active emergence of branches, the third watering at40 to 45 days of flowering and the fourth watering at 65 to 70 days of parrot sitting. Flowers and parrots should be provided if only two watering facilities are available. Giving too much water causes the plants to ripen late by catching the wrong seedlings. Alkaline water is not suitable. Increase in production along with water saving by adopting drip irrigation method

Weeding and intercropping

Keep the field clean with intercropping and weeding as required. This method seems to be the most beneficial,

Crop protection

Green caterpillar: For control of green caterpillar, apply two sprays of neem leaf extract at 15 days interval. Arrange 5-6 pheromone traps per hectare. NPV(Virus) solution for biological control. Pest control is done by spraying four sprays at weekly intervals. Mix and spray the bactericidal disinfectant Bt powder at the rate of 1.5 to 2 kg per hectare in water. Beveria bassiana fungus 40 gm per 10 liters of water mixed and sprayed at weekly intervals.

Molomshi: Mix 40 gm of biopesticides Beveria bassiana in 10 liters of water and spray at weekly intervals.

Sukaro: To prevent disease, sow seeds of disease resistant varieties like Gujarat Chana-1 and Gujarat Junagadh Chana-2. Do not sow chickpeas in the same place every time.

Pruning

When 90% of the crop is ripe, harvest before noon. After harvesting, dry in the threshing floor. When the chickpeas are completely dry, separate the grains from the thresher and store .

-: Soybean: -

Land

Soybean crop can be grown in different types of soil. Occurs very well in well drained, high organic matter soils. A well-drained soil is required for growing crops. One deep tillage and two tillage plows require for leveling the land.

Improved varieties

Gujarat Soybean-1, Gujarat Soybean-2, GJS-3

Compost

Apply 10 tons of manure per hectare while preparing the soil.

Planting time

Soybean is sown in the month of June-July after rains.

Seed treatment

Apply 200gm of Rhizobium biofertiliser culture for 10 kg of soyabean seeds before sowing the seeds and 4 kg phosphotica culture per acre as soil application.

Planting distance

45 cm between two rows of soybeans and 10 cm between two plants. Keep distance so as to maintain required number of plants in one hectare area.

Intercropping and weeding

2 to 3 intercrops as required as well as weeding twice by hand to keep the crop weed free in the early stages.

Crop protection

Thus pest infestation is less in this crop. Spraying of 5% solution (in 50 ml / 10 liters of water) made from lemongrass for control of ticks and white flies.

Pruning

When most of the soybean leaves turn yellow and 90 to 95% of the pods turn golden yellow, pruning should be done with the help of combine harvester. If the crop is harvested late, the pods are torn and the grains fall off and if there are green pods and if the crop is harvested, the pods remain wilted green, which degrades the quality of the grain. Allow the cut plants to dry in the threshing floor for 3 to 4 days to separate the seeds from the threshing floor or thresher.

-: Bajara: -

Land and soil preparation

The crop needs very fine tilt because the seeds are too small. 2-3 harrowing and ploughing is followed so that the fine tilt may be obtained to fascitate the sowing and proper distribution of seeds at appropriate depth. Crop does not tolerate soil acidity.

Planting time

• **Monsoon**: Planting should be done immediately after raining in order to get higher yields, less pest infestation and timely clearing of land for subsequent harvest. If rains occur after 15th July, early maturing varieties should be planted.

• **Summer:** It is advisable to plant millet only from February to March 15 when the cold weather is less. Late planting reduces the yield due to heat at the time of sowing and also degrades the quality of grains at the time of ripening.

• **Pre-Rabi**: Millet planting from 15th September to 10th October

Seed rate and planting distance

• Monsoon: Seed rate per hectare is 4 kg. (6 kg / ha for alkaline, alkaline-calcareous and calcareous soils). Planting should be done at a distance of 40-45cm between rows and 10-15cm within rows and the seed should not go more than 4 cm deep in the soil.

• **Summer and Pre Rabi**: Seed rate per hectare is 4 kg. (6 kg / ha for alkaline, alkaline-calcareous and calcareous soils). Planting should be done at a distance of 40-45cm between rows and 10-15cm within rows and the seed should not go more than 4 cm deep in the soil.

Seed Treatment

Treat the seeds with Azotobacter, Azospirillum and Phosphate culture.

Varieties and their selection

The following new varieties that can resistant in hybrid millet are recommended for planting.

• **Monsoon**: GHB-558, 732 (late maturing)
: GHB-577, 744 (Medium Maturity)
: GHB-538,719 (Early Maturity)

• **Summer**: GHB-558, 526 and 538

• **Pre-Rabi**: GHB-538, 526

Parvani and Khala Purvan

When the crop is 15 to 20 days old, the distance between the two plants should be 10 to 12 cm. Maintain adequate number of healthy plants by transplanting healthy plants that have sprouted in suitable humidity conditions in rows with large gamma-gaps.

Compost

Apply 10 tons of native manure per hectare before primary tillage and mix or tillage the soil. Use organic fertilizers like Azotobacter, Azospirillum and Phosphate culture.

Weeding and intercropping

To control weeds in the crop and to maintain good physical condition of the soil, intercropping and hand weeding should be done on 20th and 40th day after sowing.

Irrigation

Monsoon: Irrigation is not generally recommended in monsoon millets as millets are mainly rainfed crops. It is recommended to provide supplementary irrigation in case of any shortage of rainfall.

Summer: Total 8 to 10 irrigations in summer millet, each irrigated at intervals of 8 to 10 days.

Pre- Rabi: In Pre- Rabi millet a total of 6 to 8 irrigations, give each irrigation at intervals of 10 to 12 days.

Pest control

1. Planting immediately after the first rains reduces the infestation of this pest.
2. The rate of seed per hectare is 5 kg.
3. Keep Removal and destruction of pests damaged during transplanting.
4. Taking a mung or tuwar between two rows of millets as an intercrop reduces the infestation of stalk flies and green caterpillars.
5. To remove the weeds of the next crop.
6. Destroy the damaged plant by pulling the beetle with the caterpillar.
7. Arrange a light cage per acre, destroying the attracted pest.
8. Pheromone trap should be arranged in the number of five per hectare.
9. Arrange shiny strips (ribbons) at the milky stage to prevent damage by birds.

Disease control

If the seeds contaminated, soak the seeds in 20% salt solution, wash with clean water, sow after drying. After the onset of monsoon or till its first week, when there is sufficient moisture, planting of millet reduces the incidence of diseases and increases the production of grains. Planting after 15th July increases the severity of these diseases

Harvesting

The crop is ready for harvesting when the grain become hardy and contain moisture. Cutting earhead or cutting of entire plants by sticks. Stalk the cut plants for 4-5 days in the sun for drying grains. Grains can be separated by biting the earheads.

****Source: Director of Research AAU, Anand**