State: RAJASTHAN
Agriculture Contingency Plan for District: BIKANER

1.0 District Agriculture profile					
1.1	**Agro-Climatic/Ecological Zone**				
	Agro Ecological Sub Region (ICAR)	Western Plain, Kachchh And Part Of Kathiawar Peninsula, Hot Arid Eco-Region (2.1)			
	Agro-Climatic Zone (Planning Commission)	Trans Gangetic Plain Region (VI)			
	Agro Climatic Zone (NARP)	Irrigated North West Plain Zone (RJ-2)			
	List all the districts or part thereof falling under the NARP Zone	Bikaner, Ganganagar, Hanumangarh			
	Geographic coordinates of district headquarters	Latitude	Longitude	Altitude	
		$28^0$01'20.30" N	$73^0$18 57.64" E	245.7m	
	Name and address of the concerned ZRS/ ZARS/ RARS/ RRS/ RRTTS	Zonal Director Research, Agricultural research Station, Bikaner-334002			
	Mention the KVK located in the district	KVK, Sriganganagar Road, Beechwal, Bikaner - 334006			
1.2	**Rainfall**	Normal RF(mm)	Normal Rainy days	Normal Onset	Normal Cessation
	SW monsoon (June-Sep):	233.8	9	1st week of July	3rd week of Sept
	NE monsoon(Oct-Dec):	-	-	-	-
	Winter (Jan- March)	25.1	4	-	-
	Summer (Apr-May)	4.1	3	-	-
	Annual	263	16	-	-

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)	3040.5	1772	92.8	297.9	51.7	825.8	0.03	0.01	176.5	322.3

1. 4	**Major Soils (common names like red sandy loam deep soils (etc.,)***	**Area ('000 ha)**	**Percent (%) of total**
	Deep Yellowish brown sandy soils	3038	39.3
	Deep Light yellowish brown loamy soils	2984	38.6
	Medium Light yellowish brown loamy soils	1002	13.0
	Others Deep Pale brown loamy, medium yellowish brown sandy, shallow Pale brown gravelly sandy soils	686	08.9

	Total	7710.0	100

1.5	**Agricultural land use**	**Area (‘000 ha)**	**Cropping intensity %**
	Net sown area	1273.2	112.6
	Area sown more than once	161	
	Gross sown	1434.2	

1.6	**Irrigation**	**Area (‘000 ha)**		
	Gross irrigated area	375.3		
	Rainfed area	1036.4		
	Sources of Irrigation	Number	Area (‘000 ha)	Percentage of total irrigated area
	Canals		240.3	64.0
	Tanks	-	-	-
	Open wells	-	-	-
	Bore wells	7351	134.9	35.9
	Lift irrigation schemes	22	-	-
	Micro-irrigation		-	-
	Other sources (please specify)	-	-	-
	Total Irrigated Area		375.3	100.0
	Pump sets	62		
	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	3	-	Good
	Critical	5	-	Marginal saline
	Semi- critical	-	-	-
	Safe	-	-	-
	Wastewater availability and use	-	-	-
	Ground water quality			
*over-exploited: groundwater utilization > 100%; critical: 90-100%; semi-critical: 70-90%; safe: <70%				

1.7. Area under major field crops & horticulture (as per latest figures)

1.7	Major field crops cultivated	Area ('000 ha)							
		Kharif			*Rabi*				
		Irrigated	**Rainfed**	**Total**	**Irrigated**	**Rainfed**	**Total**	**Summer**	**Grand total**
	Pearl millet	5.2		256.8	-	-	-	-	-
	Groundnut	63.1	-	63.1	-	-	-	-	-
	Cluster bean	87.2		884.6	-	-	-	-	-
	Moth	0.9	-	275.0	-	-	-	-	-
	Gram	-	-	-	142.9		171.7	-	-
	Mustard	-	-	-	42.2	-	42.2	-	-
	Wheat	-	-	-	58.9	-	58.9	-	-

Horticulture crops

1.7	**Fruits**	**Area (ha)**		
		Total	**Irrigated**	**Rainfed**
	Aonla	0.02	0.02	-
	Ber	0.01	0.01	-
	Lime	0.01	0.02	-
	Kinnow	0.01	0.01	-
	Jamun	0.01	0.01	-
	Vegetables crops –	**Total**	**Irrigated**	**Rainfed**
	Onion	0.04	0.04	-
	Cauliflower	0.04	0.04	-
	Musk melon	0.03	0.03	-
	Long melon	0.05	0.05	-
	Carrot	0.12	0.12	-
	Medicinal and Aromatic crops-	**Total**	**Irrigated**	**Rainfed**
	Isabgol	3.19	3.19	-
	Sonamukhi	0.08	-	0.08
	Plantation crops-	-	-	-
	Fodder crops	**Total**	**Irrigated**	**Rainfed**
	Total fodder crop area	-	-	-
	Grazing land	-	-	-

