

State: Meghalaya

Agriculture Contingency Plan for District: Ri Bhoi

1.0 District Agriculture profile*				
1.1	Agro-Climatic/Ecological Zone			
	Agro Ecological Sub Region (ICAR)	North-Eastern Hills (Purvachal), Warm Perhumid Eco-Region. (17.1) Assam And Bengal Plain, Hot Subhumid To Humid (Inclusion Of Perhumid) Eco-Region (15.2)		
	Agro-Climatic Zone (Planning Commission)	Eastern Himalayan Region (VII)		
	Agro Climatic Zone (NARP)	Sub-Tropical Hill Zone (NEH-5)		
	List all the districts falling under the NARP Zone* (*>50% area falling in the zone)			
	Geographic coordinates of district headquarters	Latitude	Longitude	Altitude
		25° 54' 0" N	91° 53' 0" E	1010 m
	Name and address of the concerned ZRS/ ZARS/ RARS/ RRS/ RRTTS	ICAR Research Complex for NEH Region, Umiam, Meghalaya- 793 103		
	Mention the KVK located in the district with full address	Krishi Vigyan Kendra, Ri Bhoi, ICAR Research Complex for NEH Region, Umiam, Meghalaya- 793 103		
	Name and address of the nearest Agromet Field Unit (AMFU, IMD) for agro-advisories in the Zone	Division of Agricultural Engineering, ICAR Research Complex for NEH Region, Umiam, Meghalaya- 793 103		

1.2	Rainfall	Normal RF(mm)	Normal Rainy days (number)	Normal Onset (specify week and month)	Normal Cessation (specify week and month)
	SW monsoon (June-Sep):	1239.3	100	June 2 nd (22 nd Week)	2 nd Oct (40 th Week)
	NE Monsoon(Oct-Dec):	220.1	5	-	-
	Winter (Jan- February)	19.5	12	-	-
	Summer (March-May)	428.7	12	-	-
	Annual	1907.6	129	-	-

Source: Hydromet Division, Indian Meteorological Department; Agromet Service, Division of Agril. Engg. ICAR (RC) for NEHR, Umiam

1.3	Land use pattern of the district (latest statistics)	Geographical area	Cultivable area	Forest area	Land under non-agricultural use	Permanent pastures	Cultivable wasteland	Land under Misc. tree crops and groves	Barren and uncultivable land	Current fallows	Other fallows
	Area ('000 ha)	244.8	222.2	86.9	14.0	-	57.0	29.2	19.4	6.2	8.9

Source: Land Use Statistics of Meghalaya, 2009-10

1.4	Major Soils (common names like red sandy loam deep soils (etc.))*	Area ('000 ha)*	Percent (%) of total geographical area
	1. Red Sandy Soil	-	-
	2. Red Loamy Soil	-	-

** Classification of soil in Meghalaya.

1.5	Agricultural land use	Area ('000 ha)	Cropping intensity %	
	Net sown area	22.220	113.05%	
	Area sown more than once	2.9898		
	Gross cropped area	25.118		
1.6	Irrigation	Area ('000 ha)		
	Net irrigated area	3.10		
	Gross irrigated area	-		
	Rainfed area	19.12		
	Sources of Irrigation	Number	Area ('000 ha)	Percentage of total irrigated area
	Canals		3.10 (17 nos. of projects)	1.17%
	Tanks	NA		
	Open wells	NA		
	Bore wells	NA		
	Lift irrigation schemes	NA		
	Micro-irrigation			
	Other sources (please specify)	NA		
	Total Irrigated Area		3.10	
	Pump sets	NA		
	No. of Tractors	NA		
	Groundwater availability and use* (Data source: State/Central Ground water Department /Board)	No. of blocks/ Tehsils	(%) area	Quality of water (specify the problem such as high levels of arsenic, fluoride, saline etc)
	Over exploited			
	Critical			
	Semi- critical			
	Safe			
	Wastewater availability and use			
Ground water quality				
*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%				

Source: Land Use Statistics of Meghalaya 2009-10

1.6. a.	Fertilizer and Pesticides use	Type	Total quantity (tonnes)
1	Fertilizers*	Urea	254.00 t
		DAP	14.05 t
		Potash	2.9 t
		SSP	
		M. O. P.	43.35 t
		Fertilizer consumption $\left(\frac{\text{Total fertilizer consumption in Kg}}{\text{Gross sown area in ha}}\right)$ (kg/ha)	12.48 Kg
		Other complex fertilizers (specify)	
2	Chemical Pesticides*	Insecticides	
		Fungicides	
		Weedicides	
		Pesticide consumption	
		Others (specify)	

* If break up is not available, indicate total quantity used in the district for any recent year, mention here the year and source of statistic

Source: Statistical Handbook 2011, Ri Bhoi District
Office of the Statistical Officer, Govt. of India, Nongpoh

1.7 Area under major field crops & horticulture (as per latest figures) (Specify year 2009-10 eg., 2008-09)

1.7	S.No.	Major field crops cultivated	Area ('000 ha)							
			Kharif			Rabi			Summer	Grand total
			Irrigated	Rainfed	Total	Irrigated	Rainfed	Total		
1	Rice			9.414			0.192		9.606	
2	Wheat						0.003		0.003	
3	Maize			1.517					1.517	
4	Other Cereals						0.013		0.013	
5	Pulses			0.155			0.028		0.183	
6	Oilseeds						0.159		0.159	

Source: 1) State Level Crop Statistics on Rabi Crops 2009-10

2) State Level Crop Statistics on Kharif Crops 2009-10

Directorate of Economics and Statistics, Govt. of Meghalaya

S. No.	Horticulture crops - Fruits	Area ('000 ha)		
		Total	Irrigated	Rainfed
1	Khasi Mandarin	0.228		
2	Assam Lemon	0.040		
3	Pumello	0.040		
4	Banana	0.872		
5	Pineapple	3.654		
Others (specify)	Papaya, Other Citrus Fruits	0.183		
	Horticulture crops - Vegetables	Total	Irrigated	Rainfed
1	Cowpea	0.004		
2	Potato	0.025		
3	Chillies	0.093		
4				
5				
Others (specify)				
	Medicinal and Aromatic crops	Total	Irrigated	Rainfed

1	Turmeric	0.092		
2	Ginger	0.973		
3				
4				
5				
Others (specify)				
	Plantation crops	Total	Irrigated	Rainfed
1	Arecanut	0.149		
2	Tea leaf	1.110		
3	Black Pepper	0.146		
4	Rubber	0.887		
5	Coffee	0.072		
Others (Specify)	Eg., industrial pulpwood crops etc.			
	Fodder crops	Total	Irrigated	Rainfed
1	Maize	0.02544	Nil	0.02544
2	Oats	0.01279	0.01220	0.00059
3				
4				
5				
Others (Specify)				
	Total fodder crop area	0.03823	0.01220	0.02603
	Others (specify)			

