State: TAMILNADU

Agriculture Contingency Plan for District: THIRUVANNAMALAI

1.0 District Agriculture profile				
1.1	**Agro-Climatic/Ecological Zone**			
	Agro Ecological Region / Sub Region (ICAR)	Eastern Ghats (8.3)		
	Agro-Climatic Region (Planning Commission)	Southern Plateau and Hills region (X)		
	Agro Climatic Zone (NARP)	North eastern zone (TN-1)		
	List all the districts or part thereof falling under the NARP Zone	Chengelpet, Vellore, Thiruvannamali, Villupuram, Cuddalore excluding Chidambaram and Kattumannarkovil		
	Geographic coordinates of district	Latitude	Longitude	Altitude
		11° 55' to 13° 15' N	78° 20' to 79° 50' E	
	Name and address of the concerned ZRS/ ZARS/ RARS/ RRS/ RRTTS	Agricultural Research Station, Virinjipuram, Vellore District -632 104 Oil Seeds Research Station, Thindivanam, Vilupuram District Sugarcane Research Station, Melalathur, Vellore		
	Mention the KVK located in the district	Krishi Vigyan Kendra, Vedapuri, Thiruvannamalai		

1.2	**Rainfall**	**Average (mm)**	**Normal Onset (specify week and month)**	**Normal Cessation (specify week and month)**
	SW monsoon (June-Sep)	458	1st week of June	1st week of October
	NE Monsoon(Oct-Dec)	427	2nd week of October	4th week of December
	Winter (Jan- Feb)	59		
	Summer (Mar-May)	103		
	Annual	1047		

1.3	**Land use pattern of the district** (latest statistics)	**Geographical 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)	631.2	153.3	93.5	2.9	13.1	2.3	21.1	90.6	29.9

Source: "G" Return , 2007-08

1.4	**Major Soils**	**Area ('000 ha)**	**Percent (%) of total**
	Deep Black	135	21.5
	Deep Red	115	18.3
	Moderately Deep Black	91	14.6
	Moderately Deep Red	66	10.5
	Shallow Black	73	11.5
	Shallow Red	69	11.1

1.5	**Agricultural land use**	Area (‘000 ha)	Cropping intensity %
	Net sown area	219.8	121.4
	Area sown more than once	47.1	
	Gross cropped area	266.9	

Source: Dept. of Soil Science, TNAU, Coimbatore & Directorate of Economics & Statistics (2008-09)

1.6	**Irrigation**	**Area (‘000 ha)**	**Percent (%)**	
1	Net irrigated area	147.7	75.9	
2	Gross irrigated area	191.5	73.9	
3	Rainfed area	72.1	24.1	
	Sources of Irrigation	**Number**	**Area (‘000 ha)**	**Percent (%)**
4	Canals		1.4	1.0
5	Tanks	1965	33.3	22.2
6	Open wells	155577	157.9	80.0
7	Bore wells	1331		
8	Lift irrigation	-		
9	Other sources	-	-	
10	Total		191.7	103.2
11	Pumpsets	150879	115.0	
12	Micro-irrigation	-		

	Groundwater availability and use	No. of blocks	percentage	Quality of ground water
13	Over exploited	9	50.0	Salinity level: 73 % good, 24% moderate and 3% poor Residual Sodium Carbonate: 90% good and 9% moderate Sodium Adsorption Ratio: 100 % good
14	Critical	2	11.1	
15	Semi- critical	5	27.8	
16	Safe	2	11.1	
	Wastewater availability and use	Data not available	--	
*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%				

Source: 'G' Return.

1.7.Area under major field crops & horticulture etc. (2009-10 – Source: Office of the JDA, Thiruvannamalai)

*If break-up data (irrigated, rainfed) is not available, give total area

S.No.	Major crops cultivated	Irrigated	Rainfed	Total ('000 Ha)
	Major field crops			
1	Paddy	112.0	0.1	112.1
2	Groundnut	38.9	56.8	95.7
3	Sugarcane	28.2	0.0	28.2
4	Bajra	0.3	3.7	4.0
5	Blackgram	0.6	2.2	2.8
6	Ragi	0.9	1.5	2.4
	Horticultural crops			
1	Banana	3.2	0.0	3.2
2	Mango	0.3	0.4	0.7
3	Chillies	0.4	0.0	0.4
4	Brinjal	0.1	0.0	0.1

1.8 **Livestock**

Sl.No	Livestock	Male ('000)	Female ('000)	Total ('000)
1	Non Descriptive Cattle (Local low yielding)	94.1	110.0	204.1
2	Crossbred cattle	83.0	430.0	513.1
3	Non descriptive Buffaloes (Local low yielding)	-	-	22.6
4	Graded Buffaloes	-	-	
5	Goat			272.8
6	Sheep			366.7
7	Others: Pig, Yak, Rabbit			7.2

1.9 Poultry

	Poultry	No. of Farms	Total No. of birds (number)
	Commercial		314136
	Backyard		
	Turkey		170

