

# HORTICULTURE

# A. Banana

- 1. Application of 200 g N/plant and 200 g K<sub>2</sub>O/plant in three equal splits at 90, 120 and 150 days after planting (DAP) in banana cv. Basrai for enhancement of productivity and income. A basal dose of 5 kg FYM and 90 g P<sub>2</sub>O<sub>5</sub>/plant apply in pits during planting **(1992)**.
- 2. 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)**.
- Application of 25% N (*i.e.* 50 g N/plant) along with 5 kg FYM and 90 g P<sub>2</sub>O<sub>5</sub> in pit during planting and remaining 75% N (*i.e.* 150 g N/plant) and 200 g K<sub>2</sub>O/plant in three equal splits at 90, 120 and 150 days after planting in banana cv. Basrai for higher fruit yield and net profit (1997).
- 4. Keep weed free field of banana for entire period or for first nine months of planting for improvement of productivity **(1997)**.
- 5. 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)**.
- 6. 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)**.
- 7. 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).
- 8. Apply nitrogen (150 g N/plant) through drip in the form of urea at 90, 120 and 150 days after planting in banana cv. Basrai as well as apply total phosphorus (67.5 g  $P_2O_5$ /plant) at planting time, while potassium (150 g K<sub>2</sub>O/plant) in three equal splits at 90, 120 and 150 days after planting as soil application for obtaining maximum fruit yield **(2002)**.
- 9. Growing of banana cv. Gandevi Selection advised for higher yield and net profit over other varieties (2003).
- 10. 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)**.
- 11. Apply each 150 g nitrogen and potassium in form of Urea and Murate of Potash through drip in six equal splits at 15 days interval after 3 month of planting in banana cv. Basrai under high density plantation with paired row planting method along with phosphorous @ 90 g/plant in pit at the time of planting saves quantity of water and nutrients with sustainable yield **(2004)**.
- 12. 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)**.
- 13. 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)**.
- 14. 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)**.

- 15. 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)**.
- 16. 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	P EF	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	Мау	180-190
Last hand opening to one month before harvesting	0 .8	June	235-245 (Except rainy days)

17. 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)**.

<u>System details</u>			
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 <sup>2</sup>		
Operating time	120-130 minutes during winter and 170-180 minutes during summer		
Operating frequency	ting Alternate day		

Application of 80% recommended dose of nitrogen (240 g N/plant) and potash (160 g K<sub>2</sub>O/plant) in banana cv. Grand Naine in 4 installments exhibit higher yield and net profit over 2 or 3 installments (2013).

Ins tall.	Mo	Growth stages	N and K2O g/plant	
No.	nui		N	K <sub>2</sub> 0
1.	3 <sup>rd</sup>	Vegetative stage	96	40
2.	5 <sup>th</sup>	Flower bud initiation stage	72	56
3.	$7^{th}$	Flowering stage	72	40
4.	Qth	Bunch development after	0	24
		planting		
Apply FYM 10 kg/plant and total dose of P <sub>2</sub> O <sub>5</sub> @ 90g/plant at planting				

- 19. 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).
- 20. Planting of three (3) suckers/hill (in triangle fashion at 30 cm) at 2 x 3 m (7 x 10 feet) spacing and application of 75% recommended dose of fertilizers (225:67.5:150 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/plant)

in banana cv. Grand Naine exhibit higher yield with net return. Apply 10 kg FYM and 67.50 g  $P_2O_5$ /plant at planting, while 225 g N and 150 g K<sub>2</sub>O/plant applied in three equal splits at 90, 120 and 150 days after planting **(2015)**.

21. Use drip irrigation system in banana cv. Grand Naine and apply 75% recommended dose of N (225 g/plant) and K<sub>2</sub>O fertilizers (150 g/plant) at 15 days interval during the various growth stage as under for getting higher yield and net profit. The technology saves 25% N and K<sub>2</sub>O and 22% irrigation water **(2015)**.

S r.	Growth stages	N and K <sub>2</sub> O g/plant		No. of
No.		N	K <sub>2</sub> O	split
1	During 3 and 4 month	67.5	30	
2	During 5 and 6 month	112.5	60	4
3	During 7 month to flowering	45	48	2
4	Post shooting	00	12	1

Apply 10 kg FYM and 90 g  $P_2O_5$  in pit at planting time. 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.

- 22. Use drip irrigation in banana cv. Grand Naine to apply 250:90:250 g N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/plant and one spray of 10 ppm 2,4-D five days after complete opening of bunch for getting higher yield with standard size of fruits for export quality. Apply 10 kg FYM and 90 g P<sub>2</sub>O<sub>5</sub> at planting time, while N and K<sub>2</sub>O should be applied each @ 250 g/plant in three equal splits at 90, 120 and 150 days after planting **(2015)**.
- 23. For growing banana cv. Grand Naine under organic farming, apply 10 kg FYM and 1.25 kg Neem cake at planting, bio-fertilizers @ 50 ml each *Azospirillum* and PSB and 50 g *Trichoderma harzianum* and 25 g Arbuscular Mycorrhiza at one month after planting, 5 kg vermi-compost after three month of planting and 1.75 kg wood ash after five month of planting per plant **(2016)**.
- 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.