1.8	**Livestock**	**Male (‘000)**	**Female (‘000)**	**Total (‘000)**
	Non descriptive Cattle (local low yielding)	-	-	608.8
	Crossbred cattle	-	-	
	Non descriptive Buffaloes (local low yielding)	-	-	132.7
	Graded Buffaloes	-	-	
	Goat	-	-	686.5
	Sheep	-	-	928.9
	Others (Camel, Pig, Yak etc.)	-	-	79.2
	Commercial dairy farms (Number)			NA
1.9	**Poultry**	**No. of farms**	**Total No. of birds (‘000)**	
	Commercial	NA	3.4	
	Backyard	-	-	
1.10	**Fisheries** (Data source: Chief Planning Officer) **-NA-**			

***** Source: Rajasthan Agricultural Statistics at a Glance, 2008-09, Commissioner ate of Agriculture, Rajasthan, Jaipur

1.11 Production and Productivity of 5 major crops (Average of last 5 years 2003-04 to 2007-08) Bikaner district

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)										
	Pearl millet	98.8	475	-	-	-	-	98.8	475	-
	Groundnut	80.3	1771	-	-	-	-	80.3	1771	-
	Cluster bean	98.4	255	-	-	-	-	98.4	255	-
	Mothbean	76.4	230	-	-	-	-	76.4	230	-
	Gram	-	-	85.3	680	-	-	85.4	680	-
Others	Mustard	-	-	47.1	1060	-	-	47.2	1060	-
	Wheat	-	-	92.1	2042	-	-	92.1	2042	-
Major Horticultural crops (Crops to be identified based on total acreage)										
	Aonla	25000	1041	-	-	-	-	25000	1041	-
	Ber	21000	1400	-	-	-	-	21000	1400	-
	Onion	45	1000	-	-	-	-	45	1000	-
	Musk melon	29	1000	-	-	-	-	29	1000	-
Others	Long melon	48	1000	-	-	-	-	48	1000	-
	Carrot	116	1000	-	-	-	-	116	1000	-

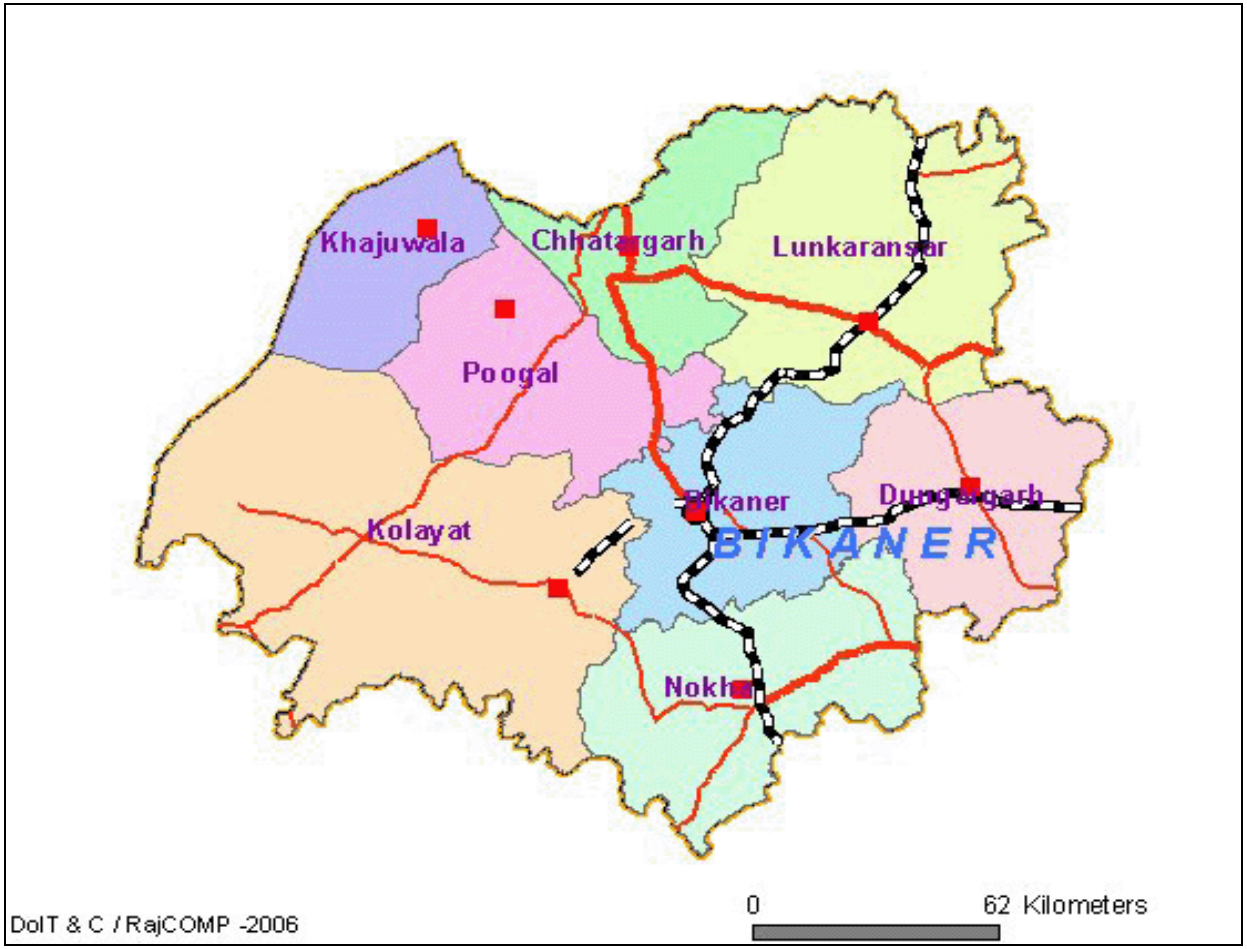
1.12 Sowing window (start and end of sowing period)