1.10	Fisheries	Area (ha)	Yield (t/ha)	Production (tones)
	Brackish water			

1.11. Production and Productivity of major crops (Average of last 3 years: 2006, 07, 08)

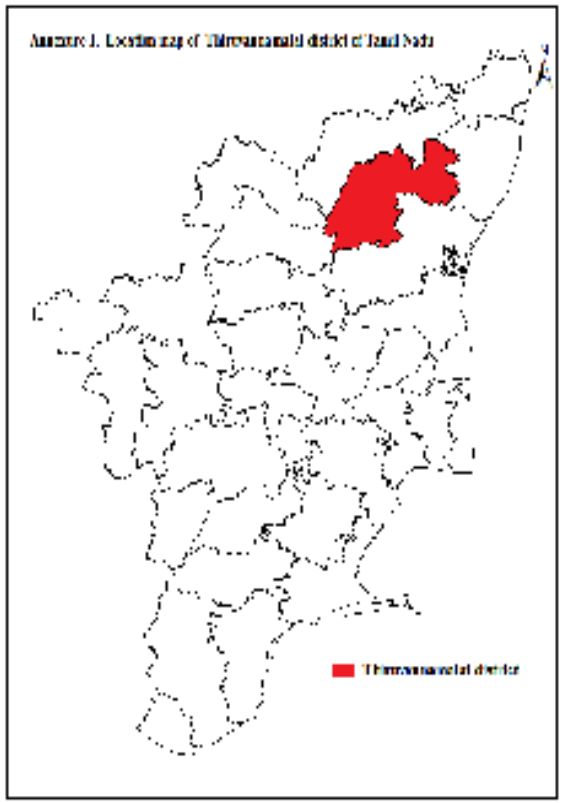
S.No.	Crops	Annual	
		Production ('000 t)	Productivity (kg/ha)
1	Paddy	392.5	3500
2	Bajra	4.2	1039
3	Ragi	3.9	1654
5	Blackgram	2.2	767
6	Groundnut	204.8	2139
7	Sugarcane	3274.3	116000
8	Brinjal	1.4	10329
9	Chillies	0.2	506
10	Banana	236.4	75104

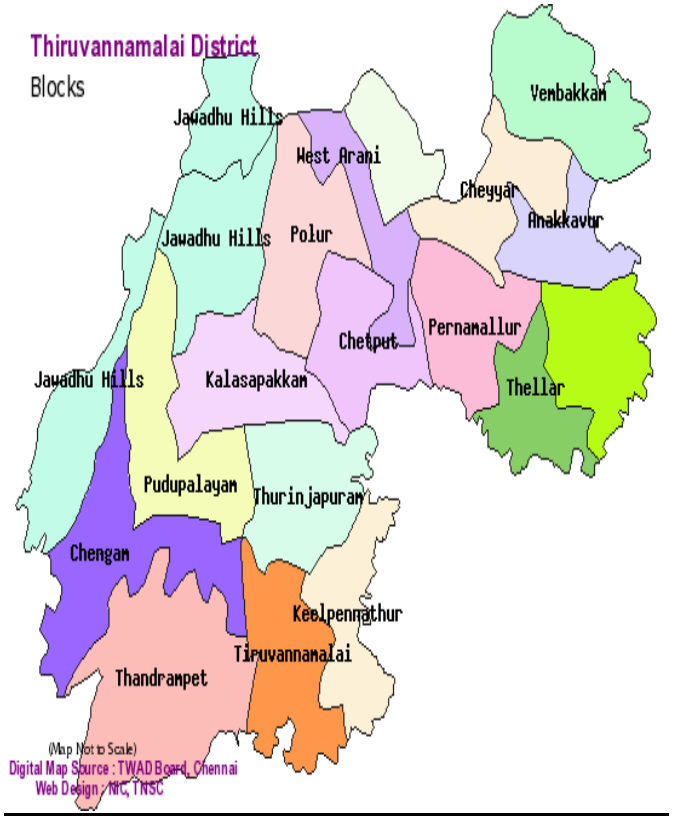
1.12	Sowing window for 5 major crops (start and end of sowing period)	Paddy	Ground nut	Blackgram	Ragi	Sugarcane
1	Kharif- Rainfed	-	July-August	-	-	-
2	Kharif-Irrigated	May- June	-	July-August	-	-
3	Rabi- Rainfed	-	-	-	November	-
4	Rabi-Irrigated	September - October	November - December	-	December – January	January –February