Source: 1) State Level Crop Statistics on Rabi Crops 2009-10
2) State Level Crop Statistics on Kharif Crops 2009-10
Directorate of Economics and Statistics, Govt. of Meghalaya
3) Office of A.H. & Vety Officer, Ri Bhoi, Nongpoh, Govt. of Meghalaya

1.8	Livestock	Male ('000)	Female ('000)	Total ('000)	
	Indigenous cattle	22.781	25.645	48.426	
	Improved / Crossbred cattle	0.538	8.507	9.045	
	Buffaloes (local low yielding)	1.781	1.823	3.604	
	Improved Buffaloes	-	-	-	
	Goat	5.631	7.776	13.407	
	Sheep	0.065	0.101	0.166	
	Pig	19.495	18.193	37.698	
	Mithun	-	-	-	
	Yak	-	-	-	
	Horses & ponies	0.060	0.036	0.096	
	Rabbit (Angora)	0.364	0.545	0.909	
	Commercial dairy farms (Number) -80				
1.9	Poultry	No. of farms	Total No. of birds ('000)		
	Commercial	35	32.300		
	Backyard	450	16.200		
1.10	Fisheries (Data source: Chief Planning Officer)				
	A. Capture				
	i) Marine (Data Source: Fisheries Department)	No. of fishermen	Boats		Storage facilities (Ice plants etc.)
			Mechanized	Non-mechanized	
	ii) Inland (Data Source: Fisheries Department)	No. Farmer owned ponds		No. of Reservoirs	No. of village tanks
405		1	45		
	B. Culture				

		Water Spread Area (ha)	Yield (t/ha/yr)	Production ('000 tons)
	i) Brackish water (Data Source: MPEDA/ Fisheries Department)			
	ii) Fresh water (Data Source: Fisheries Department)	748.566	12	89.867
	Others			

Source: 1) Office of A.H. & Vety Officer, Ri Bhoi, Nongpoh, Govt. of Meghalaya
2) Office of the Superintendent of Fisheries, Ri Bhoi, Nongpoh, Govt. of Meghalaya

1.11 Production and Productivity of major crops (Average of last 5 years: 2004, 05, 06, 07, 08; specify years)

1.11	Name of crop	Kharif		Rabi		Summer		Total		Crop residue as fodder ('000 tons)
		Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	
Major Field crops (Crops to be identified based on total acreage)										
Crop 1	Rice	256.85	2674					256.85	2674	
Crop 2	Wheat	1.19	1788					1.19	1788	
Crop 3	Maize	34.27	2259					34.27	2259	
Crop 4										
Crop 5										
Others										
Major Horticultural crops (Crops to be identified based on total acreage)										
Crop 1	Khasi Mandarin	0.575	5.867					0.575	5.867	
Crop 2	Banana	14.851	17.554					14.851	17.554	
Crop 3	Areca nut	0.074	0.564					0.074	0.564	
Crop 4	Tomato	1.425	9.965					1.425	9.965	
Crop 5	Ginger	6.432	7.825					6.432	7.825	
Others	Pineapple	39.066	11.440					39.066	11.440	

1.12	Sowing window for 5 major field crops (start and end of normal sowing period)	Crop 1: <u>Ginger</u>	2: <u>Tomato</u>	3: <u>Maize</u>	4: <u>Groundnut</u>	5: <u>Paddy</u>
	Kharif- Rainfed	April- May		April- May	June- July	
	Kharif-Irrigated					May-June
	Rabi- Rainfed		Feb-March			
	Rabi-Irrigated					Sep-Oct
	Summer-irrigated					
	Summer-rainfed					

1.13	What is the major contingency the district is prone to? (Tick mark)	Regular*	Occasional	None
	Drought		X	
	Flood		X	
	Cyclone		X	
	Hail storm		X	
	Heat wave			X
	Cold wave		X	
	Frost			X
	Sea water intrusion			X
	Snowfall			X
	Landslides		X	
	Earthquake		X	
	Pests and disease outbreak			
	<u>Potato</u> : Red Ant	X		
	Blight		X	
	<u>Banana</u> : Scaring Beetle	X		
	Pseudo Stem Borer		X	
	<u>Khasi Mandarin</u> : Trunk Borer		X	
	<u>Ginger</u> : Stem Borer		X	

	Soft Rot Wilt	X	X	
	<u>Cabbage</u> : Cabbage Butterfly Black Rot	X	X	X
	<u>Brinjal</u> : Wilt			
	<u>Tomato</u> : Late Blight Wilt	X		
	<u>Capsicum</u> : Wilt			X
			x x	
	Others: Lightening		X	

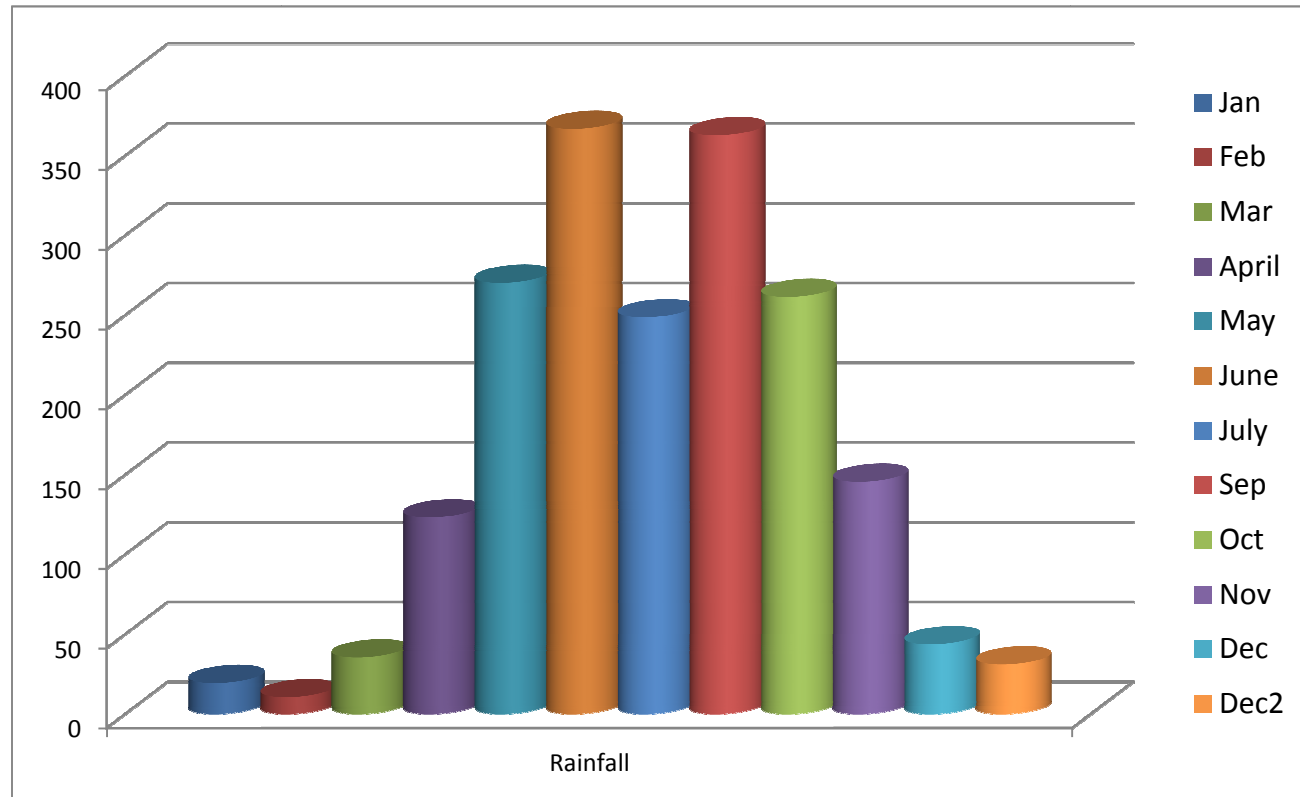
*When contingency occurs in six out of 10 years