1.12	**Kharif**	**Bajra**	**Moth**	**Cluster bean**	**Groundnut**
	Kharif- Rainfed	Bajra (1st July to 15th July)	Mothbean(1st July-15th August)	Guar (1st July to 15th July)	-
	Kharif-Irrigated	15th June -30th June	-	-	15th April-15th June
	Rabi	**Gram**	**Mustard**	**Wheat**	-
	Rabi- Rainfed	5th October -30th October	-	-	-
	Rabi-Irrigated	15th October-15th November	15th October-10th November	10th November -10th December	-

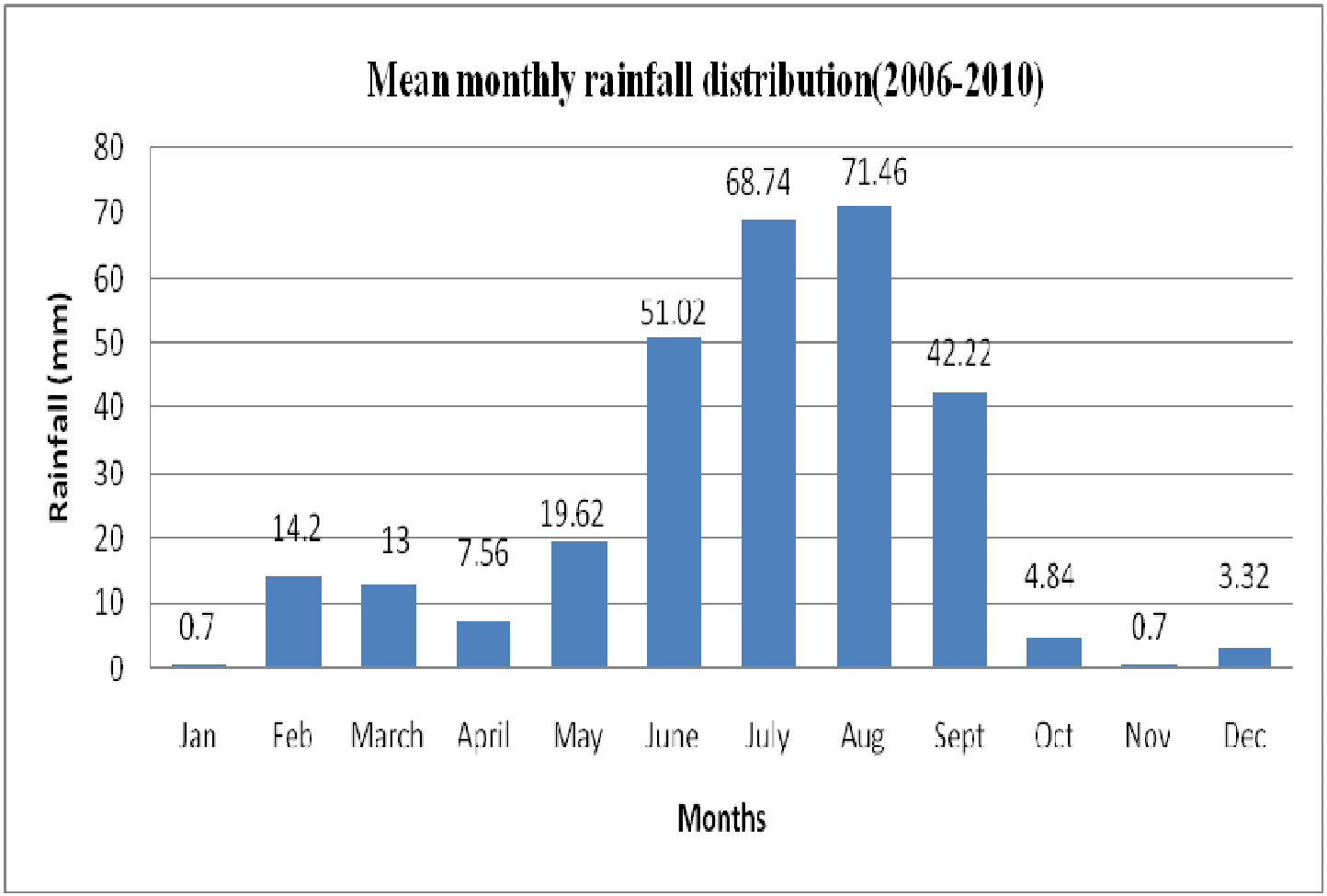
1.13	**What is the major contingency the district is prone to? (Tick mark)**	**Regular**	**Occasional**	**None**
	Drought	√	-	-
	Floods	-	-	√
	Cyclone	-	-	√
	Hail storm	-	-	√
	Heat wave	-	√	-
	Cold wave	-	√	-
	Frost	-	√	-
	Sea water intrusion	-	-	√
	Pests and disease outbreak (specify)	-	√ Downy mildew (Pearl millet)	-

