

TECHNOLOGY DEVELOPED

Technologies of ICAR-AICRP on Fruits

BANANA

Crop Improvement:

Grand Naine replaced Basrai as the most popular commercial variant in Gujarat and India all over the start of 21st century. Ultimately, scientists developed a range of alternatives and crop-enhancement methods, as listed below, to maintain the region's output.

1. Growing of banana cv. Gandevi Selection advised for higher yield and net profit over other varieties **(2003)**.
2. Planting of banana cv. Grand Naine Tissue Culture plants at 1.8 x 1.8 m spacing enhance fruit yield and net profit along with less pest and disease incidence over suckers planting **(2007)**.
3. Cultivation of banana through macro-propagated plants exhibit early maturity, higher production and net return as compared to sucker plant **(2021)**.

Crop Production:

Under multi-location experiments, technologies were kept updating on growers feedback to continue with horticultural innovation on stage-based nutrition and irrigation schedule and proposed further to increase farmers' income. These innovations were also modernized with the varietal (Basrai and Grand Naine) and spacing improvement and these are enlisted below.

4. Recommended 200 g/plant nitrogen and 200 g/plant potassium in three equal splits in banana cv. Basrai for enhancement of productivity and income **(1992)**.

Installment No.	Days after planting (DAP)	N : K ₂ O (g/plant)	Urea (g/plant)	Murate of Potash (g/plant)
I	90	66.7 : 66.7	150	110
II	120	66.7 : 66.7	150	110
III	150	66.7 : 66.7	150	110
Apply basal dose of FYM @ 5 kg/plant and 90 g P ₂ O ₅ /plant (560 g/plant SSP) in pits at planting.				

5. Planting of banana cv. Basrai with paired rows method at spacing of 1.0 x 1.2 x 2.0 m (6250 plant/ha) for high density plantation to acquire higher fruit yield and net profit **(1994)**.
6. Apply of 25% nitrogen along with 5 kg FYM along with 100% phosphorus in pit at planting and remaining 75% nitrogen and 100% potassium out of RDF (200:90:200 g/plant N:P₂O₅:K₂O) in three equal splits in banana cv. Basrai for the higher fruit yield and net profit **(1997)**.

Installment No.	Days after planting (DAP)	N : P ₂ O ₅ : K ₂ O (g/plant)	Urea (g/plant)	SSP (g/plant)	Murate of Potash (g/plant)
At planting	--	50 : 90 : 0	110	560	--
I	90	50 : 0 : 66.7	110	--	110
II	120	50 : 0 : 66.7	110	--	110
III	150	50 : 0 : 66.7	110	--	110
Apply basal dose of FYM @ 5 kg/plant in pits at planting.					

7. Keep weed free field of banana for entire period or for first nine months of planting for improvement of productivity **(1997)**.

8. The saving of 25% nitrogen and higher net profit in banana cv. Basrai can be achieved by application of 150 g N/plant through drip method in three equal split at 90, 120 and 150 days after planting **(2000)**.
9. The optimum time for planting of banana in South Gujarat is middle of June, but planting up to August does not cause any significant reduction in yield **(2001)**.
10. Cover banana bunch with blue polythene (200 gauges) after complete opening of the bunch and keep the lower end open to protect fruits during cold winter and produce blemishless fruits **(2002)**.
11. Apply 75% nitrogen (150 g/plant) through drip in the form of urea in three equal splits in banana cv. Basrai as well as apply 75% phosphorus (67.5 g/plant) at planting time, while 75% potassium (150 g/plant) as soil application in three equal splits out of RDF (200:90:200 g/plant N:P₂O₅:K₂O) to maximize fruit yield **(2002)**.

Installment No.	Days after planting (DAP)	N : P ₂ O ₅ : K ₂ O (g/plant)	Urea (g/plant) Through Drip	SSP (g/plant)	Murate of Potash (g/plant) as Soil Application
At planting	--	0 : 67.5 : 0	0	420	--
I	90	50 : 0 : 50	110	--	80
II	120	50 : 0 : 50	110	--	80
III	150	50 : 0 : 50	110	--	80
Apply basal dose of FYM @ 5 kg/plant in pits at planting.					