1.14	Include Digital maps of the district for	Location map of district within State as Annexure I	Enclosed: Yes
		Mean annual rainfall as Annexure 2	Enclosed: Yes
		Soil map as Annexure 3	Enclosed: Yes

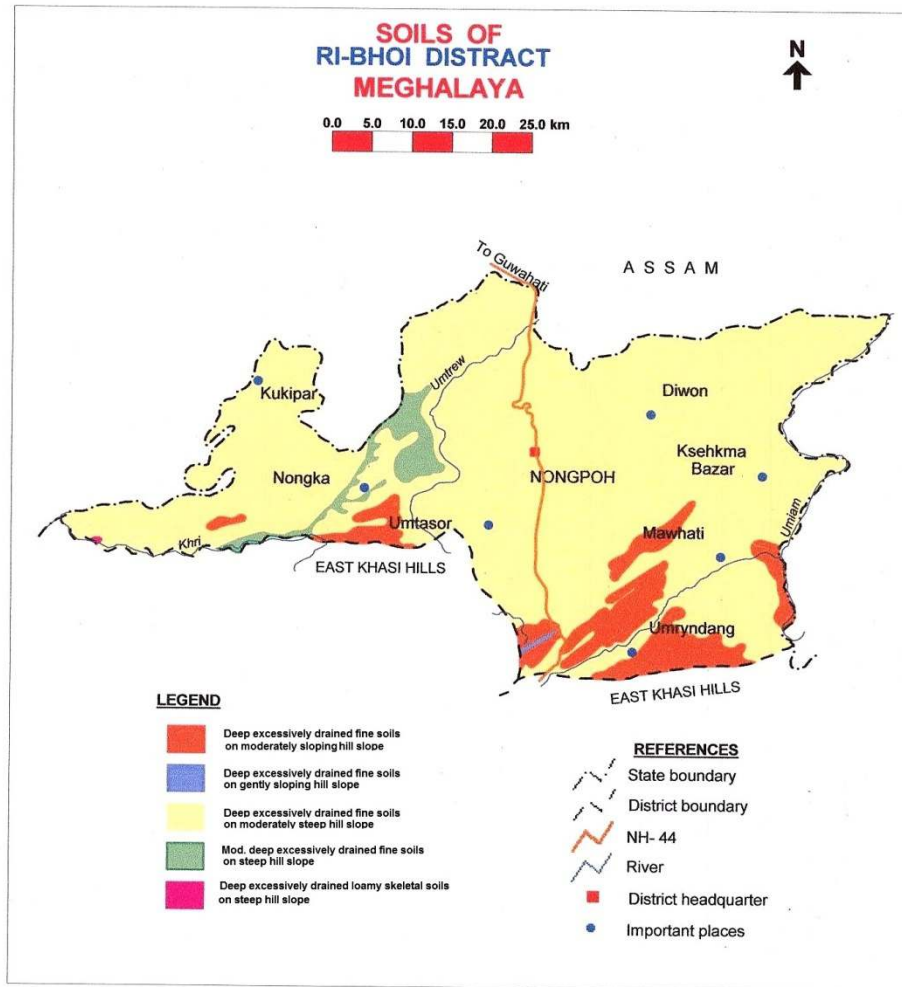
ANNEXURE I
LOCATION MAP OF RI BHOI WITHIN THE STATE



**ANNEXURE II
MEAN ANNUAL RAINFALL OF RI BHOI**



**ANNEXURE III
SOIL MAP OF RI BHOI DISTRICT**



2.0 Strategies for weather related contingencies

2.1 Drought

2.1.1 Rainfed situation (*maintain separate rows for each cropping system*)

Condition			Suggested Contingency measures		
Early season drought (delayed onset)	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Delay by 2 weeks (Specify month) * i.e. June 3 rd Week	1.Upland with moderate to high rainfall, no irrigation facility	Ginger	No Change	<ul style="list-style-type: none"> • Normal sowing of ginger can be done • Application of recommended amount of organic manures before sowing & deep ploughing 2-3 times. • Mulching with plant materials 	
		Turmeric	No Change	<ul style="list-style-type: none"> • Normal sowing of turmeric can be done • Application of recommended amount of organic manures before sowing & deep ploughing 2-3 times. • Mulching with plant materials 	
		Cucurbitaceous crops like cucumber	No change	<ul style="list-style-type: none"> • Cucumber var. Malini • Irrigation, mulching should be provided. 	Sowing time is up to June.
		Paddy	No change	<ul style="list-style-type: none"> • Planting of short duration/drought 	

<p>3rd week of June</p>				<p>tolerant varieties (Bhalum 1, 2 etc).</p> <ul style="list-style-type: none"> • Weeding, Intercultural operations, • 2% urea spray for nutrition (20 g/lit water) • 2% KCl (Potash) (20g/lit water) for drought tolerance. Application should be done at tillering stage. • If rice is harvested during Aug- Frenchbean may be taken for seed purpose. • If harvested in Sept- Frenchbean may be taken for green pod. • Oct- Toria/Lentil may be taken. • Followed by Black gram, Soyabean, Rapeseed, Lentil, French Bean(Aug/Sep) 	
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3rd week of June		Rice based cropping system a) Paddy	No change	• Intercropping, Irrigation in nurseries to be ensured.	
		b) Paddy + Groundnut		• Intercropping • Groundnut Var.: ICGS-76	
		c) Paddy + Soybean		• Intercropping • soybean Var.: JS-335	
	2. Medium land with moderate to high rainfall, no irrigation facility	Guava, Khasi mandarin, Assam lemon	No change	• Normal planting of locally available varieties can be done.	Planting time is upto July-Aug
	3. Lowland with irrigation facility	Paddy + vegetables+ Mustard	No change	• Mulching with locally available materials • Mustard Var.: TS-38	
		Paddy + pea		• Mulching with locally available materials • Pea Var.: Azad	

Condition			Suggested Contingency measures		
Early season drought (delayed onset)	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system 'including variety	Agronomic measures	Remarks on Implementation
Delay by 4 weeks (Specify month) July 1st week	1. Upland with moderate to high rainfall, no irrigation facility	Ginger	Ginger Var: Nadia	<ul style="list-style-type: none"> • Application of recommended amount of organic manures before sowing & deep ploughing 2-3 times. • Mulching with waste 	Divn. Of Horticulture, ICAR, Umiam. Deptt. Of Horticulture, Govt. of Meghalaya, Shillong