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

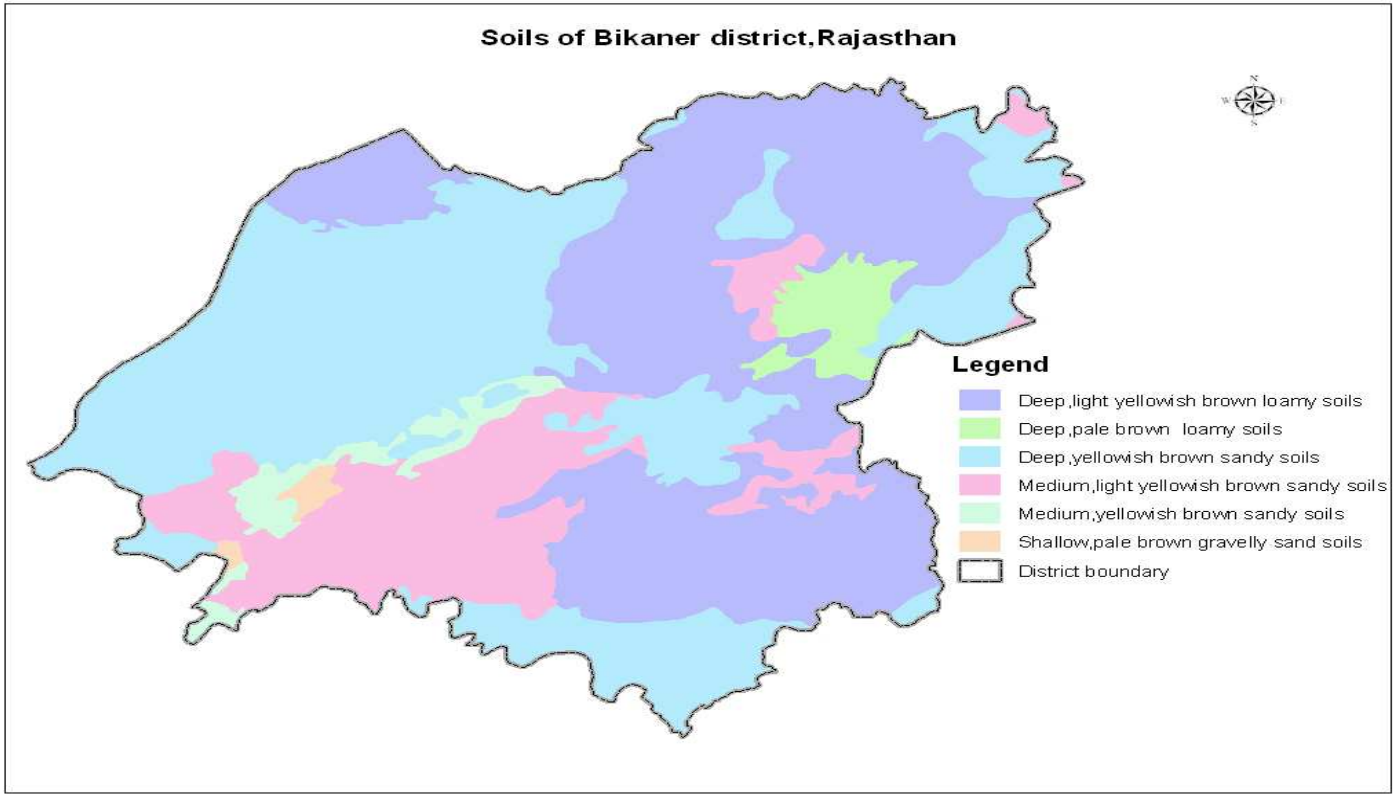
Annexure-I
Location map of Bikaner district