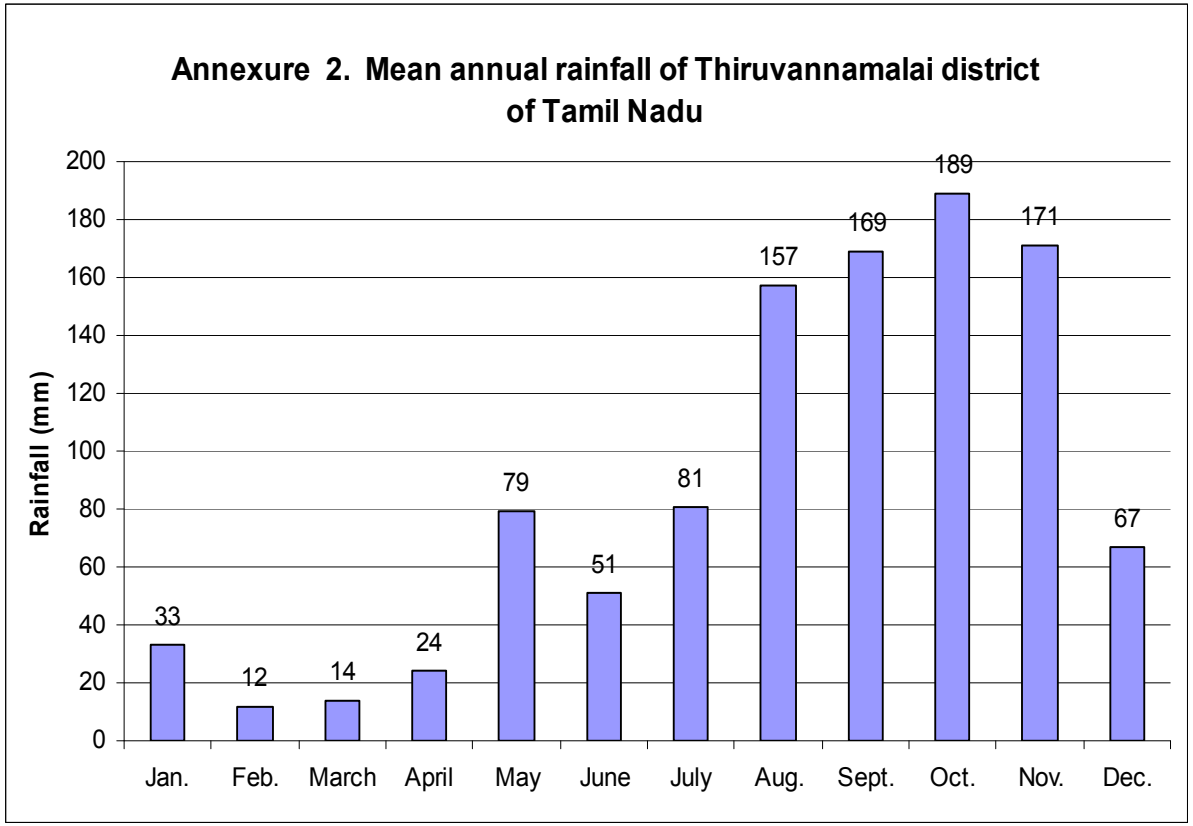
1.13	What is the major contingency the district is prone to?	Regular	Occasional	None
1	Drought		✔	
2	Flood			✔
3	Cyclone			✔
4	Hail storm			✔
5	Heat wave			✔
6	Cold wave			✔
7	Frost			✔
8	Sea water inundation			✔
9	Pests and diseases (specify)			✔

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

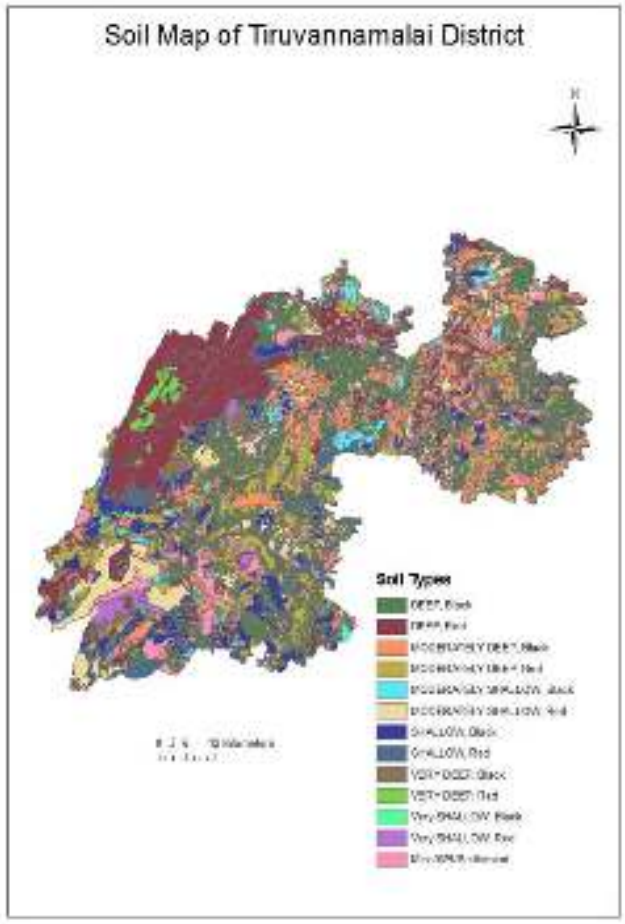
Annexure 1. Location map of Thiruvannamalai district and the blocks






Annexure 2. Mean annual rainfall of Thiruvannamalai district of Tamil Nadu
Rainfall (mm)
200
180
160
140
120
100
80
60
40
20
0
33
12
14
24
79
51
81
157
169
189
171
67
Jan.
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.

