CONTINGENCY PLANS FOR RABI AND SUMMER CROPS
District: Bhavnagar   Gujarat State

1.   **Rainfall Information(Average of 10 year-2007 to 2016)**

		Oct – Dec	Jan – Mar
(a)	Normal rainfall during *Rabi* season	18.53 mm	-
(b)	Number of rainy days	1.40	-

2.   **Rabi crops cultivated**

2a Area Production statistics(Field Crops: 2009-10 to 2013-14; Horti. Crops: 2015-16)

S. No	Cropping System	Crop name	Area ('000 ha)	Production ('000 t)	Productivity (Kg/ha)
1	Groundnut based	Wheat	9.74	28.41	2917.20
		Sorghum	11.06	-	-
		Chickpea	0.80	0.99	1144.10
		Groundnut (summer)	10.90	21.54	1809.39
		Pearl Millet (summer)	2.43	6.03	2482.76
		Onion	35.50	926.55	26100
		Brinjal	1.90	39.24	20710
		Cucurbits	1.50	21.60	14400
		Tomato	1.30	29.79	23000
2	Pearl Millet based	Wheat	4.18	12.19	2917.20
		Sorghum	4.74	-	-
		Chickpea	0.34	0.43	1144.10
		Groundnut (summer)	4.67	9.23	1809.39
		Pearl Millet (summer)	1.04	2.59	2482.76

3	Plantation crops	Coconut	3.59	354010 ('000 Nuts)	9880 (Nuts)
4	Horticulture - Fruit crops	Citrus	7.00	91.28	13050
		Mango	6.40	51.21	8000
		Guava	4.00	47.60	11900
		Sapota	2.36	25.02	10600
		Banana	2.07	99.88	48250

(Source: Reports of Bhavnagar District Panchayat, Department of Agriculture (2011-12 to 2015-16) and Horticulture (2015-16), Government of Gujarat)

2b Source wise (Water) cultivated area

S. No	Crop name	Cultivated area under ('000 ha)			
		Residual moisture condition/rainfed	Ground water irrigated	Tank irrigated	Canal irrigated
Field crops					
1	Wheat	-	8.42	-	5.50
2	Chickpea	-	1.14	-	-
3	Groundnut (summer)	-	15.57	-	-
4	Pearl Millet (summer)	-	3.47	-	-
5	Sorghum	-	8.80	-	7.00
Plantation crops					
Coconut		-	3.59	-	-
Horticulture - Fruit crops					
1	Citrus	-	7.00	-	-
2	Mango	-	6.40	-	-
3	Guava	-	4.00	-	-
4	Sapota	-	2.36	-	-
5	Banana	-	2.07	-	-
Horticulture - Vegetable crops					
1	Onion	-	21.48	6.02	8.00
2	Brinjal	-	1.90	-	-
3	Cucurbits	-	1.50	-	-
4	Tomato	-	1.30	-	-

(Source: Data source: Census of India, 2011)

3. Sowing window information

S. No.	Soil type	Cropping system	Crop name	Optimum sowing window (Please mention along with week *i.e.*, 2nd week of October – 4th week of November /*etc.*)
1	Medium to shallow black	Groundnut based	Wheat	2ndweek of November to 4th week of November
			Onion	2nd week of November to 4thweek of November
			Brinjal	August /September 2nd week to October 1st week
			Cucurbits	2nd week of September to 2nd week of October
			Tomato	2nd week of September to 2nd week of October
			Chickpea	2nd week of October to 2nd week of November
			Pearl Millet (summer)	3rd week of January to 2nd week of February
			Groundnut (summer)	3rd week of January to 2nd week of February
			Sorghum	2nd week of September to 2nd week of October
		Pearl Millet based	Wheat	2nd week of November to 4th week of November
			Onion	2nd week of November to 4th week of November
			Brinjal	August /September 2nd week to October 1st week
			Cucurbits	2nd week of September to 2nd week of October
			Tomato	2nd week of September to 2nd week of October
			Chickpea	2nd week of October to 2ndweek of November
			Pearl Millet (summer)	3rd week of January to 2nd week of February
			Groundnut (summer)	3rd week of January to 2nd week of February
			Sorghum	2nd week of September to 2nd week of October
2	Coastal alluvial	Groundnut based	Wheat	2nd week of November to 4th week of November
			Chickpea	2nd week of October to 2nd week of November
			Brinjal	August / September 2nd week to October 1st week
			Cucurbits	2nd week of September to 2nd week of October
			Tomato	2nd week of September to 2nd week of October
			Pearl Millet (summer)	3rd week of January to 2nd week of February
			Groundnut (summer)	3rd week of January to 2nd week of February
			Sorghum	2nd week of September to 2nd week of October