Annexure-II
Mean annual rainfall graph of Bikaner district



Annexure-III
Soil map



Source: NBSS&LUP, Regional Centre, Udaipur

2.0 Strategies for weather related contingencies

2.1 Drought

2.1.1 Rainfed situation

Condition			**Suggested Contingency measures**		
Early season drought (delayed onset)	**Major Farming situation**	**Normal crop/cropping syste**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delay by 2 weeks (3rd week of July)	Deep yellowish brown sandy soil (medium rainfall)	Bajra	No change	sowing at 45-60 cm Use press wheel behind tyne to obtain good germination Seed priming with thio urea (0.05%) for four hours.	Link NSC, RSSC, SAU quality seed. Implement may be procured under RKVY
		Mothbean	No change	Normal preferred practices	
		Clusterbean	No change	-do-	
		Mungbean	No change	-do-	
	Deep light yellowish brown loamy soil(high rainfall)	-do-	-do-	-do-	
	Rainfed medium light yellowish brown loamy soil (low rainfall)	-do-	-do-	-do-	

Early season drought (delayed onset)	**Major Farming situation**	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delay by 4 weeks (1st week of August)	Deep yellowish brown sandy soil (Medium rainfall)	Bajra	No Change Prefer varieties like HHB 67, ICMH 356 (extra early) Prefer mothbean & guar intercropping	• Replace 25% pearlmillet acre by guar and mothbean. • Sow pearlmillet at 60 cm • Use press wheel for sowing • Seed priming with 0.05% hiourea followed by foliar spray at vegetative & flowering.	Link NSC, RSSC,and SAU qualityseed and-NFSM for thio urea
		Mothbean	No change	Increase seed rate by 10-15%	
		Clusterbean	No Change Prefer varieties like	• Increase seed rate by 10-15% • Seed priming with 0.05% thio urea followed by foliar spray at	

Early season drought (delayed onset)	Major Farming situation	Normal Crop/cropping system	Change in crop/cropping system	Agronomic measures	Remarks on Implementation
			(RGC 936, RGC 1003)	vegetative & flowering	
		Mungbean	Mothbean, Guar like (RGC 936, RGC 1003)	increase seed rate of guar by 10-15%	
	Deep light yellowish brown loamy soils (high rainfall)	-do-	-do-	-do-	
	Medium light yellowish brown loamy soils (low rainfall)	-do-	-do-	-do-	

Early season drought (delayed onset)	Major Farming situation	NormalCrop/cropping system	Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Delay by 6 weeks (3rd week of August)	Deep yellowish brown sandy soils (Medium rainfall)	Bajra	Prefer varieties like Fodder bajra (Raj.Chari-2) Mothbean	-	Link NSC, RSSC, SAU for quality seed
		Mothbean	No Change. Prefer varieties like RMO 40	• seed priming with 0.05% thio urea followed by foliar spray of 0.05%thio urea at vegetative and flowering stage • Increase seed rate by 15-20 %.	
		Clusterbean	No Change. Prefer varieties like RGC 936	• Seed priming with 0.05% thio urea followed by foliar spray of 0.05%thio urea at vegetative and flowering stage. • Increase seed rate by 15-20 %.	
		Mungbean	Mothbean	-	
	Deep light yellowish brown loamy soils (High rainfall)	-do-	-do-	-do-	
	Medium light yellowish brown loamy soils(low rainfall)	-do-	-do-	-do-	

Early season drought (delayed onset)	Major Farming situation	NormalCrop/cropping system	Change in crop/cropping system	Agronomic measures	Remarks on Implementation
Delay by 8 weeks (1st week of September)	Deep yellowish brown sandy soils (Medium rainfall)	Bajra	Keep fallow	Conserve soil moisture by *Bhakhar* & planking and utilize residual soil moisture for rabi crops like taramira (RTM 314), gram(RSG 888)	Link NSC, RSSC, SAU for quality seed
		Mothbean	Keep fallow	-do-	
		Clusterbean	Keep fallow	-do-	
		Mungbean	Keep fallow	-do-	
	Deep light yellowish brown loamy soils (High rainfall)	-do-	-do-	-do-	
	Medium light yellowish brown loamy soils (low rainfall)	-do-	-do-	-do-	

Condition			Suggested Contingency measures		
Early season drought (Normal onset, followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient and moisture conservation measures**	**Remarks on Implementation**
	Deep yellowish brown sandy soils (Medium rainfall)	Bajra	Fill up the gaps with transplanted seedlings raised from community seedlings	Dust mulching with hoe	Link NSC, RSSC, SAU for quality seed. Implements for hoeing & weeding be procured under RKVY
		Mothbean	Gap filling with improved var. of seeds if the gaps will around 30%	-do-	
		Clusterbean	-do-	-do-	
		Mungbean	-do-	-do-	
	Deep light yellowish brown loamy soils (High rainfall)	-do-	-do-	-do-	
	Medium light yellowish brown loamy soils (low rainfall)	-do-	-do-	-do-	