Annexure 3. Soil map of Thiruvannamalai district of Tamil Nadu



2.0 Strategies for weather related contingencies

2.1 Drought

2.1.1 Rainfed situation (*Kharif* season)

Condition	**Major Farming situation**	**Normal Crop /cropping system**	**Suggested Contingency measures**		
Early season drought (delayed onset)			**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delayed by 2 weeks (June 3rd week)	Red, laterite and heavy clay soils	• Groundnut / Maize (June-Sep.) • Gingelly (June-Sep.)	No change	-	-
Delayed by 4 weeks (July 1st week)			Pearl millet / horsegram / minor millets	<u>Pearl millet</u> Use short duration drought resistant varieties Seed hardening with 2 % potassium chloride Dust mulching by inter cultivation operations If failure of Maize/pearl millet, seasame may be sowing Re-sowing with fodder (fodder can be harvested at any stage keeping in view sowing of the next season)	-
Delayed by 6 weeks			Pearl millet / horsegram /	-do-	

July 3rd week			minor millets / pulses		
Delayed by 8Weeks August 1st week			Fallow	-Plan for rabi crops	

Condition	**Major Farming situation**	**Normal Crop/cropping system**	**Suggested Contingency measures**		
			Crop management	**Soil management**	**Remarks on Implementation**
Early season drought (Normal onset, followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.)	Red, laterite and heavy clay soils	Groundnut / Maize (June-Sep Groundnut (June-Sep.) Gingelly (June-Sep.)	Re-sow with subsequent rain rather than allowing sub-optimal poor plant stand or Gap filling	In-situ moisture conservation with locally available materials	
Mid season drought (long dry spell) At vegetative stage			Anticipating the prolonged dry spell Follow Intercropping (Companion cops – green gram, cowpea) Foliar spraying of nutrient / top dressing with fertilizer	Frequent inter culture operation to facilitate effect of loose soil as dust mulch Irrigation with rain gun or mobile sprinklers from farm ponds	
Mid season drought (long dry spell) At reproductive stage			Thinning	Frequent interculture operation to facilitate effect of loose soil as dust mulch Irrigation with rain gun or mobile sprinklers with available water	
Terminal drought			If necessary, harvest at physiological maturity	Supplemental irrigation if available	Linkage with NFSM for supply of seed

2.1.2 Rabi Season

Condition	Major Farming situation	Normal Crop/cropping system	Suggested Contingency measures		
Early season drought (delayed onset of NE Monsoon			**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delayed by 2 weeks October 3rd week	Red, laterite and heavy clay soils	• Groundnut / Pulses / F ingermillet (Oct.-Feb.) • Gingelly (Oct.-Feb.) • Groundnut (Oct.-Feb.)	No crop change	Foliar spraying of nutrient/ top dressing with fertilizer is done generally after establishment good crop stand	Linkage with NFSM for supply of seed
Delayed by 4 weeks November 1st week			Pearl millet / Horsegram /minor Millets / Pulses (Oct.- Jan.)	<u>Pearl millet</u> Usage of short duration drought resistant varieties Seed hardening with 2 % potassium chloride Dust mulching by intercultivation In case of failure of Maize/ Pearl millet, Seasamum may be sown <u>Pulses</u> Seed hardening with 100 ppm of Zinc Sulphate and 100 ppm of Manganese Sulphate (Blackgram and	

				Greengram) Seed hardening with 100ppm of Zinc Sulphate (Red gram) Seed hardening with 1% Potassium Dihydrogen Phosphate (Bengalgram) Re-sowing with fodder (fodder can be harvested at any stage keeping in view sowing of the next season)	
Delayed by 6 weeks November 3rd week			Pearl millet / Horsegram / minor millets / Pulses (Oct.-Jan.)	-do-	
Delayed by 8Weeks December 1st week			Fallow	Rabi crops	

Condition	**Major Farming situation**	**Crop/cropping system**	**Suggested Contingency measures**		
			Crop management	**Soil management**	**Remarks on Implementation**
Early season drought (Normal onset, followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.)	Red, laterite and heavy clay soils	• Groundnut / pulses /fingermillet (Oct.-Feb.)	Re-sow with subsequent rain rather than allowing sub-optimal poor plant stand to persist	In-situ moisture conservation with locally available materials Irrigation with rain gun or mobile sprinklers with	-

		• Gingelly (Oct.-Feb.)		available water	
Mid season drought (long dry spell) At vegetative stage			Anticipating the prolonged dry spell follow Inter-row cropping (Companion – green gram, cowpea) Foliar spraying of nutrient/ top dressing with fertilizer is done	Frequent inter culture operation to facilitate effect of loose soil as dust mulch Irrigation with raingun or mobile sprinklers with available water	
Mid season drought (long dry spell) At reproductive stage			Reduction of moisture stress by thinning the crops	Frequent inter culture operation to facilitate effect of loose soil as dust mulch	
Terminal drought			-	Supplemental irrigation to save crop	

2.1.2 Irrigated situation

Condition	**Major Farming situation**	**Normal Crop/cropping system**	**Suggested Contingency measures**		
			Changes in Crop/Cropping system	**Agronomic measures**	**Remarks on Implementation**
Delayed/ limited release of water in canals due to low rainfall	Command areas (Sathanur) Heavy clay and sandy soils	Rice/Maize (Aug.-Jan) – Pulses/Gingelly (Jan. – Apr.)	Groundnut/Maize (Aug. – Dec.) – Pulses (Jan.- Apr.)	<u>Rice</u> Use of short duration drought resistant varieties Upland rice/aerobic rice/SRI/Semi-dry rice cultivation	