12. Planting of banana cv. Gandevi Selection at 1.2 x 1.5 x 2.4 m spacing (4600 plants/ha) in paired row method for high density plantation maximize fruit yield and net profit **(2003)**.
13. Under high density plantation with paired row planting method in banana cv. Basrai, apply each 75% nitrogen (150 g/plant) and potassium (150 g/plant) in form of Urea and Murate of Potash through drip out of RDF (200:90:200 g/plant N:P₂O₅:K₂O) in six equal splits at 15 days intervals after 3 month of planting along with 100% phosphorous in pit at the time of planting saves 25% nutrients and quantity of water with sustainable fruit yield **(2004)**.

Installment No.	Days after planting (DAP)	N : P ₂ O ₅ : K ₂ O (g/plant)	Urea (g/plant) Through Drip	SSP (g/plant)	Murate of Potash (g/plant) Through Drip
At planting	--	0 : 90 : 0	0	560	--
I	90	25 : 0 : 25	55	--	40
II	105	25 : 0 : 25	55	--	40
III	120	25 : 0 : 25	55	--	40
IV	135	25 : 0 : 25	55	--	40
V	150	25 : 0 : 25	55	--	40
VI	165	25 : 0 : 25	55	--	40
Apply basal dose of FYM @ 5 kg/plant in pits at planting.					

14. Planting of banana cv. Grand Naine in paired row method at 1.0 x 1.2 x 2.0 m spacing (6250 plant/ha) exhibit higher fruit yield over normal spacing **(2007)**.
15. Apply *Azospirillum* @ 50 g/plant at two month of planting along with 100% RDF (10 kg FYM + 200 g nitrogen + 90 g phosphorus + 200 g potash) in banana cv. Grand Naine to get nearly 17% higher yield over normal cultivation practices **(2009)**.
16. Grow cabbage at 45 x 30 cm spacing in early growth stage of banana cv. Grand Naine under 1.8 x 1.8 m spacing planted in late *Kharif* to get higher income from intercropping **(2009)**.
17. Exercise stage-based irrigation through drip system in banana cv. Grand Naine as under for maximizes net profit and saving of water over flood system **(2011)**.

Stage	PEF	Month	Operating Time (Min)
Planting to bud initiation	0.8	July - Nov.	140-150 (Except rainy days)
Bud initiation to shooting	0.6	Dec. - April	140-150
Shooting to last hand opening	0.7	May	180-190
Last hand opening to one month before harvesting	0.8	June	235-245 (Except rainy days)

18. Irrigation through drip system (70% ER) with 75% recommended dose of nitrogen and 100% recommended dose of each phosphorus and potash in banana cv. Grand Naine enhance net profit and save water over flood system of irrigation **(2011)**.

System details		
Lateral spacing	:	1.8 m
Dripper spacing	:	0.3 m away from either side of plant (2 dripper)
Dripper discharge	:	4 LPH
Operating pressure	:	1.2 kg/ cm ²
Operating time	:	120-130 minutes during winter and 170-180 minutes during summer
Operating frequency	:	Alternate day

19. Application of 80% recommended dose of nitrogen (240 g/plant) and potash (160 g/plant) in banana cv. Grand Naine out of RDF (300:90:200 N:P₂O₅:K₂O g/plant) in 4 installments exhibit higher yield and net profit over 2 or 3 installments **(2013)**.

Install. No.	Month	Growth stages	N : K ₂ O (g/plant)	Urea (g/plant)	Murate of Potash (g/plant)
I	3 rd	Vegetative stage	90 : 40	200	70
II	5 th	Flower bud initiation stage	75 : 60	165	100
III	7 th	Flowering stage	75 : 40	165	70
IV	9 th	Bunch development	0 : 20	0	30
Apply FYM @ 10 kg/plant and 100% dose of P ₂ O ₅ (90 g/plant) at planting					

20. Banana cv. Gandevi Selection has higher productivity (20-30%) than Grand Naine, however both these varieties are comparable with each other on the basis of per day production *i.e.* 192.60 kg (Gandevi selection) and 189.87 kg (Grand Naine). In spite of longer crop period, Gandevi selection provides almost the same per day production and higher benefit in comparison to cultivar Grand Naine. As price of banana fluctuates on day to day basis, Gandevi Selection provides economically same remunerative as Grand Naine **(2013)**.