Condition			Suggested Contingency measures		
Mid season drought(long dry spell)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient and moisture conservation measures**	**Remarks on Implementation**
At vegetative stage	Deep yellowish brown sandy soils (Medium rainfall)	Bajra	➢ Thinning of 20-25 % plants with in the row, ➢ Spray of thiourea @ 500 pp during the dry soell	Dust mulch with hoe ot harrow Avoid top dressing of urea Life saving irrigation from farm pond if possible Alternate furrow irrigation Apply10-20kgN/ha after relief of fry spell to gain lost vigor	Link watershed, MANREGA, NREGS for the support of farm pond technology
		Mothbean	Spray of thio urea at 500 ppm during the dry spell	-do-	
		Clusterbean	Spray of thiourea at 500 ppm at vegetative.	-do-	
		Mungbean	Spray 2% urea or MOP during the dry spell	-do-	
	Deep light yellowish brown loamy soils (High rainfall)	-do-	-do-	-do-	
	Medium light yellowish brown sandy soils (Low rainfall)	-do-	-do-	-do-	

Condition			Suggested Contingency measures		
Mid season drought (long dry spell)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient and moisture conservation measures**	**Remarks on Implementation**
At reproductive stage	Deep yellowish brown sandy soils (medium rainfall)	Bajra	Spray of thiourea at 500 ppm	Life saving irrigation with water from water harvesting structure. Alernate furrow irrigation Top dressing of 10-20 kgN/ha or Spraying of 2% urea after relief of dry spell	Water harvesting structure can be constructed under MANREGA

Condition			Suggested Contingency measures		
Mid season drought (long dry spell)	**Major Farming situation**	**Normal Crop/cropping system**	**Crop management**	**Soil nutrient and moisture conservation measures**	**Remarks on Implementation**
		Mothbean		Life saving irrigation with water from water harvesting structure Alernate furrow irrigation Top dressing of 10-20 kgN/ha or Spraying of 2% urea after relief of dry spell	
		Clusterbean	Spray of thiourea at 500 ppm	-do-	
		Mungbean	-do-	-do--	
	Deep light yellowish brown loamy soils(High rainfall)	-do-	-do-	-do-	
	Medium light yellowish brown sandy soils (Low rainfall)	-do-	-do-	-do-	

Condition			Suggested Contingency measures		
Terminal drought	**Major Farming situation**	**Normal crop/cropping system**	**Crop management**	**Rabi Crop planning**	**Remarks on Implementation**
Early withdrawal Monsoon Terminal drought	Deep yellowish brown sandy soils (Medium rainfall)	Bajra	Life saving irrigation with farm pond water If damage will be severe, Harvest for fodder	Sowing of Barley using poor quality water in kolayat/Nokha/Bikaner	Water harvesting structure can be constructed under MANREGA
		Mothbean	-do-	-do-	
		Custerbean	-do-	-do-	
		Mungbean	-do-	-do-	
	Deep light yellowish brown loamy soils (High rainfall)	-do-	-do-	-do-	

Condition			Suggested Contingency measures		
Terminal drought	**Major Farming situation**	**Normal crop/cropping system**	**Crop management**	**Rabi Crop planning**	**Remarks on Implementation**
	Medium light yellowish brown sandy soils (Low rainfall)	-do-	-do-	-do-	

2.1.2 Irrigated situation

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delayed release of water in canals due to low rainfall	Canal IGNP Irrigated area	Groundnut	No change Prefer short duration varieties viz., TG 37 A, TBG-39	• Irrigation at critical crop growth stages • Alternate furrow irrigation • In=situ moisture conservation measures • Use sprinkler/micro Pressurized irrigation method.	LinkGovernment schemes for the support of micro irrigation systems Create awareness and skill improvements to the farmers through KVKs
		Guar	No change Prefer RGC-986, RGC 1017, RGC 1003	• In-situ moisture conservation measures • Irrigation at critical crop growth stages • Use sprinkler/micro Pressurized irrigation method	
		Cotton	No change. Prefer RST-9,Bikaneri nerma, Ganganagar ageti, Rs 2013 and RG-8, RG-18	Reduce area under cotton Alternate furrow irrigation in cotton Use drip irrigation method.	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
		Mungbean	No change Prefer var. likeRMG-344, RMG 268	• Irrigation at crical crop growth stages • Alternate furrow irrigation • Use sprinkler Pressurized irrigation method.if feasible	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Delayed release of water in canals due to low rainfall	Canal Irrigated areas-	Wheat	No Change Prefer varieties like Raj-3765, Raj 4083	Irrigate by sprinkler method at critical stages. Spray 0.05 % Thiourea at reproductive stage.	Thio urea and Sprinkler system may be obtained under NFSM
		chickpea	No Change Prefer varieties like RSG 888, RSG 807, RSC 44	Irrigate by sprinkler method at critical stages. Spray 0.05 % Thiourea at reproductive stage.	
		Mustard	No Change Prefer varieties like Laxmi, Bio-902 ,RGN 48	Irrigate by sprinkler method at critical stages. Spray 0.05 % Thiourea at reproductive stage.	