		Ginger + Cucumber	Ginger Var: Nadia Cucumber var- Malini	materials <ul style="list-style-type: none"> • Intercropping with Cucurbits • Frequent intercultural operation for conservation of moisture 	
		Turmeric	Turmeric Var: Megha Turmeric-1	<ul style="list-style-type: none"> • Application of recommended amount of organic manures before sowing & deep ploughing 2-3 times. • Mulching with waste materials • Frequent intercultural operation for conservation of moisture 	
	2. Medium land	Sweet potato, Colocasia	No change	<ul style="list-style-type: none"> • Normal sowing of sweet potato and colocasia 	
	3. Rainfed Lowland	Paddy	No change	<ul style="list-style-type: none"> • Watering in nursery to be ensured • Mid altitude- Shhsarang, Lampnah • Low alt- Ranjit, IR 64 • Frequent intraculture operations for conservation of moisture • Closer spacing and 	

				<p>increase seed rate and nitrogen fertilizer rate by 20-25%</p> <ul style="list-style-type: none"> • Stock rice seedling (bundles) in corner of main field for gap filling after transplanting 	
		Paddy	Short duration variety: e.g Vivek Dhan 82, VL Dhan 61, Luit etc.	<ul style="list-style-type: none"> • Intercultural operations can be delayed after first ploughing • Sowing of paddy nursery at 15 days interval may be more area put under nursery • Mulching • Closer spacing and increase seed rate and nitrogen fertilizer rate by 20-25% • Stock rice seedling (bundles) in corner of main field for gap filling after transplanting 	
Condition			Suggested Contingency measures		
Early season drought	Major Farming	Normal Crop/cropping	Change in crop/cropping system	Agronomic measures	Remarks on

(delayed onset)	situation	system	including variety		Implementation
Delay by 6 weeks (Specify month) July 3 rd weeks	1. Upland with moderate to high rainfall, no irrigation facility	Sweet potato, Brinjal, Carrot, Radish, Okra	No change	<ul style="list-style-type: none"> • Normal sowing time • Mulching • Frequent intraculture operation for conservation of moisture 	
	2. Rainfed , lowland	Rice based cropping system a) Paddy + tomato - pea	Short duration rice variety : Vivek Dhan 82, VL Dhan 61, Luit etc. Tomato Var: Rocky, Avinash Pea Var: Azad	<ul style="list-style-type: none"> • Puddling can be delayed in rainfed lowland • Pea/lentil can be grown under zero tillage after rice harvest with adequate water (drainage) management • System of Rice intensification (SRI) • Sowing of paddy nursery at 15 days interval may be more area put under nursery • Mulching • Closer spacing and increase seed rate and nitrogen fertilizer rate by 20-25% • Stock rice seedling (bundles) in corner of main field for gap 	

				filling after transplanting	
		b) Rice + pea	Short duration rice variety : Vivek Dhan 82, VL Dhan 61, Luit etc. Pea Var: Azad	<ul style="list-style-type: none"> • Frequent intraculture operation for conservation of moisture • System of Rice intensification (SRI) • Sowing of paddy nursery at 15 days interval may be more area put under nursery • Mulching • Closer spacing and increase seed rate and nitrogen fertilizer rate by 20-25% • Stock rice seedling (bundles) in corner of main field for gap filling after transplanting 	
Condition			Suggested Contingency measures		
Early season drought (delayed onset)	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system including variety	Agronomic measures	Remarks on Implementation
	1. Upland with	Sweet potato, Brinjal,	No change	<ul style="list-style-type: none"> • Delayed sowing will not affect quality of 	

Delay by 8 weeks (Specify month) August 1st week	moderate to high rainfall no irrigation facility	Carrot, Radish		produce <ul style="list-style-type: none"> • Mulching • Frequent intraculture operation for conservation of moisture • Apply sufficient organic manure • Mulching • Life saving irrigation • Apply 2% urea 	
		2. Rainfed upland	Rice based cropping system a) Paddy + Groundnut	Paddy var.: Bhalum-1, Bhalum-2 Groundnut Var. ICGS-76	<ul style="list-style-type: none"> • Delayed sowing of the crop • Apply sufficient organic manure • Mulching • Wider spacing (60X 30) cm for maize • Life saving irrigation • Apply 2% urea • Closer spacing and increase seed rate and nitrogen fertilizer rate by 20-25% • Stock rice seedling (bundles) in corner of main field for gap filling after transplanting
	b) Paddy + Soybean	Soybean var.- JS-335			
	c) Paddy + Maize	Maize short duration var.: RCM-1-3, RCM-75			
	d) Paddy + Blackgram	Blackgram var: T-9			
	e) Paddy + French bean	French bean Var: Anupam			

	6. Rainfed lowland	a) Paddy + Mustard +pea b) Paddy SRI	Mustard var: TS-38 Pea Var: Azad • Short duration rice : Vivekdhan 82, VL Dhan 61, Luit etc.	<ul style="list-style-type: none"> • Delayed sowing of the crop • Apply sufficient organic manure • SRI/ICM rice culture, Direct seeding • Repairing of bunds Life saving irrigation • Apply 2% urea • Closer spacing and increase seed rate and nitrogen fertilizer rate by 20-25% • Stock rice seedling (bundles) in corner of main field for gap filling after transplanting 	-
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Condition			Suggested Contingency measures		
Early season drought (Normal onset)	Major Farming situation	Normal Crop/cropping system	Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
Normal onset followed by 15-20 days dry spell after sowing leading to poor germination/crop	1 Upland with moderate to high rainfall, no irrigation facility	Ginger, Turmeric	<ul style="list-style-type: none"> • Normal sowing time • Mulching with waste materials 	<ul style="list-style-type: none"> • Application of sufficient amount of organic manures(@ 20 tn/ha) before sowing & proper land preparation • Balance fertilization N:P:K @ 100:90:90 	-

stand etc. June 1 st week				kg/ha <ul style="list-style-type: none"> • Mulching with green/dry leaves • Wider spacing • Frequent intercultural operation for conservation of conservation • Cover cropping with main crop • Furrow application of FYM • Soil moisture conservation measures to be followed 	
		Snake gourd, bottlegourd, bittergourd, okra, guava, Khasi mandarin, Assam lemon	Irrigation, resowing, application of NPK fertilizer.	<ul style="list-style-type: none"> • Moisture conservation by mulching, ridging. 	Sowing time is up to June.
	Rainfed Lowland	Rice based	<ul style="list-style-type: none"> • 8-10 days nursery can be replanted • SRI nursery can be sown 	<ul style="list-style-type: none"> • Conserve rain water by repairing of bunds • Life saving irrigation • Urea spray 2 % or KCl 2 %. Urea application at active tillering stage can be delayed in rainfed shallow lowland • Crop filling with same 	