21. Under planting of three (3) suckers/hill (in triangle fashion at 30 cm) at 2 x 3 m (7 x 10 feet) spacing in banana cv. Grand Naine, soil application of 75% RDF (225:67.5:150 N:P₂O₅:K₂O g/plant) in three equal splits exhibit higher yield with net return **(2015)**.

Install. No.	Days after planting (DAP)	N : P ₂ O ₅ : K ₂ O (g/plant)	Urea (g/plant)	SSP (g/plant)	Murate of Potash (g/plant)
At planting	--	0 : 67.5 : 0	0	420	--
I	90	75 : 0 : 50	160	--	80
II	120	75 : 0 : 50	160	--	80
III	150	75 : 0 : 50	160	--	80
Apply basal dose of FYM @ 10 kg/plant in pits at planting.					

22. Use drip irrigation system in banana cv. Grand Naine and apply 75% recommended dose of N (225 g/plant) and K₂O fertilizers (150 g/plant) at 15 days interval during the various growth stage as under for getting higher yield and net profit. The drip system should be operated for 90 minutes in winter and 150 minutes in summer everyday having two drippers of 4 lph spaced at 30 cm either side of pseudostem. The technology saves 25% N and K₂O and 22% irrigation water **(2015)**.

Install. No.	Months & Growth stages	N : K ₂ O (g/plant)	Urea (g/plant)	Murate of Potash (g/plant)	No. of split
I	During 3 and 4 month	67.5 : 30	145	50	4
II	During 5 and 6 month	112.5 : 60	250	100	4
III	During 7 month to flowering	45 : 48	100	80	2
IV	Post shooting	0 : 12	0	20	1
Apply FYM @ 10 kg/plant and 100% dose of P ₂ O ₅ (90 g/plant) at planting					

23. For growing banana cv. Grand Naine under organic farming, the follow sequential application of nutrients as given below **(2016)**.

Install. No.	Days after planting (DAP)	Nutrients
I	At planting	FYM @ 10 kg/plant and Neem cake @ 1.25 kg/plant
II	1	Bio-fertilizers viz., <i>Azospirillum</i> @ 50 ml/plant, Phosphate Solubilizing Bacteria (PSB) @ 50 ml/plant and <i>Trichoderma harzianum</i> @ 50 g/plant and <i>Arbuscular Mycorrhiza</i> @ 25 g/plant
III	3	Vermi-compost @ 5 kg/plant
IV	5	Wood ash @ 1.75 kg/plant

24. For production of low cost quality planting material, follow macro-propagation technique in banana. A sucker treated with *Arbuscular Mycorrhiza* and *Trichoderma viride* each @ 30 g/sucker produces maximum 20 plants per sucker within 5-6 months **(2016)**.

Methodology

- Selection of good quality suckers weighing 500-1000 g.
 - Suckers are detopped just above the juncture of the aerial shoot (Decortications).
 - Removal of apical meristem to 4 cm depth and 2 cm width (Decapitation).
 - Give 6-8 cross wise cuts to sucker.
 - Place sucker in net house at 1 x 1 feet distance and covered with sawdust.
 - Apply 30 g each *Arbuscular Mycorrhiza* and *Trichoderma viride* around each sucker.
 - Removal of juvenile meristem of primary and secondary buds to produce tertiary buds.
 - Plants produced from tertiary buds having 4-5 leaves separated and planted in plastic bag in media containing Red soil:Sand:FYM in ratio of 1:1:1.
 - Plants kept in net house for hardening.
 - Follow regular watering during entire procedure.
25. Adopt soil test based fertilizer recommendation as per ready reckoner under drip irrigation in banana cv. Grand Naine with following modules for getting targeted yield **(2019)**.
- Apply 10 kg FYM/pit at the time of land preparation.
 - Drip irrigation (80% ER at all stages) system should be operated for 80 minute in winter and 130 minute in summer on alternate day having two drippers of 4 lph spaced at 30 cm either side of pseudostem.
 - Use black plastic mulch (100 micron thickness).
 - Use 2% Banana Shakti micro nutrient foliar spray at 3rd, 4th and 5th month after planting (formulated by NRCB).