Condition			Suggested Contingency measures		
	Major Farming situation	**Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Limited release of water in canals due to low rainfall	Canal Irrigated area	Ground nut	No Change Prefer varieties like TG-37 A, TBG-39.	Use water at critical crop growth stages with alternate furrow Prefer Pressurized irrigation	Sprinkler system may be obtained under Govt schemes

Condition			Suggested Contingency measures		
	Major Farming situation	**Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
			Reduce area under groundnut	method if feasible, Mulching in crop rows	
		Guar	No Change Prefer varieties like RGC-986, RGC 1017, RGC 1003 Area of groundnut or cotton may be put under this crop	Use water at critical crop growth stages with alternate furrow Use Pressurized irrigation method if feasible Mulching crop rows	
		Cotton	No Change Prefer desi cotton varieties like RST-9,Bikaneri nerma, Ganganagar ageti, Rs 2013 and desi cotton RG-8,RG-18 Reduce area under the crop	Alternate furrow irrigation in cotton Mulching in crop rows Use micro irrigation systems if feasible	
		Mungbean	No Change Prefer varieties like RMG-344, RMG 268 Area of groundnut or cotton may be put under this crop	Use water at critical crop growth stages with alternate furrow Use Pressurized irrigation method if feasible, Mulching crop rows	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Limited release of water in canals due to low	Canal Irrigated areas	Wheat	No Change Prefer varieties like Raj-1482,Raj	➢ Irrigate by sprinkler at critical stages. ➢ Spray 0.05 % Thiourea at reproductive stage.	Sprinkler system may be obtained

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
rainfall			3077,Raj 3765,Raj 3777, Raj 4083	➢ Reduce area under wheat and allocate area under mustard/barley/gram/ isabgol	under Govt schemes
		chickpea	No Change Prefer varieties like RSG 888, RSG 807, GNG 663,	➢ Irrigate by sprinkler method at only at critical stages. ➢ Replace wheat area by gram	
		Mustard	No Change Prefer varieties like T59,Bio 902,Pusa bold, Aravali, RGN 13, RGN 48, Laxmi,	➢ Irrigate by sprinkler method at only at critical stages. ➢ Spray 0.05 % Thiourea at reproductive stage. ➢ Replace area of wheat by mustard	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Non release of water in canals under delayed onset of monsoon in catchment	Canal Irrigated areas	Ground Nut	Mothbean (RMO 40, RMO 257,RMO 435), Guar (RGC 936,1003) or Bajra (HHB 67-I), ICMH 356) Bajra Fodder	Seed priming with 0.05% thiourea foliar spray at vegetative and reproductive stage in mothbean and guar Dust mulch with hoe Rain water harvesting, recycling through farm ponds	Use of NSC, RSSC, SAU for quality seed Link watersheds,NREGSfor the support of farm pond Technology
		Cotton	In saline water area poogal/Khajuwal sowing of cotton in limited area may be done	-do-	
		Guar	No Change Prefer varieties like RGC 936	Seed priming with 0.05% thiourea Foliar spray at vegetative and reproductive stage Dust mulch with hoe	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
				Rain water harvesting, recycling through farm ponds	
		Mungbean	No Change Prefer varieties like RMG 344,RMG 268	-do-	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Non release of water in canals under delayed onset of monsoon in catchment	Canal Irrigated areas	Wheat	Do not prefer wheat Small area may be put under taramira/gram if conserved moisture is available	Dust mulching Life saving irrigation with ranwater collected in farm pond	Link watersheds and NREGS for the support of farm pond technology-
		Gram	Only gram, mustard, barley or Taramira may be grown if conserved moisture is available because of late season rain fall	Dust mulching Life saving irrigation with ranwater collected in farm pond	
		Mustard	Only gram, mustard, barley or taramira be grown if conserved moisture is available because of late season rain fall	Dust mulching, Spray 0.05 % Thiourea at reproductive stage. Life saving irrigation with ranwater collected in farm pond	

Lack of inflows into tanks due to insufficient /delayed onset of monsoon	**N. A.**

Condition			**Suggested Contingency measures**		
	Major Farming situation	**Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Insufficient groundwater recharge due to low rainfall	Tube well area	Ground Nut	Reduce area under groundnut, prefer short duration varieities (TG 37 A and TBG 39). Allocate groundnut area to low water requiring crops viz. Moth (RMO 40, RMO 257) Guar RGC 936,RGC 1003) Bajra (HHB 67 I,ICMH 356)	Irrigate crops with ground water in conjuction with rainwater harvesting through water harvesting structures Use micro irrigation systems like sprinkler or drip if feasible	Link watersheds and NREGS for the support of farm pond technology
		Cotton	Prefer (RST-9,Bikaneri nerma, Ganganagar ageti, Rs 2013 and RG-8,RG-18	Irrigate crop by drip irrigation at critical stages with water from both rainwater harvesting and ground water resources	
		Guar	No change Prefer var. like RGC-986, RGC 1017, RGC 1003	Irrigate crop by pressurized irrigation at critical growth stages Seed pricing with 0.05% thiourea followed by foliar spray at vegetative & foliar stage.	
		Mungbean	No change Prefer var. likeRMG-62, RMG 268	Irrigate crop by pressurized irrigation at critical growth stages	