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- Use black plastic mulch (100 micron thickness).
- Use 2% Banana Shakti micro nutrient foliar spray at 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> 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, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O as per STCR ready reckoner. N and K<sub>2</sub>O applied in three equal split through fertigation at 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> month after planting, whereas P<sub>2</sub>O<sub>5</sub> as soil application one month after planting.
- 26. Cultivation of banana through macro-propagated plants exhibit early maturity, higher production and net return as compared to sucker plant **(2021)**.
- 27. Cultivation of gynodioecious varieties of papaya under insect proof net house (40 mesh) for higher yield, net return and good quality fruits. Further, incidence of papaya ring spot virus (PRSV) can be prevented **(2022)**.
- 28. 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).

### B. Sapota

- 1. 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)**.
- 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)**.
- 3. 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)**.
- 4. Apply 100% recommended dose of fertilizers @ 1000:500:500 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/tree/year to adult trees in three splits *i.e.* 250:500:125 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/tree in June, 500:00:250 g N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/ tree in August and 250:00:125 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/tree during October instead of two equal split *i.e.* during June and October gives higher yield fruits sapota cv. Kalipatti. Apply FYM @ 100 kg/tree in June **(2013)**.
- 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 4<sup>th</sup> 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 physico-chemical properties (**2013**).
- Apply 100% recommended dose of fertilizer @ 1000 : 500 : 500 g N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O / tree / year in three split doses *i.e.* 25% (250:125:125 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/tree) in June along with FYM @ 100 kg/tree/year, remaining 25% (250:125: 125 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/tree) in October and 50% (500:250:250 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O g/tree) in February instead of two equal splits *i.e.* in June and October in sapota cv. Kalipatti. The technology gives higher fruit yield with higher net

realization in winter season in comparison to summer season (Project on Research on Fruits- 2018).

- 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. Apply FYM 75 kg in June month and 750:375:375 g N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/tree in June and October month (in two equal splits), Bio-fertilizers- Azospirillum + PSB each @ 40 ml/tree in July, 50 ppm GA<sub>3</sub> spray in November and 0.5% Grade-4 micronutrients spray in December month for getting higher yield and income **(Project on Research on Fruits- 2020)**.
- 9. Apply 80% recommended dose of chemical fertilizers (800:400:400 g N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/tree) in four splits July, September, November and February month {as per given below table} and 15 kg vermicompost along with Azotobacter 100 ml and PSB 100 ml per tree (10<sup>8</sup> CFU/g) per tree in July and Grade-4 multi micronutrient (0.5%) spray in October month for enhancing fruit yield and net income in winter season in mature trees of sapota cv. Kalipatti over 2 splits (2021).

80%	recommended	dose of chemica	al fertilizer	
Time and stage of application	I Vegetative flush (July)	II Fruit set (September)	III Fruit growth (November)	IV Fruit growth (February)
N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O (%)	32:40:20%	16:00:20%	16:40-20%	16:00:20%
N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O g/tree	320:200:100	160:00:100	160:200:100	160:00:100
Urea (g/tree)	700	350	350	350
SSP (g/tree)	1250	0	1250	0
Murate of Potash (g/tree)	170	170	170	170

### C. Papaya

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)**.

### ENTOMOLOGY

# A. Banana

1. 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<sup>o</sup> angle when bud at upright position) **(2015)**.

# B. Sapota

- 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. 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)**.
  - Lamda-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 chlorpyriphos (50%) + cypermethrin (5%) 55 EC @ 1 ml/lit.
- 4. 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).
- 5. Sequential four application of deltamethrin 2.8 EC @ 1 ml/lit water and *Bt* powder (*Bacillus thuringiensis* var. *kurstaki* 1 x 10<sup>8</sup> CFU/gm) @ 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).
- 6. 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)**.

#### **PLANT PATHOLOGY**

### A. Banana

- 1. Apply four sequential sprays of either carbendazim @ 1.0 g/lit or propiconazole @ 1.0 mi/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)**.

### B. Papaya

- 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/l it ↓ After 15 days Neem oil 2% foliar application + 0.5 ml sticker/lit ↓ After15 days Foliar application of Urea @ 10 g + Zinc Sulphate @ 15 g + Boron @ 10 g/lit ↓ After15 days Foliar application of Urea @ 10 g + Zinc Sulphate @ 15 g + Boron @ 10 g/lit ↓ After15 days Difenconazole 25 EC @ 0.5 ml + 0.5 ml sticker/lit

#### C. Sapota

- 1. The sapota variety PKM-1 is found less susceptible to the brown leaf spot disease and also give higher yield **(2000)**.
- 2. Sapota cv. Kalipatti planted at wider and closer spacing are as equally infested by brown leaf spot disease **(2000)**.
- 3. 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).

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