				nursery saved in the same field during transplanting <ul style="list-style-type: none"> • Intercultural operations can be delayed • Spraying of Boron (Borax) and Potassium (Potassium Chloride) increases drought tolerance 	
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Condition		Suggested Contingency measures			
Mid season drought (long dry spell, consecutive 2 weeks rainless(>2.5 mm) period)	Major Farming situation	Normal Crop/cropping system	Crop management	Soil nutrient & moisture conservation measures	Remarks on Implementation
At vegetative stage June 3 rd wk	1. Upland with moderate to high rainfall, no irrigation facility	Ginger, Turmeric, Guava, Khasi mandarin, Cucurbitaceous crops	<ul style="list-style-type: none"> • Weeding • Thinning the plant population • Spray of anti-transpirants • Mulching • Need based plant protection measures 	<ul style="list-style-type: none"> • Application of sufficient amount of organic manures before sowing • Balance fertilization • Life saving irrigation • Well conserve moisture through mulching • Wider spacing • Frequent intercultural operation for 	-

				conservation of moisture <ul style="list-style-type: none"> • Cover cropping with main crop • Furrow application of FYM • Soil conservation measures to be followed • Early sowing of winter vegetables 	
	2. Rainfed upland	Paddy	<ul style="list-style-type: none"> • Weeding • Thinning the plant population • Spray of anti-transpirants • Mulching • Need based plant protection measures • Growing of catch crop eg. Blackgarm • Utilizing paddy fallow for second crop 	<ul style="list-style-type: none"> • Conserve rain water by repairing field bunds • Undertake gap filling with conserve nursery of same age • 2% Urea spray • Frequent intercultural operation for conservation of moisture • Cover cropping with main crop • Furrow application of FYM • Soil conservation measures to be followed • Early sowing of 	Local variety in tillering stage

				winter vegetables	
		Maize	<ul style="list-style-type: none"> • Mulching • Need based plant protection measures • Thinning plant population • Early sowing of winter vegetables 	<ul style="list-style-type: none"> • Weeding and mulching • Life saving irrigation • Frequent intercultural operation for conservation of moisture • Cover cropping with main crop • Furrow application of FYM • Soil conservation measures to be followed 	
	3. Lowland	Groundnut	<ul style="list-style-type: none"> • Mulching • Need based plant protection measures • Thinning plant population • Early sowing of winter vegetables 	<ul style="list-style-type: none"> • Weeding and mulching • Life saving irrigation • Frequent intercultural operation for conservation of moisture • Cover cropping with main crop • Furrow application of FYM • Soil conservation measures to be followed • Early sowing of 	

				winter vegetables	
		Black gram	<ul style="list-style-type: none"> • Mulching • Need based plant protection measures • Thinning plant population • Early sowing of winter vegetables 	<ul style="list-style-type: none"> • Weeding and mulching • Life saving irrigation • Frequent intercultural operation for conservation of moisture • Cover cropping with main crop • Furrow application of FYM • Soil conservation measures to be followed • Early sowing of winter vegetables 	
	4. Rainfed shallow lowland	Rice based	<ul style="list-style-type: none"> • Mulching • Need based plant protection measures • Thinning plant population • Early sowing of winter vegetables • Spraying of Boron (Borax) and Potassium (Potassium Chloride) increases drought tolerance • Utilizing paddy fallows for second 	<ul style="list-style-type: none"> • Watering in nursery • Life saving irrigation • Frequent intercultural operation for conservation of moisture • Cover cropping with main crop • Furrow application of FYM • Soil conservation 	Conserve in situ moisture

			crop	measures to be followed • Early sowing of winter vegetables	
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Condition			Suggested Contingency measures		
Mid season drought (long dry spell)	Major Farming situation ^a	Normal Crop/cropping system ^b	Crop management	Soil nutrient & moisture conservation measures ^d	Remarks on Implementation ^e
At flowering/ fruiting stage	1 Upland with moderate to high rainfall, no irrigation facility	Cucurbitaceous crops, okra, guava, Khasi mandarin	<ul style="list-style-type: none"> • Need based plant protection measures • Spray of anti-transpirants 	<ul style="list-style-type: none"> • Moisture conservation practices like ridging, mulching. • Frequent intercultural operation for conservation of moisture • Life saving irrigation • Soil conservation measures to be followed 	
	2. Rainfed shallow Lowland	Rice based	<ul style="list-style-type: none"> • Alternate Wetting and Drying technology can be utilized 	<ul style="list-style-type: none"> • Life saving irrigation can be provided to crop at critical stages • Moisture conservation practices like ridging, mulching. 	

				<ul style="list-style-type: none"> • Frequent intercultural operation for conservation of moisture • Soil conservation measures to be followed 	
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Condition		Suggested Contingency measures			
Terminal drought	Major Farming situation	Normal Crop/cropping system	Crop management	Rabi Crop Planning	Remarks on Implementation
July-August	Upland	Maize	<ul style="list-style-type: none"> • Harvest for fodder/green cob • Life saving irrigation • Sow French bean in upland immediately after harvest • Mulching with greens/dry leaves • Cover cropping with main crop • Furrow application of FYM • Frequent intercultural operation for conservation of moisture • Appropriate pest and disease management 	Sowing of mustard during September in dry field	

September-October Oct-Nov	1 Upland with moderate to high rainfall, no irrigation facility	Ginger, Turmeric, Fruit crops, Cucurbitaceous crops, Brinjal, Okra	<ul style="list-style-type: none"> • Harvest for fodder/green cob • Life saving irrigation • Sow French bean in upland immediately after harvest • Mulching with greens/dry leaves • Cover cropping with main crop • Furrow application of FYM 	-	-
	2. Rainfed shallow Lowland	Boro rice (var. TRC-Borodhan-1, Naveen, Ranjit)	<ul style="list-style-type: none"> • Harvest for fodder/green cob • Life saving irrigation • Sow French bean in upland immediately after harvest • Mulching with greens/dry leaves • Cover cropping with main crop • Furrow application of FYM 	<ul style="list-style-type: none"> • Mustard seeds can be broadcasted in the lowland field 	
	Lowland rice	Boro Rice(var. TRC-Borodhan-1, Naveen, Ranjit)	<ul style="list-style-type: none"> • Life saving irrigation • Harvest at physiological maturity • Harvest for fodder/green cob • Sow French bean in upland immediately after harvest • Mulching with 		

			greens/dry leaves • Cover cropping with main crop • Furrow application of FYM		
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2.1.2 Drought - Irrigated situation

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change crop/cropping system	Agronomic measures	Remarks on Implementation
Delayed release of water in canals due to low rainfall	Lowland	Rice	No change	Late duration variety	Assistance of NFSM, RKVY schemes may be taken. For seeds contact with nearest ICAR Research Centers, SAUs

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change crop/cropping system	Agronomic measures	Remarks on Implementation
Limited release of water in canals due to low rainfall	Lowland	Rice	No change	Late duration variety	Assistance of NFSM, RKVY schemes may be taken. For seeds contact with nearest ICAR Research Centres, SAUs
	Lowland	Rice	SRI nursery to be used	8-10 days old seedling	

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change crop/cropping system	Agronomic measures	Remarks on Implementation ^f
Non release of water in canals under delayed onset of monsoon in catchment	Lowland	Rice	SRI hybrids to be used	low seed rate	Assistance of NFSM, RKVY schemes may be taken. For seeds contact with nearest ICAR Research Centres, SAUs .
	Lowland	Rice	Delayed transplanting	Direct sown under transplanting	

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
			Change crop/cropping system	Agronomic measures	Remarks on Implementation
Lack of inflow into tanks due to insufficient/ delayed onset of monsoon	Lowland	Rice	Delayed transplanting	Direct sown under unpuddled condition	Assistance of NFSM, RKVY schemes may be taken. For seeds contact with nearest ICAR Research Centres, SAUs .