Pearl Millet based	Wheat	2nd week of November to 4th week of November
	Brinjal	August / September 2nd week to October 1st week
	Cucurbits	2nd week of September to 2nd week of October
	Tomato	2nd week of September to 2nd week of October
	Chickpea	2nd week of October to 2nd week of November
	Pearl Millet (summer)	3rd week of January to 2nd week of February
	Groundnut (summer)	3rd week of January to 2nd week of February
	Sorghum	2nd week of September to 2nd week of October

4.Contingency measures Field crops
4.1.For crops grown with residual moisture i.e., under rainfed condition
(a) Excess residual moisture

S.No.	Soil type	Cropping system	Crop name	Sowing Window	Variety	Management practices
1	Medium to shallow black	NA	-	-	-	-
2	Coastal alluvial	NA	-	-	-	-

(b) Less than optimum moisture i.e., 25% less than normal, which can happen due to insufficient rainfall during September/October months. Deficit of 20-40% rainfall

S.No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
1	Medium to shallow black	NA	-	-	-	-
2	Coastal alluvial	NA	-	-	-	-

(c)Severe limitation in moisture. Deficit of rainfall during September/October months by more than 40%.

S.N.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
1	Medium to shallow black	NA	-	-	-	-
2	Coastal alluvial	NA	-	-	-	-

4.2. For crops grown with groundwater

(a) Above normal rainfall in *Kharif* coupled with good distribution

S.No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
1	Medium to shallow black	Groundnut based	Wheat	2nd week of November to 4th week of November	GW-451, GJW-463, GW-496, GW-366 Lok-1	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.
			Groundnut (summer)	3rd week of January to 2nd week of February	GG 2,6, TG- 37- A, TPG 41, TG 26	• Adopt recommended package of practices.
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3, 5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).
		Pearl Millet based	Wheat	2nd week of November to 4th week of November	GW 496, GW 366, GW 463,	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.
			Groundnut (summer)	3rd week of January to 2nd week of February	GG 2,6, TG- 37- A, TPG 41, TG 26	• Adopt recommended package of practices.
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.

S.No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3,5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).
2	Coastal alluvial	Groundnut based	Wheat	2nd week of November to 4th week of November	GW-451, GJW-463, GW-496, GW-366 Lok-1	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.
			Groundnut (summer)	3rd week of January to 2nd week of February	GG 2,6, TG- 37- A, TPG 41, TG 26	• Adopt recommended package of practices.
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8%EC (5 ml /10 lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3,5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).

S.No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
		Pearl Millet based	Wheat	2nd week of November to 4th week of November	GW-451, GJW-463, GW-496, GW-366 Lok-1	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.
			Groundnut (Summer)	3rd week of January to 2nd week of February	GG 2,6, TG- 37- A, TPG 41, TG 26	• Adopt recommended package of practices.
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3,5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).

(b) Normal rainfall

S. No.	Soil type	Cropping system	Crop name	Sowing window	Variety	Management practices
1	Medium to shallow black	Groundnut based	Wheat	2nd week of November to 4th week of November	GW 496, GW 366, GW 463	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.
			Groundnut (Summer)	3rd week of January to 2nd week of February	GG 2,6, TG- 37- A, TPG-41, TG 26	• Adopt recommended package of practices

S. No.	Soil type	Cropping system	Crop name	Sowing window	Variety	Management practices
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1,GG-2, GJG-3, 5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).
		Pearl Millet based	Wheat	2nd week of November to 4th week of November	GW 496, GW 366, GW 463	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.
			Groundnut (Summer)	3rd week of January to 2nd week of February	GG 2,6,TG 37-A, TPG 41, TG 26	• Adopt recommended package of practices
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3, 5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).
2	Coastal alluvial	Groundnut based	Wheat	2nd week of November to 4th week of November	GW 496, GW 366, GW 463	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/10litre water) for better quality of grain.