- Bunch spray with 2% Sulphate of Potash (1st spray after male bud removal and 2nd spray at 30 days after 1st spray).
 - Adopt fertilizer dose of N, P₂O₅ and K₂O as per STCR ready reckoner. N and K₂O applied in three equal split through fertigation at 3rd, 4th and 5th month after planting, whereas P₂O₅ as soil application one month after planting.
26. Foliar application of Acetyl Salicylic Acid (18 mg/lit) at floral primordial initiation stage in banana plant (5 month after planting) under probability of water stress condition up to one month. The treatment reduced the effect of water stress and gave satisfactory growth, yield and increased net profit of banana **(2023)**.
27. Apply 7.5 kg FYM and 225 : 67.5 : 150 N : P₂O₅ : K₂O g per plant (75% RDF) in soil along with three foliar sprays of Novel organic liquid nutrients @ 2% (3rd and 5th month after planting on plant and after denavelling on bunch) in banana cv. Grand Nain for getting maximum yield and higher net return with 25% saving of fertilizers **(2026)**.

Crop Protection:

For the management of major insect pests and diseases of banana, different plant protection schedule recommended for reducing the losses in field as given below.

1. Apply four sequential sprays of either carbendazim @ 1.0 g/lit or propiconazole @ 1.0 ml/lit or thiophanate methyl @ 2.0 g/lit at one month interval after initiation of disease for effective and economic management of sigatoka leaf spot disease in banana **(2002)**.
2. Follow either paring and 0.15 % Acephate dip + 1% Bordeaux mixture or paring + 0.15% Acephate dip for 10 min or suckers dip in Copper Oxychloride @ 5.0 g/lit for 30 min for successful and economic management of rhizome rot of banana **(2002)**.
3. Plant healthy sucker of banana followed by drenching of bactericide at 15 days, 2 month and 4 months after planting with green manuring of sunhemp (3 times) in the interspaces till 6 months of planting for effective management of bacterial rhizome rot disease of banana **(2014)**.
4. For effective management of rust thrips in banana, inject the bud with one ml solution of imidacloprid 17.8 SL (0.6 ml/lit water) or 2 ml solution of azadirachtin 10000 ppm (5 ml/lit water) at the time of emergence of flower (30° angle when bud at upright position) **(2015)**.

SAPOTA

Crop Improvement:

Kalipatti is main variety cultivated on commercial scale in Gujarat. Cultivation of sapota other varieties like Murabba, Cricket ball, Pilipatti, Zumakhiya and Bhuripatti are also found in few pockets of Valsad and Navsari districts. Therefore, the most of research work was occurred on their rootstock enhancement as given below.

1. Recommendation of *Rayan/Khiranee* as rootstock (approx. 2^{1/2} years) for propagation of sapota seedlings in India first time from this centre **(GAU- 1977)**.
2. Farmers/nurserymen are advised to soak the *Rayan (Khiranee)* seed in 1% Thiourea for six hours or in dung paste for 24 hours to obtain higher percentage of germination from one month old seeds of *Rayan*. After treatment, the seeds should be washed and dried in shade before sowing **(1993)**.

Crop Production:

The most of the technologies on spacing, pruning, stage-based nutrition and irrigation schedule were based on popular cv. Kalipatti and also promoted to boost farmers' income as listed below.