				Use of pre-emergence herbicide Additional dosage (25%) of recommended N Spray of potassium chloride <u>Pulses</u> Seed hardening with 100ppm of Zinc Sulphate and 100 ppm of Manganese sulphate (Black gram and green gram) Seed hardening with 100ppm of Zinc Sulphate (Red gram) Seed hardening with 1% Potassium Dihydrogen Phosphate (Bengal gram) <u>Groundnut</u> Seed treatment with 0.5 % Calcium chloride Irrigation at pegging, flowering and pod development stage	

				0.5 % potassium chloride spray during flowering and pod development stages to alleviate water stress Apply composted coir pith to soil for better water retention <u>Maize</u> Irrigation at 75 % available soil moisture Depletion (ASMD) Irrigation at critical stages (40 to 65 DAS) Skip irrigation at seedling, knee high and dough stages under water scarce situation Gingelly Life saving irrigation at 7DAS Irrigation at critical stages of moisture requirement - flowering stage (35-45 DAS)	

Non release of water in canals under delayed onset of monsoon in catchment		Rice/Maize (Aug.-Jan) – Pulses/Gingelly (Jan. – Apr.)	Pearl millet/Sorghum/fodder (Oct.-Jan.) Cluster bean/Vegetable beans (Oct.-Jan.) in heavy soils	<u>Rice</u> Use of short duration drought resistant varieties Upland rice/aerobic rice/SRI/Semi-dry rice cultivation Perfect leveling of main field Shallow water depth at the time of planting (2cm) Use of pre-emergence herbicide Additional dosage (25%) of recommended N to make good volatilization loss of N Top dressing of Potassium <u>Maize</u> Irrigation scheduled at 75 % available soil moisture Depletion (ASMD) Irrigation done during the critical phase (40 to 65 DAS)	

				Skipping irrigation at seedling, Knee high and dough stages followed under water scarce situation <u>Pearl millet</u> Use of short duration drought resistant varieties Seed hardening with 2 % potassium chloride Irrigation at crop critical growth phases (Heading and flowering) Dust mulching by intercultivation operations If failure of Maize/pearl millet, seasame may be sown (low seed requirement) <u>Sorghum</u> Seed hardening with 2 % potassium chloride <u>Vegetables</u> Drip irrigation and	

				fertigation Mulching soil surface with organic materials and clean cultivation Growing vegetable such as cluster bean, cowpea, lab lab bean, radish, peas which can sustain with less amount of water Enhancing cucurbitaceous vegetables by raising nursery in Polythene bags followed by transplanting in order to save 2-3 irrigations Sowing/planting cucurbitaceous vegetable adopting hill and channel system to economise water <u>Fodder crop</u> Life irrigation Raingun can be effectively used for irrigation with a water saving of 25-30%	

Lack of inflows into tanks due to insufficient /delayed onset of monsoon		Rice/Maize (Aug.-Jan) – Pulses/Gingelly (Jan. – Apr.)	Pearl millet/Sorghum/fodder (Oct.-Jan.) Cluster bean/vegetable beans (Oct.-Jan.) in heavy soils	-do-	
Insufficient groundwater recharge due to low rainfall	Red and laterite soils (Well irrigated areas)	• Rice (Aug.-Jan.) - groundnut (Feb.-April) – gingelly (Apr. - June) • Sugarcane (Dec.-Jan.) - ratoon sugarcane (Jan.-Nov.) - rice (Dec.-May) - groundnut (June-Sep.) – 3 years rotation • Vegetables (June-Oct.) - maize (Oct.-Jan.) - cotton / pulses (Feb.-May) • Maize (June-Sep.) – marigold (Oct.-Feb.) - pulses (Feb.-May) • Vegetables (Jun.-Sept.) – sugarbeet (Sept.-Feb) – pulses (Feb-May) • Groundnut (Jun-Sept) – sugarbeet (Sept.-Feb) – Sweet sorghum* (Feb-	Vegetables (May-July) - Maize/Sunflower (Aug.-Dec.) - Pearl millet / Groundnut / Gingelly/ (Jan.-April) • Groundnut (Jun-Sept) – (Sept. sowing) • Maize (Jun-Sept) – Sugarbeet (Sept.-Feb) – pulses (Feb-Apr) • Pearl millet / Sorghum / *Periwinkle*/ Senna (July-Oct.) - Wheat (Nov.-Feb.) - Cluster bean / lab lab / Bhendi / Water melon (Feb.-May)	<u>If Sugarcane is still taken up, follow:</u> Drip irrigation & fertigation (25-30 % water saved) Planting setts at 150cm (super factory model) Alternate furrow irrigation and broad bed furrow method Skip furrow irrigation (clay and loam soils) Sugarcane trash mulching/dust mulching through inter cultivation operation Alternate furrow should be skipped and may be converted to ridges having a wider bed.	