Condition			Suggested Contingency measures		
	Major Farming situation	Normal Crop/cropping system	Change crop/cropping system	Agronomic measures	Remarks on Implementation

Insufficient groundwater recharge due to low rainfall	Lowland	Rice	Late duration	Direct sown under unpuddled condition	Assistance of NFSM,RKVY schemes may be taken.For seeds contact with nearest ICAR Research Centres, SAUs .
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2.2 Unusual rains (untimely, unseasonal etc) (for both rainfed and irrigated situations)

Condition	Suggested Contingency Measures			
	Vegetative stage	Flowering stage	Crop maturity stage	Post harvest
Continuous high rainfall in a short span leading to water logging				
Crop 1 Rice, Maize, Groundnut ,Soybean	Drainage of stagnating water, ridge planting	Drainage channels	Harvesting immediately at physiological maturity	Storing the produce at dry place
Crop 2 Potato, Blackgram, Cowpea	Drainage channels, ridge planting	Drainage	Harvesting immediately at physiological maturity	Storing the produce at dry place
Crop 3 Mustard, Arhar	Drainage channels, ridge planting	Drainage	Harvesting immediately at physiological maturity	
Horticulture				
Crop 1 Khasi mandarin, Guava, Assam lemon, Pineapple, etc.	Drainage, ridge planting	Drainage, Application of hormones, nutrient, sprays to prevent flower drop.	Drainage	Shifting of the produce to drier place, Cold storage.
Crop 2 Ginger, Turmeric	Drainage, ridge planting	-	-	Shifting of the produce to drier place.
Crop 3 Cucurbitaceous crops	Drainage, ridge planting	Drainage, Application of hormones, nutrient, sprays to prevent flower drop	Drainage	Harvesting of the produce before the rain occurs. Shifting of the

				produce to drier place, Cold storage.
Heavy rainfall with high speed winds in a short span²				
Crop 1 Rice, Maize, Groundnut ,Soybean	Needbased plant protection, disease resistant varieties, IPM	Needbased plant protection, disease resistant varieties, IPM	-	
Crop 2 Potato, Blackgram, Cowpea				
Crop 3 Mustard, Arhar				
Horticulture				
Crop 1 Khasi mandarin, Guava, Assam lemon, Pineapple, etc.	Drainage, make trenches/furrows in between ridges to facilitate drainage of excess water, propping. Needbased plant protection, disease resistant varieties, IPM	Installation of wind breaks Needbased plant protection, disease resistant varieties, IPM	Installation of wind breaks	Shifting of the produce to drier place, Cold storage.
Crop 2 Ginger, Turmeric	Drainage Needbased plant protection, disease resistant varieties, IPM	Needbased plant protection, disease resistant varieties, IPM	Drainage Needbased plant protection, disease resistant varieties, IPM	Shifting of the produce to drier place ,Harvesting should be done before rain as far as possible, Drying to remove excess moisture of produce.
Crop 3 Cucurbitaceous crops	Drainage Needbased plant protection, disease resistant varieties, IPM	Drainage, Application of hormones, nutrient, sprays to prevent flower drop. Needbased plant protection, disease resistant varieties, IPM	Drainage	Shifting of the produce to drier place, Cold storage.
Outbreak of pests and diseases due to unseasonal rains	-	-	-	-
Crop1- Paddy	<ul style="list-style-type: none"> During this phase, appearance of Blast disease maybe 	At flowering stage, the blast disease causes	-	-

	observed. As soon as one or two blast spots are seen, Carbendazim @ 1 g/lit of water is to be sprayed.	improper grain filling, poor milling recovery and chaffy ear heads. Apply Carbendazim @ 1 g/lit of water. There may be occurrence of Brown spot disease also. For this dry or wet seed treatment with carbendazim @ 1 g/kg of seed followed by one spraying of Mancozeb @ 2.5 g/lit maybe done at initial symptom development.		
Crop2- Maize	Need based plant protection IPDM	During this drought season, the occurrence of Aphids in Maize crop at its vegetative stage is quite high. Long dry spells increase the incidence of this insect. This can be controlled by spraying Endosulfan (0.1%) or Monocrotophos (0.05%) at 80-90 DAS.	-	-
Crop3- Groundnut	Need based plant protection IPDM		Incidence of White grub. The following control measures must be taken up: <ul style="list-style-type: none"> • Deep ploughing in summer must be taken up 	

			<ul style="list-style-type: none"> • Crop rotation with maize must be done • Early sowing must be done to avoid damage due to the insect pest. • Collection and destruction of white grub adults must be done <p>Spraying the plants with Chloropyriphos 20 EC @ 2 ml/lit of water must be done.-</p>	
Crop4- Black gram	During this dry spell, shot holes made by Beetles can be seen. This can be controlled by spraying Endosulfan @ 2ml/ lit of water	<ul style="list-style-type: none"> • Need based plant protection IPDM • Bio control 		

2.3 Floods

Condition	Suggested Contingency Measures ⁰			
	Seeding/ nursery stage	Vegetative stage	Reproductive stage	At harvest
Transient water logging/partial inundation ¹				
Horticulture				
Crop 1 Assam lemon	Making trenches/furrows in between ridges to drain out the excess water.	Earthing up	Earthing up	Shifting of the produce to drier place.
Continuous submergence for more than 2 days²	Not applicable			
Horticulture				
Sea water inundation³				