3. Fertilizer should be applied within the radial distance of 2.0 m from the trunk and up to the depth of 30 cm under the tree and thoroughly mixed in the soil for efficient utilization of nutrients by sapota tree **(1989)**.
4. For high density plantation in sapota cv. Kalipatti, the plantation should be raised at 5 x 5 m spacing up to 13 years age for getting higher yield per unit area **(1997)**.
5. The pruning treatments imposed in 20 years old sapota cv. Kalipatti planted at 10 x 5 m spacing cannot show significant improvement in yield in comparison to conventional spacing (10 x 10 m). But these pruning treatments in terms of physicochemical properties resulted in significantly higher fruit diameter and pulp skin ratio in treatment heading back of scaffold branches 60 cm away from the point of inter locking. Significantly higher TSS recorded in treatment topping the tree height above 4th tier. The increase in fruit weight also recorded in treatment combination heading back of scaffold branches and topping. Thus pruning treatment has resulted in higher physio-chemical properties **(2013)**.
6. Application of 100% recommended dose of fertilizers (1000:500:500 N:P₂O₅:K₂O g/tree/year) to adult trees of sapota cv. Kalipatti in three splits as per given table below instead of two equal split *i.e.* during June and October enhance fruit yield **(2013)**.

Install. No.	Month	N : P ₂ O ₅ : K ₂ O (g/tree/year)	Urea (g/tree)	SSP (g/tree)	Murate of Potash (g/tree)
I	June	250 : 500 : 125	550	3000	200
II	August	500 : 0 : 250	1100	0	400
III	October	250 : 0 : 125	550	0	200
Apply FYM @ 100 kg/tree in June.					

7. Sapota cv. Kalipatti orchards of more than 30 years old are recommended to prune 1.0 m upper terminal growth once during December for sustaining yield and net returns **(2018)**.
8. Application of 100% recommended dose of fertilizer (1000 : 500 : 500 g N : P₂O₅ : K₂O/ tree/ year) to adult trees of sapota cv. Kalipatti in three split doses as per given table below instead of two equal splits *i.e.* in June and October gives higher fruit yield with higher net realization in winter season in comparison to summer season **(Project on Research on Fruits- 2018)**.

Install. No.	Month	N : P ₂ O ₅ : K ₂ O (g/tree/year)	Urea (g/tree)	SSP (g/tree)	Murate of Potash (g/tree)
I	June	250 : 125 : 125	550	780	200
II	October	250 : 125 : 125	550	780	200
III	February	500 : 250 : 250	1100	1500	400
Apply FYM @ 100 kg/tree in June.					

9. Application of FYM 75 kg and 750:375:375 g/tree N:P₂O₅:K₂O in June and October month (Two equal splits), Bio-fertilizers - *Azospirillum* + PSB @ 40 ml/tree application in July, 50 ppm GA₃ spray in November and 0.5% Grade 4 micronutrients spray in December in sapota cv. Kalipatti orchards gave higher yield and income **(2020)**.
10. Apply 80% recommended dose of chemical fertilizers (800:400:400 g N:P₂O₅:K₂O/tree/year) in four splits with bio-fertilizers, GA₃ and Grade-4 micronutrients spray as per given below over 2/3 splits for enhancing fruit yield and net income in winter season in mature trees of sapota cv. Kalipatti **(2021)**.

Install. No.	Month	Growth stages	N:P ₂ O ₅ :K ₂ O (%)	N:P ₂ O ₅ :K ₂ O (g/tree/year)	Urea (g/tree)	SSP (g/tree)	Murate of Potash (g/tree)
I	July	Vegetative flush	32:40:20%	320:200:100	700	1250	170
			Soil application of Vermi-compost @ 15 kg/tree, <i>Azotobacter</i> @ 100 ml/tree and Phosphate Solubilizing Bacteria (PSB) @				

			100 ml/tree (10 ⁸ CFU/g)				
II	September	Fruit set	16:00:20%	160:00:100	350	0	170
	October		Spray Grade-4 multi micronutrient (0.5%)				
III	November	Fruit growth	16:40-20%	160:200:100	350	1250	170
IV	February	Fruit growth	16:00:20%	160:00:100	350	0	170

Crop Protection:

In sapota, major insect pests are bud borer, chiku moth, seed borer, midrib folder and fruit fly as well as leaf spot and wilt are major diseases. The various plant protection schedules were tested and recommended for reducing the fruit productivity.