S. No.	Soil type	Cropping system	Crop name	Sowing window	Variety	Management practices
			Groundnut (Summer)	3rd week of January to 2nd week of February	GG 2,6, TG-37 A, TPG 41, TG 26	• Adopt recommended package of practices
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538 GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3, 5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).
		Pearl Millet based	Wheat	2nd week of November to 4th week of November	GW 496, GW 366, GW 463	• Adopt recommended agronomic and irrigation practices. • Immediate after last irrigation spray 2 % urea and mancozeb 75 % WP (27 g/ 10litre water) for better quality of grain.
			Groundnut (Summer)	3rd week of January to 2nd week of February	GG 2,6,TG-37-A, TPG 41, TG 26	• Adopt recommended package of practices
			Pearl Millet (summer)	3rd week of January to 2nd week of February	GHB 538, GHB 558	• Adopt recommended package of practices.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended agronomic practices • Spray imidacloprid 17.8 % EC (5 ml /10lit. water) to prevent shoot fly damage
			Chickpea	2nd week of October to 2nd week of November	GG-1, GG-2, GJG-3, 5	• Adopt recommended agronomic practices • Monitor the crop for heliothis and prodenia infestation, if infestation observed above ETL spray spinosad 45 % SC (3 ml/10 lit. water).

(c) Deficient rainfall in *Kharif* season (25-50% deficient)

S. No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
1	Medium to shallow black	Groundnut based	Wheat	2nd week of November to 3rd week of November	GW 496, GW 366, GW 463	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation system and irrigate at critical stages only • Give irrigation during night time to reduce transpiration
			Groundnut (Summer)	-	-	• Avoid summer crop sowing
			Pearl Millet (summer)	-	-	• Avoid summer crop sowing
			Sorghum	2nd week of November to 3rd week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only.
			Chickpea	2nd week of October to 4th week of November	GG-1, GG-2, GJG-3,5	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only. • Give irrigation during night time to reduce transpiration
		Pearl Millet based	Wheat	2nd week of November to 3rd week of November	GW 496, GW 366, GW 463	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation system and irrigate at critical stages only • Give irrigation during night time to reduce transpiration
			Groundnut (Summer)	-	-	• Avoid summer crop sowing

S. No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
			Pearl Millet (summer)	-	-	• Avoid summer crop sowing
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only.
			Chickpea	2nd week of October to 4th week of November	GG-1, GG-2, GJG-3,5	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only. • Give irrigation during night time to reduce transpiration
2	Coastal alluvial	Groundnut based	Wheat	2nd week of November to 3rd week of November	GW 496, GW 366, GW 463	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation system and irrigate at critical stages only • Give irrigation during night time to reduce transpiration
			Groundnut (Summer)	-	-	• Avoid summer crop sowing
			Pearl Millet (summer)	-	-	• Avoid summer crop sowing
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only.
			Chickpea	2nd week of October to 4th week of November	GG-1, GG-2, GJG-3,5	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation

S. No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
						• Irrigate at critical stages only. • Give irrigation during night time to reduce transpiration
		Pearl Millet based	Wheat	2nd week of November to 3rd week of November	GW 496, GW 366, GW 463	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation system and irrigate at critical stages only • Give irrigation during night time to reduce transpiration
			Groundnut (Summer)	-	-	• Avoid summer crop sowing
			Pearl Millet (summer)	-	-	• Avoid summer crop sowing
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only.
			Chickpea	2nd week of October to 4th week of November	GG-1, GG-2, GJG-3,5	• Adopt management practices as given in point 4.4(a) plus following practices • Use organic manure • Use MIS irrigation • Irrigate at critical stages only. • Give irrigation during night time to reduce transpiration

(d) Scanty rainfall in *Kharif* season

S. No.	Soil type	Cropping system	Crop name	Sowing time	Variety	Management practices
1	Medium to shallow black	Groundnut based	Wheat	2nd week of November to 4th week of November	-	• Avoid wheat sowing, grow fodder crops, Recharge wells as pre planning.

			Chick Pea	2nd week of October to 2nd week of November	GG-1, GJG-3, GG-5	• Adoption of MIS. • Irrigation at critical stages. • Recharge wells as pre planning.
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Life saving irrigation
2	Coastal alluvial	Groundnut based	Wheat	2nd week of November to 4th week of November	-	• Avoid wheat sowing, grow fodder crops, Recharge wells as pre planning.