		May) • Groundnut (Jun-Sept.) – Jatropha* (Sept. sowing)		Short duration crops like pulses can be raised in wider bed without excessive irrigation Intercultural operations may be undertaken to create dust mulch Irrigation at critical stages of crop growth Weed control through herbicides/weeds may be cut and used as surface mulch to conserve soil moisture Earthing up operation also could be taken If poor growth main crop can be harvested and maintained as ratoon (harvested crop may used seed cane) Spray of 2.5 % urea with 2.5 % KCl or MOP may be useful in areas where some soil moisture is available. This will impart drought tolerance to plants	

				<u>Rice</u> Seed treatment with seed hardening chemicals Upland rice/aerobic rice/SRI/Semi-dry rice cultivation Additional dosage (25%) of recommended N Top dressing of potassium Spray anti-transpirants Spray of potassium chloride <u>Vegetables</u> Drip irrigation and fertigation Mulching soil surface with organic materials and clean cultivation Growing vegetable such as cluster bean, cowpea, lab lab bean, radish, peas which can sustain with less amount of water Enhancing cucurbitaceous	

				vegetables by raising nursery in Polythene bags followed by transplanting in order to save 2-3 irrigatins Sowing/planting cucurbitaceous vegetable adopting hill and channel system to economise water <u>Maize</u> Irrigation will be scheduled at 75 % available soil moisture Depletion (ASMD) Irrigation will be done during the critical phase (40 to 65 DAS) Skipping irrigation at seedling, Knee high and dough stages may be followed under water scarce situation <u>Pearl millet</u> Usage of short duration drought resistant varieties	

				Seed hardening with 2 % potassium chloride Irrigation at crop critical growth phases (Heading and flowering) Dust mulching by intercultivation operations If Maize / Pearl millet fail, Seasame may be sown (low seed requirement) <u>Sorghum</u> Seed hardening with 2 % potassium chloride <u>Groundnut</u> Irrigation at critical stages pegging, flowering and pod development stage 0.5 % potassium chloride spray during flowering and pod development stages will aid to mitigate the ill effects of water stress Coir pith compost increase moisture	

				availability and better drainage in heavy textured soil is required Seed treatment with 0.5 % Calcium chloride <u>Gingelly</u> Life saving irrigation at 7DAS Critical stages for moisture requirement is flowering phase (35-45 DAS) <u>Sunflower</u> Skip/alternate furrow irrigation under water scarce condition Seed treatment with 2% of potassium chloride solution	
Any other condition (specify)	-	-	-	-	-

2.2 Unusual rains (untimely, unseasonal etc) (for both rainfed and irrigated situations) – This situation occurs very rarely

Condition	Suggested contingency measure			
	Vegetative stage	**Flowering stage**	**Crop maturity stage**	**Post harvest**
Continuous high rainfall in a short span leading to water logging				
Crops	Drain excess water	Drain excess water	Follow weather advisory before harvest decision	1. Shift produce immediately from the field 2. Threshing will be taken as soon as possible 3. Drying the produce with mechanical dryers 4. Postharvest chemical treatments of produce and marketing

2.5 Contingent strategies for Livestock & Poultry

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
Drought			
Feed & Fodder availability	Training to farmers on silage & hay making with method demonstration has to be carried out Education on drought resistant grasses & tree fodders Increase in concentrate feed to off set drought	➢ Silage, Azola and hay to be fed during draught. ➢ Increased amount of concentrates to be given to off set grazing.	Supply of Co3,Co4 cuttings to farmers Impact on the training programme & method demonstration on feed & fodder management during drought period has to be evaluated.

Drinking water	De-silting of ponds	Daily requirement of water supply for cattle in Tiruvannamalai district: 12671.053Kld (Kld- Kilo Litres per day) Existing system of water supply (Cattle troughs, Ponds, Oorani,Springs Canals & ditches) : 3686.253 Kld Digging of Borewells, open wells, with Power pump, Mini power pump and Hand pump to meet the water requirement is suggested.	Power pump - 4023 Nos. Mini power pump - 3190 Nos. Community drinking water trough can be arranged in shandies and more in community grazing areas
Health & Disease management	Information to farmers on how to combat outbreaks Possible outbreaks during drought By Capacity building programmes, Awareness campaign.	FMD outbreak occurred during July 2008 at Vadamathimangalam, Tiruvannamali Dt. Vaccination for FMD & deworming were carried out during in the outbreak area. Refresher courses for Veterinary staff and Livestock Inspector with regard to health & management measures may be taken up	Vaccination & deworming were carried out during Mass contact programs/ Kalnadai Padukappu thittam. ASCAD awareness campaigns were carried out Impact on information disseminated to the farmers on disease prevention & control measures during drought period has to be carried out.
Floods	Not applicable		
Heat wave & Cold wave		Community shed for giving shelter to all livestock during heat wave & cold wave is suggested. Planting of trees/ fodder trees in village community grazing area is suggested.	
Feed & Fodder availability	Training to farmers on silage & hay making with method demonstration has to be carried out Education on drought resistant grasses & tree fodders	--	Supply of Co3,Co4 cuttings

	Increase in concentrate feed to off set drought		
Drinking water	Desilting of ponds	--	Supply of Power pumps and mini-power pumps as in the past Community drinking water trough can be arranged in shandies and more in community grazing areas
Health & Disease management	Information to farmers on how to combat outbreaks Possible outbreaks during drought By Capacity building programmes, Awareness campaign.	Awareness on Summer and winter management recommendations are to be given during Awareness campaigns and farmers interaction is the suggestive measure to overcome heat and cold wave.	Vaccination & de-worming Mass contact programs/ Kalnadai Padukappu thittam. ASCAD awareness campaigns as done in the past Impact on information disseminated to the farmers on disease prevention & control measures during drought period needs to be assessed for further improvement