1. Apply three sprays either of monocrotophos 0.05% @ 1.5ml/lit at 15 days interval during peak flowering starting from second fortnight of March for management of bud boring insects (Bud borer, *Anarsia achrasella* and Chiku moth, *Nephopteryx eugraphella*) in sapota **(1998)**.
2. Install 10 methyl eugenol traps (0.056 ml or 4 drops each of methyl eugenol and knock-down contact insecticides to be recharged at weekly interval) per ha at a height of 4 feet placed at equal distance in sapota orchard to trap the male fruit flies **(1998)**.
3. The sapota variety PKM-1 found less susceptible to the brown leaf spot disease and also give higher yield **(2000)**.
4. Sapota cv. Kalipatti planted at wider and closer spacing are as equally infested by brown leaf spot disease **(2000)**.
5. Apply two sprays of either carbendazim 0.1% @ 0.5 g/lit or mancozeb 0.2% @ 2 g/lit water at one month interval after initiation of diseases for effective and economical management of pestalotiopsis leaf spot disease in sapota **(2006)**.
6. Apply two sprays of any one of the following insecticides during peak flowering at 20 days interval for effective management of bud boring insects (Bud borer, *Anarsia achrasella* and Chiku moth, *Nephopteryx eugraphella*) in sapota **(2006)**.
 - Lambda-cyhalothrin 0.005% @ 1 ml/lit.
 - A ready-made mixture of profenophos (40%) + cypermethrin (4%) 44 EC @ 1 ml/lit.
 - A ready-made mixture of chlorpyrifos (50%) + cypermethrin (5%) 55 EC @ 1 ml/lit.
7. Apply sequential three sprays of profenophos 50 EC @ 1.5 ml or novaluron 10 EC @ 0.5 ml/lit water at 20 days interval from October onwards for effective management of seed borer **(2015)**.
8. Sequential four application of deltamethrin 2.8 EC @ 1 ml/lit water and *Bt* powder (*Bacillus thuringiensis* var. *Kurstaki* - 1 x 10⁸ CFU/g) @ 1 g/lit water at 15 days interval at marble stage of fruit (October onwards) minimizes fruit damage of seed borer (*Trymalitis margarias* Meyrick) in sapota **(2021)**.
9. Kalipatti, Kirthibarthi, DHS-2, Cricket ball and CO-2 were found more susceptible to sapota seed borer, *Trymalitis margarias* Meyrick; while CO-1, CO-3, PKM-3 and PKM-4 were showed less susceptible to seed borer. The fruit infestation was found higher from December to February **(2022)**.
10. The sapota varieties/hybrids viz., Kalipatti, CO-2, Kirthibharti, CO-1 and DHS-1 were found more susceptible, while Chala Collection-3, PKM-1, Chala Collection-1, Pilipatti and Chala Collection-2 found less susceptible to bud borer (*Anarsia achrasella*). The bud infestation was found maximum during April to June at peak flowering phase. The sapota varieties/hybrids viz., Paria Collection, Kirthibharti, CO-2 and CO-1 were found more susceptible, while Chala Collection-2, Chala Collection-3, PKM-1, Mohangootee and Chala Collection-1 found less susceptible to chiku moth (*Nephopteryx eugraphella*). May and December are the critical

months of infestation. Escape type resistance was found in less infested sapota varieties due to late flowering initiation in both pests **(NAU- 2024)**.

11. The following varieties/hybrids were found resistant or susceptible to the major pests of sapota in critical month of infestation with morphological and biochemical contents under high-density plantation (5 × 5 m) **(NAU- 2024)**.

Insect pest name	Resistant	Susceptible	Month of peak infestation	Factor responsible for resistant /susceptibility	
				Morphology	Biochemical/ nutritional
Bud borer, <i>Anarsia achrasella</i> Bradley	PKM-1, CO-3	Kalipatti	May-June	Low bud diameter	High Carbohydrate in bud
Chiku moth, <i>Nephopteryx eugraphella</i> (Ragonot)	PKM-1, CO-3	Kalipatti	May-June and December-January	Low bud diameter	High Carbohydrate and Non-Reducing Sugar in bud
Seed borer, <i>Trymalitis margarias</i> Meyrick	PKM-1, CO-3	Kalipatti and DHS-2	February-March	Low seed length	--
Fruit fly, <i>Bactrocera</i> spp.	CO-3	DHS-1	May-June	--	Low TSS
Midrib folder, <i>Banisia myrsusales eleoralis</i> (Walker)	PKM-1 and Cricket ball	Kalipatti and DHS-1	May and December	--	High Potassium (K ₂ O) in leaf

PAPAYA

Crop Improvement:

Following the start of papaya research at Gandevi station in 2010, multi-location trials have been conducted on coded and selected varieties in comparison to Taiwan red lady. These trials will be recommended for commercial use in the future.