- Management practices to be followed for different crops during the crop growing season.
- To include number of irrigations, reducing the evaporation losses, planting density, *etc.*
- Management practices for heat waves in northern region particularly for wheat crop
- Management practices for cold waves, hail storms

Management practices for unseasonal rains

Condition	Management practices to be adopted			
Continuous high rainfall in a short span leading to water logging	Vegetative stage	Flowering stage	Crop maturity stage	Post-harvest
Wheat	-	-	• Surface drainage (for management of water logging, lodging crop • To control black point in grain, spray mancozeb0.2%(27 g/10 litre water).	• Protect product with plastic sheet (100 micron UV stabilized colour plastic) or shift produces to farm shed • Protection against pest/disease damage in storage etc., • Preparation for quick drying technique • Separate good and bad lot.
Groundnut (summer)	-	-	• Immediately harvest bunch groundnut. • Quick surface drainage, open channel around field.	• Protect product with plastic sheet (100 micron UV stabilized colour plastic) or shift produces to farm shed • Protection against pest/disease damage in storage etc., • Preparation for quick drying technique • Separate good and bad lot.

Pearl Millet	-	-	• Immediately harvest the crop • Surface drainage (for management of water logging)	• Protect product with plastic sheet (100 micron UV stabilized colour plastic) or shift produces to farm shed • Protection against pest/disease damage in storage etc., • Preparation for quick drying technique • Separate good and bad lot.
Pulses	-	-	• Provide drainage, harvest immediately after drying	• Protect product with plastic sheet (100 micron UV stabilized colour plastic) or shift produces to farm shed • Protection against pest/disease damage in storage *etc.,* • Preparation for quick drying technique • Separate good and bad lot.
Sorghum	-	-	• Provide drainage • Harvest immediately after drying	• Protect product with plastic sheet (100 µ UV stabilized colour plastic) or shift produces to farm shed. • Protection against pest/disease damage in storage etc. • Preparation for quick drying technique • Separate good and bad lot.
Vegetables	Surface drainage (for management of water logging condition)	Surface drainage (for management of water logging condition)	• Surface drainage (for management of water logging crop and to control cumin blight) • Spray mancozeb 0.2% and 0.2%(30 g/10 litre water)wettable sulphur for protection against powdery mildew disease	• Protection against pest/disease damage in storage *etc.*, • Preparation for quick drying technique • Grading, sorting

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For crops grown with Canal Irrigation: The scenario would be based on the storage available in the reservoirs.
a. Limited release of water

S. No.	Soil type	Cropping system	Crop name	Sowing window	Variety	Management practices
1	Medium to shallow black	Groundnut based	Wheat	2nd week of November to 4th week of November	GW-496, GW-366 Lok-1	• Irrigation at critical stages • Conjunctive use of canal and groundwater • Or groundwater should be utilized during later stages.
			Chick Pea	2nd week of October to 2nd week of November	GG-1, GJG-3, GG-5	• Irrigation at critical stages
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Supplemental irrigation if possible. Harvest non flowering plants for fodder purpose if water is not available
2	Coastal alluvial	Pearl Millet based	Wheat	2nd week of November to 4th week of November	GW-496, GW-366, Lok-1	• Irrigation at critical stages
			Sorghum	2nd week of November to 4th week of November	Gundhari, GFS-3, GAFS-11, CSV-21F	• Supplemental irrigation if possible. Harvest non flowering plants for fodder purpose if water is not available

b. Delayed release of water

S. No.	Soil type	Cropping system	Crop name	Sowing window	Variety	Management practices
1	Medium to shallow black	NA	Chick Pea	2nd week of October to 2nd week of November	GG-3, GJG-3	• Irrigation at critical stages
2	Coastal alluvial	NA	Pulses	2nd week of October to 2nd week of November	GG-3, GJG-3	• Irrigation at critical stages

Recommendation for head reach, middle and tail and points are to be given.
b. Delayed release of water:
For head reach:
Water Distribution management:
- Repair and maintenance of field channel.
- Cleaning and lining of distributaries and main canal.