2.5.3 Fisheries/ Aquaculture

	Suggested contingency measures		
	Before the event	**During the event**	**After the event**
1) Drought			
A. Capture			
Marine	Not applicable	Not applicable	Not applicable
Inland			

(i) Shallow water depth due to insufficient rains/inflow	i. Rainwater harvesting ii. Deepening/ Desilting of existing water bodies iii. Removal of debris and strengthening of pond embankments through turfing	**i.** Shallow areas of derelict water bodies can be used for raising table sized fishes using stunted fish seeds and the culture can be done in enclosures (pens). Pens of 0.1 to 0.2ha are ideal for easy operation and economical. **ii.** Indian major carps and freshwater prawns are ideal species for culture. **iii.** Temporarily raising the height of the enclosures maybe done to prevent loss of stock in the event of sudden rise in water level due to sudden onset of rain or flooding.	**i.** Due to severe water shortage farmers have to harvest fish in large quantities to avoid loss due to mortality. Leading to difficulties in marketing the fish farmers can be trained on the frozen storage techniques and in preparing value added products (ready to eat and processed products) **ii**. Adoption of short term culture of species wherein culture of species having rapid initial growth can be stocked. Eg. minor carps like silver barb *(Puntius gonionotus)* and fringe lipped carp (*Labeo fimbriatus)* can be undertaken. **iii.** Culture of minor carp like *Amblypharyngodon mola* can be done in shallow ponds and this being an auto breeder it spawns two or three times in a year which also ensure auto stocking.
(ii) Changes in water quality	i. Strictly implement in avoiding the use of plastics and other non-biodegradable material along the	i. Reduced water volume in the pond/ local water bodies lowers its buffering capacity hence every precaution has to be taken while adopting use of manures and fertilizers to avoid onset of algal blooms and eutrophication	

	river belts (intervention and polluting by human is a common factor) ii. Avoid entry of pollutants like industrial effluents, run off from agricultural land into rivers		
(iii) Any other	--	i. Stunting of major carp fingerlings and stocking in grow out ponds as they grow faster (three times more growth than the non stunted fingerlings) ii. Ornamental fish rearing utilizing gold fishes, koi carp or live bearers like mollies and guppies can be done in summer. This ensures money flow to the farmers Supply of fish stock in case of loss	
B. Aquaculture/ Mariculture	**Before the event**	**During the event**	**After the event**
(i) Shallow water in ponds due to insufficient rains/inflow	i. Water depth should be at least 1m for initiating fish culture. ii. Adopt low stocking density to reduce culture duration and culture	i. Farmers can be advised to take up integrated farming (poultry, piggery, duckery and animal husbandry with crops) to cut down cost on expensive inputs like feed and manure.	i. Prepare pond for the next crop after early harvest ii. Always keep a constant check on the onset of algal blooms which will cause mass mortality of fishes

	should be done only after ensuring water availability for minimum period of 3 months. iii. In low tidal amplitude areas which receives north-east monsoon it is advised not to go for summer crop because of high temperatures which will lead to stress of culturable species.	ii. Avoid fertilization and manuring on supplementary basis iii. Air breathing fish culture to be practiced (Cat fish farming)	iii. Harvest fish brood stock, if any and shift to deeper safer areas like cement systems in indoor units to utilize for breeding on onset of monsoon
(ii) Impact of silt load build up in ponds / change in water quality	i. Rainwater harvesting ii. Deepening/ Desilting of existing water bodies iii. Removal of debris	i. Feeding should be minimum to avoid organic loading	i. On onset of sudden heavy rains heavy mortality will result so feeding should be controlled to avoid waste accumulation on pond bottom soil.
(iii) Any other	i. The physico-chemical quality of water has to be monitored regularly for its suitability for fish culture.	i. Concept of Re-circulatory system can be adopted as additional water is not required thereby curtailing need for water exchange. ii. Use of aerators to overcome thermal stratification and build up of ammonia during high temperatures will help break the thermal stratification ** ***subsidy can be provided to farmers for the aerators*** iii. Partial harvesting to reduce biomass thereby	i. Train the farmers to breed fish in captivity and produce required amount of seed either through hormonal treatment and environment manipulation. ii. Use of cryopreserved milt supplied from research units to aid breeding and ensure healthy stock (in collaboration with TANUVAS)

		competition for space and food is reduced. iv. Reduced stocking densities	
2) Floods	**Before the event**	**During the event**	**After the event**
A. Capture			
Marine	i. Train fisher folk on hygienic handling of fishes, short and long term preservation techniques and on preparation and packaging of value added fish products – as a small scale village activity ii. Establish cold chain facilities iii. Ensure strengthening of coastal belt by planting and maintaining the mangrove ecosystems ** *mangrove wetlands mitigate the adverse impact of storms, cyclones Tsunami in coastal areas and coastal erosion* ** *mangroves are ideal breeding ,nursery and feeding grounds for a number of commercially important prawns, fishes and other shell fishes.*	i. Avoid fishing in deeper waters to avoid loss to gear, craft and human lives.	i. Loss incurred should be reported will be assessed by the State Fisheries Department officials and reimbursed.