Crop Production:

In papaya, one major recommendation for cultivation of papaya was released for farmers' is as follows.

1. Cultivate gynodiocious varieties of papaya under insect proof net house (40 mesh) for getting good quality fruits, higher yield and net return with negligible incidence of papaya ring spot virus (PRSV) disease **(2022)**.
2. Apply 10 kg FYM at the time of planting and 75% RDF (150:150:187.5 N:P₂O₅:K₂O g/plant) in four equal splits at 2nd, 4th, 6th and 8th month after planting and Arka Microbial Consortium (11 g/plant) along with 1 kg FYM in two equal splits (at the time of planting and 6 month after planting) in papaya to increase the yield and net return as well as enhance the nutrient status of soil in papaya **(2026)**.

Crop Protection:

In major papaya growing belts, various fungal and viral diseases are the key constraint to the long-term viability and productivity of the crop and few technologies for minimizing losses caused by various diseases in papaya were recommended as enlisted below.

1. The farmers growing papaya are advised to raise the papaya seedlings under Nylon net (40-60 mesh) and spraying of acephate 75 SP 1.5 g/lit of water at 3 days before planting as well as use of two rows of border crop of maize sown 15 days before planting. Apply 1% Neem oil @ 2 ml/lit with acephate 75 SP 1.5 g/lit of water (0.11%; 675 g a.i./ha) at 15 days interval up to 5 month for effective management of papaya ring spot virus (PRSV) disease **(2014)**.
2. The higher papaya fruits yield and marketable fruits along with minimum infestation of diseases can be obtained in Module I comprising sequential application of different fungicide and micronutrients over Module II comprising standard package of practices and Module III (control) **(2020)**.

Module I:

Seed treatment with captan @ 5 g per 100 g seed, seedling raising under Nylon net (40-60 mesh) and spraying of acephate 75 SP @ 1.5 g/lit 3 days before transplanting in main field. Growing of two rows of maize and castor/sesbania as border crop 15 days before papaya planting. Follow need based sequential application as given under.

↓ After 10 days

Drench with Dimethomorph 50 WP @ 0.4 g + Mancozeb 75 WP @ 2g /lit

↓ After 15 days

Neem Oil 2% Foliar application + 0.5 ml/lit sticker at 30 days interval till flowering

↓ After 15 days

Foliar application of Urea @ 10 g + Zinc Sulphate @ 15 g + Boron @ 10g/lit

↓ After 7 days

Application of Hexaconazole 5 EC @ 2 ml + Zineb 75 WP @ 2 g + 0.5 ml sticker/lit

↓ After 7 days

Neem oil 2% foliar application + 0.5 ml sticker/lit

↓ After 7 days

Application of Hexaconazole 5 EC @ 2 ml + Zineb 75 WP @ 2 g + 0.5 ml sticker/lit

↓ After 7 days

Foliar application of Urea @ 10 g + Zinc Sulphate @ 15 g + Boron @ 10 g/lit

↓ After 15 days

Neem oil 2% foliar application + 0.5 ml sticker/lit

↓ After 15 days

Foliar application of Urea @ 10 g + Zinc Sulphate @ 15 g + Boron @ 10 g/lit

↓ After 15 days

Difenconazole 25 EC @ 0.5 ml + 0.5 ml sticker/lit

MANGO

Crop Improvement:

1. Nursery owners of South Gujarat preparing mango grafts are recommended to use 4-month-old rootstock for saddle approach grafting in the month of October for getting higher survival of grafts with net return