2.4 Extreme events: Heat wave / Cold wave/Frost/ Hailstorm /Cyclone

Extreme event type	Suggested Contingency Measures ^f			
	Seeding/ nursery stage	Vegetative stage	Reproductive stage	At harvest
Heat Wave				
Horticulture				
Crop 1 (specify) Fruit crops	Provide shade	Irrigate, provide shade, white wash on tree trunks	Apply growth hormones to prevent fruit drop, maintain water balance to avoid fruit cracking	Harvest at morning hours, pre cooling is important
Crop 2 Kharif vegetables	Irrigation Nursery should be raised inside well covered structure and about 50 percent more seedlings should be raised	Life saving irrigations Replanting Planting of trees to act as wind break Staking of plants	Life saving irrigations Planting of trees (wind break)	Harvest at morning hours, pre cooling is important
Crop 3 Ginger and turmeric	-	Life saving irrigations		
Cold Wave				
Crop 1 Paddy	Delayed raising of Rice nursery	8-10 days old seedling to be transplanted	Urea application at panicle stage delayed	
Crop 2 Groundnut	<ul style="list-style-type: none"> • Irrigation • Nursery should be raised in well covered structure • 50 % more seedlings should be raised 	<ul style="list-style-type: none"> • Irrigation • Replanting • Planting of trees to act as wind break • Staking of plants 	<ul style="list-style-type: none"> • Life saving irrigation • Planting of trees to act as wind break 	Early harvest
Crop 3 Soybean				
Crop 4 Arhar				
Horticulture				
Crop 1 (specify) Fruit crops	<ul style="list-style-type: none"> • Irrigation • Nursery should be raised in well covered structure • 50 % more seedlings should be raised 	<ul style="list-style-type: none"> • Irrigation • Replanting • Planting of trees to act as wind break • Staking of plants 	<ul style="list-style-type: none"> • Life saving irrigation • Planting of trees to act as wind break 	Early harvest
Crop 2 Winter vegetables				
Crop 3 Ginger and turmeric				
Frost				

Horticulture				
Crop 1 Fruit crops	Provide shade	Provide wind break, irrigate regularly	Small trees cover with grasses, irrigate regularly	-
Crop 2 Winter vegetables	Provide shade	Irrigate regularly	Irrigate regularly	-
Hailstorm				
Crop 1 Paddy	Rice nursery delayed raising	8-10 days old seedling to be transplanted	Recommended urea application at panicle stage delayed	
Crop 2 Groundnut	Nursery should be raised in well covered structure More seedlings to be planted	Replanting	Wind break	
Crop 3 Soybean		Wind break Staking of plants		
Horticulture				
Crop 1 (specify) Fruit crops	Nursery should be raised in well covered structure More seedlings to be planted	Replanting Wind break Staking of plants	Windbreak	
Cyclone	Not applicable			

2.5 Contingent strategies for Livestock, Poultry & Fisheries

2.5.1 Livestock

	Suggested contingency measures		
	Before the event	During the event	After the event
Drought			
Feed and fodder availability	i. Creation of permanent fodder, feed and seed banks ii. Raising drought tolerant perennial grasses and fodders like congo signal, guinea, oat etc. as permanent source of fodder. Iii. Preservation and conservation of legume trees, bushes, brooms, grasses and legumes through silage and hay making Iv. Burning of jungles of hills and	i. Feeding of locally available jungle tree leaves like <i>Artocarpus hetrophyllus</i> , <i>Fircus hookerii</i> , <i>Symingtonia populnea</i> , <i>Schefflera wallichiana</i> for ruminant. Ii. Feeding of non conventional feed and forage resources like broom, <i>stylosanthes</i> , Job's tears etc. Iii. Feeding of crop residues (rice straw) and agro industrial byproduct after chemical or biological	i. Cultivation of high yielding and drought tolerant varieties of grasses and fodder like oat, congo signal, guinea, para and napier grasses. Ii. Introduction of fodder trees, bushes and grasses as rehabilitation option on all kinds of wasted and abandoned lands.

	paddy straw should not be allowed. V. Development of fodder varieties of cultivated crops having tolerance for varying degree of drought	treatment and processing. Iv. The maintenance ration should be reduced to half.	
Drinking water	i. Creation of alternate drinking water bodies ii. Livestock based water management strategy which focuses as recycling of water iii. Searching of natural stream of water	i. Use of water from water reservoir/natural stream ii. Animal should be forced to drink saline water	i. Development of watershed based livestock farming. Ii. Harvesting of rain water through Jalkund.
Health and Disease management	i. Precautionary measures like vaccination and deworming of animals should be done. Ii. Life saving approaches such as drenching/watering, guard against heat stress, drips of normal saline and dextrose, therapeutic care and drugs should be available.	i. Health checkup of animal particularly for dehydration which may cause death of animals. Ii. There should be safe provisions for disposal of dead animals. Iii. Additional supplementation of concentrates and fodders for productive, lactating and pregnant animals should be provided.	I . Deworming and vaccination against common diseases should be done. ii. Supplementation of minerals and vitamins in feed for few days to restore the normal fertility of animals. Iii. Organization of animal health
Floods	Not applicable		
Feed and fodder availability			
Drinking water			
Health and Disease management			
Cyclone			
Feed and fodder availability			
Drinking water			
Health and Disease management			
Heat wave and cold wave			
Shelter/ environment management			
Health and Disease management			

2.5.2

Poultry

	Suggested contingency measures		
	Before the event ^s	During the event	After the event
Drought			
Shortage of feed ingredients	i. Establishment of permanent storage facilities for feed ingredients. ii. Stock sufficient concentrate feed and mineral mixtures. Check regularly for moldy feeds and possible Aflatoxins.	Feeding of stocked up feed and minerals. Proper rationing of feed and minerals to be done.	Restocking of feed and minerals. Sampling at regular intervals for quality checks.
Drinking water	Hygienic and potable water source to be kept operational.	Regular testing of water for pathogens/toxicants Use of water to be monitored.	i. Development of watershed based poultry farming. ii. Harvesting of rain water through Jalkund. iii. Regular quality checks for potability of water.
Health and Disease management Sampling and surveillance to be done for diseases.	Precautionary measures like vaccination and deworming of animals should be done regularly.	Health checkup of bird particularly for dehydration which may cause death of birds. Monitoring for diseases like AI, NDV, IBD. Regular liasoning with Veterinary Department.	i. Deworming and vaccination against common diseases should be done. ii. Supplementation of minerals and vitamins in feed for few days. Surveillance and diagnosis of diseases to be carried out periodically.
Floods	Not applicable		
Shortage of food ingredients			
Drinking water			
Health and Disease management			
Cyclone			
Shortage of food ingredients			
Drinking water			

Health and Disease management	
Heat wave and cold wave	
Shelter/ environment management	
Health and Disease management	

Fisheries/ Aquaculture

	Suggested contingency measures		
	Before the event	During the event	After the event
1) Drought	-	-	-
A. Capture	-	-	-
Marine	-	-	-
Inland	-	-	-
(i) Shallow water depth due to insufficient rains/ inflow	<ul style="list-style-type: none"> ➤ Reduce water level increases the catch per unit effort in the inland capture fisheries so motivate the fishermen not to fish brood fishes & stocked fingerlings 	<ul style="list-style-type: none"> ➤ Do not fish in the deep pools & other shallow areas, where brood stock are vulnerable for over fishing. Do not fish brood stock, if caught or found in vulnerable places, shift them to deep, safe areas, do not fish the stocked fingerlings from reservoirs and beels ➤ Salvage the fish seed/ fry in upland stream home to spawning grounds of valuable cold water fish species to deeper portions of river 	<ul style="list-style-type: none"> ➤ Gradually normal catching practices can be resumed
(ii) Changes in water quality	-	-	-
(iii) Any other	-	-	-
B. Aquaculture	-	-	-
(i) Shallow water depth due to insufficient rains/ inflow	<ul style="list-style-type: none"> ➤ Developing water harvesting facilities & water supply facilities ➤ Developing water 	<ul style="list-style-type: none"> ➤ Water supply from that sources ➤ Reduce the stocking densities ➤ Culture of air breathing fish 	<ul style="list-style-type: none"> ➤ Resume normal operational practices gradually