	iv. Ecologically sensitive areas to be earmarked such as mangroves, corals and estuaries to avoid overfishing v. Commercial exploitation of coral reefs and large scale removal of mangrove vegetation to be surveyed as this leads to dwindling fish harvests		
Inland			
(i) Average compensation paid due to loss of human life	--- NA---		As per the norms of the State Government and implemented by the State Fisheries Department
(ii) No. of boats / nets/damaged	---NA---		
(iii) No. of houses damaged	---NA---		
(iv) Loss of stock	Sell the available fish stock as much as possible	Installation of gill net and using cast net for fishing the stock escaped through flooding	There is a possiblility of onset of toxic gases in the system, hence immediate stocking of fishes should not be carried out
(v) Changes in water quality	Strengthening of bunds and embankments either through turfing and terracing to avoid water overflow or entry of waters from outside.	Water should not be used for domestic purposes	There is a possiblility of onset of toxic gases in the system, hence immediate stocking of fishes should not be carried out
(vi) Health and	Water quality management to be followed thoroughly by		Ulcers and pox diseases in fishes will occur hence

diseases	weekly sampling to monitor water quality parameters		the fish stock has to be discarded or buried.
B. Aquaculture/ Mariculture in ponds	**Before the event**	**During the event**	**After the event**
(i) Inundation with flood water	i. Avoid culture of fishes requiring longer duration of culture. ii. Initiating fish culture in advance in areas frequently prone to flooding.	Immediately harvest the stocked fishes	--
(ii) Water exchange and changes in water quality	i. Strengthening of bunds and embankments either through turfing and terrracing		Application of lime to stabilize pH.
(iii) Health and diseases	i. Water quality management to be followed thoroughly by weekly sampling to monitor water quality parameters		Discard diseased stock and the following measures to be practiced: i. Drying up of confined water bodies ii. Let pond bottom to sun dry by cracking of soil to let out the release of obnoxious gases and other pests iii. Application of lime to balance soil pH.
(iv) Loss of stock and inputs (feed, chemicals etc)	The stock (feed and medicines) have to be stored separately in rooms designed for the purpose with air circulation facilities and they have to be stored on raised platforms to avoid loss		Discard stock if affected by water as they will lead to fungal borne infections in the fish stock.
(v) Infrastructure	i. Initiating fish culture in advance in areas frequently prone		As on date there has been no measure to give

damage (pumps, aerators, huts etc)	to flooding to prevent damage to the infrastructure		subsidy to the inland fish farmers for loss of fish stock or infrastructure hence the farmers are suffering a heavy loss. Therefore suggestions can be made to the Government to assess the impact of damage and the rate of compensation can be decided by the officials
(vi) Any other	Compensation to practicing inland fish farmers may be contemplated in case of cyclone. The practicing inland/marine fish farmers should register with the State Fisheries Department to avail the formulated compensation		
3. Cyclone / Tsunami	**Before the event**	**During the event**	**After the event**
A. Capture			
Marine			
(i) Average compensation paid due to loss of fishermen lives	As per prevailing Government norms		
(ii) Avg. no. of boats / nets/damaged	As per prevailing Government norms		
(iii) Avg. no. of houses damaged	**As per the existing government norms compensation is given to the fisherfolk whenever there is loss due to the impact of cyclones/tsunami		
Inland	**Cyclone / Tsunami**		

B. Aquaculture/ Mariculture	Before the event	During the event	After the event
(i) Overflow / flooding of ponds	i. Planting trees like casuarinas along coastal belt to avoid coastal erosion and inundation of sea waters.	--	
(ii) Changes in water quality (fresh water / brackish water ratio)	i. Stocking fishes which can tolerate wide salinity changes eg. Milkfish, pearl spot etc.	--	Application of lime to stabilize pH.
(iii) Health and diseases	i. Water quality management to be followed thoroughly by weekly sampling to monitor water quality parameters	--	Discard diseased stock and the following measures to be practiced: i. Drying up of confined water bodies ii. Let pond bottom to sun dry by cracking of soil to let out the release of obnoxious gases and other pests iii. Application of lime to balance soil pH.
(iv) Loss of stock and inputs (feed, chemicals etc)	i.The stock (feed and medicines) have to be stored separately in rooms designed for the purpose with air circulation facilities and they have to be stored on raised platforms to avoid loss	--	Discard stock if affected by water as they will lead to fungal borne infections in the fish stock.
(v) Infrastructure damage (pumps, aerators,	Initiating fish culture in advance in areas frequently prone to flooding to prevent damage to the infrastructure	--	-

shelters/huts etc)			
(vi) Any other	Training programmes for stakeholders including resource users, planners and policy makers on coastal regulations, shoreline protection and environmental awareness		
4 Heat wave and cold wave	**Before the event**	**During the event**	**After the event**
A. Capture			
Marine			i. To conduct studies on the ecological changes to assess the density and diversity of phyto and zooplankton and other benthic macro fauna
Inland			
B. Aquaculture	**Before the event**	**During the event**	**After the event**
(i) Changes in pond environment (water quality)			
(ii) Health and Disease management			
(iii) Any other	i. Conservation of our coral reefs (natural treasures) as they are the most diversified and complex marine ecosystems ii. Conserve sea grass beds by imposing strict measures on trawling, removal for commercial purposes.		