Water utilization management:
- Delay sowing up to 4th week of November for prevailing cropping patterns
- There after adopt late sowing varieties like GW173 of wheat.
- Adopt short duration crop varieties.
- Change crop according to time of water availability.
- Conjunctive use of groundwater/harvested water and canal water
- Use MIS on community base according to crops.

For middle reach:
Water Distribution management:
- Repair and maintenance of field channel.
- Cleaning and lining of distributaries and main canal.

Water utilization management:
- Delay sowing up to 4th week of November for prevailing cropping patterns.
- Use groundwater/ harvested water for sowing and continue using till canal water reaches.
- There after adopt late sowing varieties like GW173 of wheat.
- Adopt short duration crop varieties.
- Change crop according to time of water availability.
- Conjunctive use of groundwater/harvested water and canal water
- Use MIS on community base according to crops.

For tail reach:
Water Distribution management:
- Repair and maintenance of field channel.
- Cleaning and lining of distributaries and main canal.

Water utilization management:
- Delay sowing up to 4th week of November for prevailing cropping patterns.
- Use groundwater/ harvested water for sowing of cropand continue using till canal water released.
- There after adopt late sowing varieties like GW-173 of wheat.
- Adopt short duration crop varieties.
- Change crop according to time of water availability.
- Adopt crops with stress resistant and less water requirement like cumin, semi-rabi pearl millet, fodder sorghum and chickpea
- Irrigate up to flowering stage only or critical stage irrigation approach may be adopted.
- Use alternate furrow irrigation where ever possible.
- Conjunctive use of groundwater/harvested water and canal water
- Use MIS on community base according to crops.

5. Contingency measures for Horticulture Crops (Existing / New plantations)

S. No	Crop Name	Specific management practices to be taken up following excess/deficient/scanty rainfall	Time of intervention	Remarks
		Existing plantations		
1	Mango	**Excess rainfall**		
		• Provide surface drainage • Add gypsum 1-2 kg per plant	June to September	
		• Spray 0.2% (30 g/10 litre water) wettable sulphur or 0.005 % (10 ml/10 litre water) hexaconazole for protection against powdery mildew	November to January	
		Deficient/scanty rainfall		
		• Use of MIS • Use mulching • Use subsurface drip irrigation if possible • Apply of Murram in soil	December to May October to May	• Apply irrigation through MIS with mulch or subsurface MIS in case of last monsoon below normal
2	Coconut	**Excess rainfall**		
		Provide drainage		
		Deficient/scanty rainfall		
		• Use of MIS • Use mulching • Use subsurface drip irrigation if possible • Apply of Murram in soil	December to May October to May	
3	Sapota	**Excess rainfall**		
		• Provide surface drainage • Add gypsum @ 1-2 kg/ plant	June to September	
		Deficient/scanty rainfall		
		• Use of MIS • Use mulching • Use subsurface drip irrigation if possible • Apply of Murram in soil	December to May October to May	
4	Guava	**Excess rainfall**		
		• Provide surface drainage • Add gypsum @ 1-2 kg/ plant	June to September	

		Deficient/scanty rainfall		
		• Use of MIS • Use mulching • Use subsurface drip irrigation if possible • Apply of Murram in soil	December to May October to May	
5	Pomegranate	**Excess rainfall**		
		• Provide surface drainage	June to September	
		Deficient/scanty rainfall		
		• Use of MIS • Use mulching • Use subsurface drip irrigation if possible • Apply of Murram in soil	December to May October to May	
6	Banana	**Excess rainfall**		
		• Provide drainage/ Staking to the bunch	Bunching stage	
		Deficient/scanty rainfall		
		• Use of drip irrigation system	-	
7	Citrus	**Excess rainfall**		
		• Provide surface drainage • Add gypsum @ 1-2 kg/ plant	June to September	
		Deficient/scanty rainfall		
		• Use of drip irrigation system	October to May	
	New plantations			
1	Mango	**Excess rainfall**		
		• Provide proper drainage • Provide staking • Earthing up near stem • Add gypsum @ 1-2 kg/plant • Drenching of carbendazim @ 10 g/10 lit. water • Forking the soil	June to September	
		Deficient/scanty rainfall		
		• Adopt drip irrigation system for planting, mulching	-	Apply irrigation through drip with mulch or subsurface drip irrigation in case of last monsoon below normal