	<p>recirculatory facility/aeration</p> <ul style="list-style-type: none"> ➤ Providing training to farmers about the process of preparing value added fish product 	<p>species, e.g.- Catfish, Murrels etc.</p> <ul style="list-style-type: none"> ➤ Culture of stunted fingerlings ➤ Changes feeding regimes ➤ Recirculating water/aeration ➤ Introduction of genetically improved variety ➤ Monitor fish pond on daily basis , if possible ➤ Cautious approach adopted while using manure & fertilizer to avoid algal blooms & eutrophication ➤ Paddy cum fish culture ➤ Integrated farming with holistic approach ➤ Ornamental fish rearing ➤ Adopting short term culture practices ➤ During severe water shortage farmers might need to harvest fish in large quantities at short notice, leading to difficulties in marketing, fish and shellfish can be stored in cold storage, dried or used for preparing value added product like pickles, papad etc. 	
(ii) Impact of silt load build up in ponds/ change in water quality	<ul style="list-style-type: none"> ➤ Prevention of different siltation process like silt catchment basin near water source/inlet ➤ Make available all the desiltration equipments & machineries 	<ul style="list-style-type: none"> ➤ Desiltration of ponds ➤ Monitoring water quality & application of available corrective measures 	<ul style="list-style-type: none"> ➤ Resume normal operational practices gradually

	<ul style="list-style-type: none"> ➤ Arranging all the water testing facilities like chemical, equipments kits etc. ➤ Make available all the corrective measures. 		
2) Floods	-	-	-
A. Capture	-	-	-
Marine	-	-	-
Inland	-	-	-
(i) Average compensation paid due to loss of human life	-	-	-
(ii) No. of boats/ nets damaged	-	-	-
(iii) No. of houses damaged	-	-	-
(iv) Loss of stock	-	-	-
(v) Changes in water quality	-	-	-
(vi) Health and Diseases	-	-	-
B. Aquaculture	-	-	-
(i) Inundation with flood water	<ul style="list-style-type: none"> ➤ Arranging all types of pond surrounding material like bamboo, nets wooden materials etc. ➤ Surround the pond with fencing material (nets) depend on the size of the stock possible max height level where water can reach during flood situation ➤ Flood facing the pond site should be strengthen or may be concrete made ➤ Developing fish nursery with ready stock of fingerlings in a safe place to compensate the lose during flood situation 	<ul style="list-style-type: none"> ➤ Monitoring the surrounding fencing ➤ Monitoring the pen and cage culture 	<ul style="list-style-type: none"> ➤ Water level can be brought down up to optimum level using outlet facility ➤ Surrounding fencing can be removed ➤ Compensate the fish stock lose with restocking ➤ Resume normal operational practices gradually ➤ Pen and cage structure can be removed or may be continued

	<ul style="list-style-type: none"> ➤ Developing of Pen and cage culture facilities ➤ Huge quantities of fingerlings will be required for post flood situation of stocking water bodies, mobilizing the various private hatcheries in their respective states or from their own farms 		
(ii) Water continuation and changes in water quality	<ul style="list-style-type: none"> ➤ Arranging all the water testing facilities like chemical, equipments kits etc. ➤ Mobile van can be an alternative to test the different water related parameters ➤ Make available all the corrective measures. 	<ul style="list-style-type: none"> ➤ High turbidity situation liming can be applied to maintain the required transparency level 	<ul style="list-style-type: none"> ➤ Measures water quality parameters ➤ Application of possible corrective measures ➤ Resume normal operational practices gradually
(iii) Health and diseases	<ul style="list-style-type: none"> ➤ Prophylactic measures like vaccination , $KmnO_4$ treatment should be done 	<ul style="list-style-type: none"> ➤ No action required 	<ul style="list-style-type: none"> ➤ Fish sampling and consequent health check up ➤ possible recommended treatment to the fish stock ➤ fish stocking if required due to loss due to disease ➤ Resume normal operational practices gradually
(iv) Loss of stock and inputs (feed, chemicals, etc)	<ul style="list-style-type: none"> ➤ Get an insurance policy ➤ Developing fish stocking facility in a safe place to compensate the loss during flood situation ➤ Developing input storage facility in a safe place to compensate the loss during flood situation 	<ul style="list-style-type: none"> ➤ Put maximum effort to prevent losses during flood situation 	<ul style="list-style-type: none"> ➤ Apply for insurance claim ➤ Reestablished the stock and inputs ➤ Resume normal operational practices gradually

(v) infrastructure damage (pumps, aerators, huts etc)	<ul style="list-style-type: none"> ➤ Get an insurance policy ➤ Developing additional infrastructure facility 	<ul style="list-style-type: none"> ➤ Put maximum effort to prevent loses during flood situation 	<ul style="list-style-type: none"> ➤ Apply for insurance claim ➤ Reestablished the infrastructure ➤ Resume normal operational practices gradually
(vi) Any other	-	-	-
3) Cyclone/ Tsunami	-	-	-
A. Capture	-	-	-
Marine	-	-	-
(i) Average compensation paid due to loss of fishermen lives	-	-	-
(ii) Average no. of boats/ nets damaged	-	-	-
(iii) Average mo. of houses damaged	-	-	-
Inland	-	-	-
B. Aquaculture	-	-	-
(i) Overflow/ flooding of ponds	-	-	-
(ii) Changes in water quality (fresh water/ brackish water ratio)	-	-	-
(iii) Health and diseases	-	-	-
(iv) Loss of stock and inputs (feed, chemicals etc)	-	-	-
(v) Infrastructure damage (pumps. Aerators, shelters/huts etc)	-	-	-
(vi) Any other	-	-	-
4. Heat wave and cold wave	-	-	-
A. Capture	-	-	-
Marine	-	-	-
Inland	-	-	-
B. Aquaculture	-	-	-
(i) Changes in pond in pond environment (water quality)	<ul style="list-style-type: none"> ➤ Construction of poly house ➤ Creating a shadow zone by tilted wall facing the wave 	<ul style="list-style-type: none"> ➤ Culture and monitoring the system 	<ul style="list-style-type: none"> ➤ After system gets normalize go for removing polyhouse ➤ Resume normal operational

	direction		practices gradually
(ii) Health and Disease management	<ul style="list-style-type: none"> ➤ Prophylactic measures like vaccination , $KmnO_4$ treatment should be done 	<ul style="list-style-type: none"> ➤ Treatment of disease fishes and removal of dead fishes 	<ul style="list-style-type: none"> ➤ Fish sampling and consequent health check up ➤ possible recommended treatment to the fish stock ➤ fish stocking if required due to lose due to disease ➤ Resume normal operational practices gradually
(iii) Any other			