2	Coconut	**Excess rainfall**		
		• Add gypsum 1-2 kg per plant • Drenching of carbendazim @ 1 g/lit. • Forking the soil	-	
		Deficient/scanty rainfall		
		• Use of drip irrigation system • Use mulching • Use subsurface drip irrigation if possible.	-	
3	Sapota	**Excess rainfall**		
		• Provide Surface drainage		
		Deficient/scanty rainfall		
		• Use of drip irrigation system • Use mulching		
4	Guava	**Excess rainfall**		
		• Provide Surface drainage		
		Deficient/scanty rainfall		
		• Use of drip irrigation system • Use mulching		
5	Pomegranate	**Excess rainfall**		
		• Provide proper drainage • Provide staking		
		Deficient/scanty rainfall		
		• Use of drip irrigation system • Use mulching		
6	Banana	**Excess rainfall**		
		• Provide drainage/ Staking to the bunch	Bunching stage	
		Deficient/scanty rainfall		
		• Use of drip irrigation system • Use mulching		

7	Citrus	**Excess rainfall**		
		• Provide drainage • Apply fungicide		
		Deficient/scanty rainfall		
		• Use of drip irrigation system • Use mulching		

6.Contingency measures for Horticulture Crops(vegetables)

S. No.	Crop Name	Specific management practices to be takenup following excess/deficient/scanty rainfall	Time of intervention	Remarks
1	Onion (GWO-1, Junagadh local(Pilipati), Talaja Red, Agrifound light red, GJRO-11, GJWO-3)	**Excess rainfall**		
		• Provide drainage • Delay in sowing	June to September	• Raise nursery on raised bed or broad bed and furrow • Manage soil for good drainage • Soil drenching with fungicides
		Deficient/scanty rainfall		
		• Use micro irrigation with plastic mulch	November to February	• Apply irrigation through MIS • Use plastic mulch • Give irrigation during night time to reduce transpiration • Soil amendments, and/or reduced tillage.
2	Brinjal (JBGR-1, GLB-2, GJB-2,3, GJLB-4, GABH-3, 4)	**Excess rainfall**		
		• Provide drainage • Delay in nursery raising	July to August	• Use surface drainage system • Raise nursery on raised bed or broad bed and furrow
		Deficient/scanty rainfall		
		• Use micro irrigation with plastic mulch and /or place the drip system to subsurface • Alternate furrow irrigation	September to March	• Apply irrigation through drip with mulch • Give irrigation during night time to reduce transpiration • Apply irrigation in alternate furrow with rotation • Soil amendments, and/or reduced tillage.
3	Garlic (GG-4, GJG-5)	**Excess rainfall**		
		• Provide drainage • Delay in sowing	June to September	• Manage soil for good drainage,

		Deficient/scanty rainfall		
		• Use micro irrigation with plastic mulch • Alternate furrow irrigation	November to February	• Apply irrigation through MIS with mulch • Give irrigation during night time to reduce transpiration • Soil amendments, and/or reduced tillage.
4	Tomato (GT-1, 2, Anand Tomato-3, Junagadh Tomato-3, Pusha Rubi and Govt. approved hybrids)	Excess rainfall		
		• Provide drainage	June to September	• Use raised bed or broad bed and furrow system • Manage soil for better drainage
		Deficient/scanty rainfall		
		• Use micro irrigation with plastic mulch	November to February	• Apply irrigation through drip with mulch • Give irrigation during night time to reduce transpiration • Apply irrigation in alternate furrow with rotation • Soil amendments, and/or reduced tillage

7. Temperature related stresses for field and horticulture crops:
Excess temperatures/ Less than normal temperatures

S.No	Crop name	Stage of crop growth	Threshold temperature*	Suggested management practice
1	2	3	4	5
	Excess temperatures			
1	Wheat	Germination	$<25\ ^0C$	• Delay sowing up to optimum temp(20-25 ^0C)
		Anthesis	$>22\ ^0C$	• Light and frequent irrigation
		Milking stage	$>26\ ^0C$	• Light and frequent irrigation
		Grain filling	$>30\ ^0C$ not suitable	• Light and frequent irrigation • Use early sowing variety Lok-1 and prefer early maturing variety GW173 and GW 11 in late sowing to avoid of high temp.
		Dough Stage	$7-18\ ^0C$	• Light and frequent irrigation if temp. greater than 18 ^0C
2	Pearl Millet	Germination	$<18^0C$	• Delay sowing (Second/third wk of Feb.)
		Crop growth	$>33\ ^0C$	• Light and frequent irrigation
3	Groundnut	Germination	$< 17^0C$	If temperature is below than 17^0C • Delay sowing. • Use organic mulch.

				• Delay second irrigation after sowing. • In case of line sowing harrowing to be followed to loose the soil surface.
		Vegetative	>35^{0}C	• Sprinkler and drip irrigation
		Pegging	>30^{0}C	• Sprinkler and drip irrigation
		Pod development	>34 ^{0}C	• Sprinkler and drip irrigation
4.	Onion	Bulb develop.	>32 ^{0}C	• Drip irrigation • Frequent light irrigation
5.	Garlic	Bulb develop.	>25 ^{0}C	• Drip irrigation • Frequent light irrigation
6.	Tomato	Flowering	>32 ^{0}C	• Use of mulch and irrigate the crop with mini/micro sprinkler
		Fruit setting	**>**35 °C	• Use of mulch and irrigate the crop with sprinkler
7.	Brinjal	Whole crop period	>35^{0}C	• Drip irrigation • Use of straw/ silver plastic mulch
8	Chickpea	Germination	>24^{0}C	• Delay sowing to get optimum temp(15-20 ^{0}C)
		Flowering	>30^{0}C	• Give irrigation • External application of ABA* can protect plant against heat stress
		Pod development	>30^{0}C	• Give irrigation • External application of ABA* can protect plant against heat stress
		Seed development	>30^{0}C	• Give irrigation • External application of ABA* can protect plant against heat stress
9	Coconut	Tree growth	>35°C	• Application of lime solution on the trunk up to a height of 2-3 m at the start of the summer season
		Flowering & Fruit setting	<20 ^{0}C & >35°C	• Regular irrigation is recommended during low or high temperature.
10	Mango	Flowering & fruit setting	< 15 ^{0}C Night & > 25 ^{0}C Day during 5 days	• Smudging technique during low temperature at early morning. • Irrigation during low or high temperature. • Mulching during low or high temperature. • Shelter belts/Wind breaks

		Initial fruit development	> 35 ^{0}C with higher day-night fluctuation during week or more.	• Nutrients & Irrigation. • Spray NAA**20 ppm + 2% urea • Mulching • Shelter belts/Wind breaks
		Maturity stage	35-40 ^{0}C during week or more causing sun burning mostly on western side fruits	• Irrigation • Mulching • Sod*** culture • Shelter belts/Wind breaks
11	Acid lime	Pl. growth	<15 ^{0}C & > 40 ^{0}C	• Smudging technique during low temperature at early morning. • White washing of trunk • Shelter to plant by thatching • Frequent light irrigation • Mulching with organic waste. • Shelter belts/wind breaks
		Flowering & fruit setting	> 35 ^{0}C during a week or more	• Frequent light irrigation • Mulching with organic waste. • Shelter belts/wind breaks
		Fruit maturity	> 40 ^{0}C during a week or more	• White washing of trunk • Frequent light irrigation • Mulching with organic waste. • Shelter belts/wind breaks
12	Pomegranate	Plant growth	< 18 ^{0}C low & > 35 ^{0}C high	• Smudging technique during low temperature at early morning. • Irrigation during low or high temperature. • Mulching during low or high temperature. • Shelter belts/wind breaks
		Flowering & fruit setting	< 20 ^{0}C low & > 35 ^{0}C high	
		Fruit maturity	> 40 ^{0}C high for one week or more	• Wrapping of individual fruits • Frequent and light irrigation • Mulching or sod culture • Shelter belts/wind breaks
13	Sapota	Plant growth	<15^{0}C	• Wind breaks
		Fruit and flower drop	>40 ^{0}C	• Wind breaks •

14	Guava	Pl. growth	< 15 ^{0}C for one week or more	• Smudging technique during low temperature at early morning. • Irrigation during low or high temperature. • Mulching during low or high temperature. • Shelter belts/wind breaks
		Flowering & fruit setting	< 7 ^{0}C low & > 35 ^{0}C high for one week or more	
11	Banana	Pl. growth	< 10 ^{0}C low & > 38 ^{0}C high for period of 5 days	• Smudging technique during low temperature at early morning. • Irrigation during low or high temperature. • Mulching during low or high temperature. • Shelter belts/wind breaks
		Flowering	< 15 ^{0}C low & > 25 ^{0}C high for period of 5 days	
		Fruit maturity	> 38 ^{0}C high for one week or more	• Wrapping or sleeving of bunch • Irrigation • Mulching or sod culture • Shelter belts/wind breaks

* Temperature increase or decrease over normal and for number of days. For example, increase of 3 degrees over normal for a period of 5 days.

    *ABA   – Abscisic acid

    **NAA   – Naphthalene acetic acid

    ***Sod culture – Green cover on soil by growing fodder or green manure crop to reduce soil temperature

8. Management practices for livestock(to cover shelter management during cold or heat waves, production/regulation of fodder in rabi season in deficient monsoon years/ excess monsoon rainfall years etc),

For Fodder crops grown with residual moisture i.e., under rainfed condition
(a) Excess (rainfall during September/October months) residual moisture

S. No.	Soil type	Cropping system	Fodder name	Variety	• Management practices
1	Medium to shallow black	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Surface drainage (to control water logging condition)
2	Coastal alluvial	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Surface drainage (to control water logging condition)

(b) Normal rainfall (rainfall during September/October months) residual moisture

S. No.	Soil type	Cropping system	Crop name	Variety	Management practices
1	Medium to shallow black	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended package of agronomic practices
2	Coastal alluvial	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended package of agronomic practices

(c) Less than optimum moisture i.e., 25% less than normal, which can happen due to insufficient rainfall during September/October months. Deficit of 20-40% rainfall

S.No.	Soil type	Cropping system	Fodder name	Variety	Management practices
1	Medium to shallow black	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Don't feed as green fodder.
2	Coastal alluvial	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Don't feed as green fodder.

(d) Severe limitation in moisture. Deficit of rainfall during September/October months by more than 40%.

S.No.	Soil type	Cropping system	Fodder name	Variety	Management practices
1	Medium to shallow black	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Don't feed as green fodder.
2	Coastal alluvial	Groundnut based	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Don't feed as green fodder.

For fodder crops (mostly perennial fodder varieties as sole fodder crop) grown with groundwater

S.No.	Soil type	Foddername	Variety	Management practices
1	Medium to shallow black	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended package of agronomic practices
		Lucerne	Anand-2,3,T -9	• Adopt recommended package of agronomic practices
		Maize	African tall,Ambar,GM 2,4,6	• Adopt recommended package of agronomic practices
		Grass	Napier, Jinjvo	• Adopt recommended package of agronomic practices
2	Coastal alluvial	Sorghum	Gundhari, GFS-3, GAFS-11, CSV-21F	• Adopt recommended package of agronomic practices
		Lucerne	Anand-2,3,T -9	• Adopt recommended package of agronomic practices
		Maize	African tall,Ambar,GM 2,4,6	• Adopt recommended package of agronomic practices
		Grass	Napier,Jinjvo	• Adopt recommended package of agronomic practices

Livestock management during severe heat waves

Nutritional management	Shelter Management	Health management	Miscellaneous, if any
• Feed 5 kg green fodder along with unconventional feed per animal	• Arrangement to be made such as Cover roof with dry grass, Fans & ventilation, Fogger bathing twice a day	• Vaccination against FMD • Provide ventilation	• Give sufficient water as per the animal's requirement • Cover animal under insurance • Avoid grazing in open field • Cover floor with dry material and spray water on it at proper interval, Keep under tree shed.

Livestock management during severe cold waves

Nutritional Management	Shelter Management	Health Management	Miscellaneous, if any
• Feed silage & Hay (Urea treated with wheat straw) along with concentrate feed.	• Operate heaters protect shed by tying gunny bags Arrangement to be made such as covering roof with dry grass, Fans & ventilation. • Use halogen light during night time • Cover floor with dry material	• Add antibiotics in drinking water to protect young animals from Pneumonia.	• Cover animal under insurance • Avoid grazing in open field during early morning • Light fire during night time • Cover animal body with gunny/cotton clothes • Give warm water for drinking