Condition			Suggested Contingency measures		
	Major Farming situation	**Normal Crop/cropping system**	**Change in crop/cropping system**	**Agronomic measures**	**Remarks on Implementation**
Insufficient groundwater recharge due to low rainfall	Canal Irrigated areas	Wheat	Reduce wheat area depending upon water availability Grow whear var. like Raj 3077,Raj 3765,Raj 3777, Raj 4083 Allocate wheat area to gram/taramira(RTM-314), Isaggol (RI 1)	Irrigate crop by sprinkler method at critical stages Dust mulching	Link watersheds and NREGS for the support of farm pond technology
		Gram	Reduce area Sowing of early maturing and drought tolerant varieties of Gram viz. RSG 888, RSG 807, RSG 44, GNG 663	Irrigate crop by sprinkler method at critical stages Dust mulching	
		Mustard	Reduce area Grow Bio 902,Pusa bold, Aravali, RGN 13, RGN 48	Irrigate crop by sprinkler method at critical stages Dust mulching Spray 0.05 % Thiourea at vegetative and reproductive stages.	

2.2 Un-timely/ unseasonal rains

Condition	Suggested contingency measure			
Continuous high rainfall in a short span leading to water logging	**Vegetative stage**	**Flowering stage**	**Crop maturity stage**	**Post Harvest**
Bajra/mothbean/guar	-	Provide drainage	N.A.	N.A.
Horticulture				
Heavy rainfall with high speed winds in a short span				
Chickpea	-	Control heliothis by spraying	N.A	Drying of the

		Indoxacarb 14.5 SC 0.1% or Spinosad 45 SC 0.03%. Control fungal diseases by spraying 0.2% carbendazim		produce immediately after stoppage of rain
Condition	**Suggested contingency measure**			
Mustard	-	-	Spraying of 0.2 % *Trichoderma hamatum* + *T.Viride* for control of stem rot	-
Wheat	-	-	Stop irrigation	-
Horticulture				
Ber	-	Foliar spray of NAA 50 ppm	-	Dispose of the dropped fruits or prepare value added products
Outbreak of pests and diseases due to unseasonal rains				
Chickpea	-	-	Control heliothis by spraying Indoxacarb 14.5 SC 0.1% or Spinosad 45 SC 0.03%. Control fungal diseases by spraying 0.2% carbendazim	Dry the produce before storage to prevent storage pest and fungal infection
Mustard	N.A.	-	Spraying of 0.2 % mancozeb	-do-
Wheat	N.A.	N.A.	Stop irrigation	-do-

2.3 Floods

Condition	**Suggested contingency measure**			
Transient water logging/ partial inundation	**Seedling / nursery stage**	**Vegetative stage**	**Reproductive stage**	**At harvest**
	N.A.			
Horticulture	**N.A.**			
Continuous submergence for more than 2 days	**N.A.**			

Sea water inundation	**N.A.**

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

Extreme event type	**Suggested contingency measure**			
	Seedling / nursery stage	**Vegetative stage**	**Reproductive stage**	**At harvest**
Heat Wave				
Wheat	-	-	Irrigate, spray 1000 ppm thiourea at grain filling stage	-
Mustard	-	-	Apply surface irrigation, spray 1000 ppm thiourea at grain filling stage	-
Chickpea	-	-	Irrigate	-
Cotton	-	-	Spray with 2% KNO_3	-
Horticulture				
Kinnow	-	-	-	-
Cold wave				
Mustard	-	-	Apply light irrigation	-
Chickpea	-	-	-do-	-
Castor	-	-	-do-	-
Horticulture				
Aonla	N.A.	N.A.	-	-
Frost				
Mustard	-	-	Apply light irrigation	-
Chickpea	-	Apply irrigation, Spray of 0.1% H_2SO_4	-do-	-
Horticulture				
Aonla	-	-	Apply irrigation	-

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	As the district frequently prone to drought, it should have some feed and fodder reserves at any point of the year for mobilization to the drought affected villages, Hence the under mentioned feed reserves should be created at district head quarter Urea molasses mineral bricks (UMMB):50-100 t Hay:100-250 t Concentrates: 20-50 t Minerals and vitamin supplements mixture:5-10 t Available crop residues especially Bajra Karabi, Wheat/barley straw/ Chopped sewan/Dhaman/Bharut/ Dry leaves of Jharberi/ Groundnut bhusa should be stored properly in the farm of hay at individual farmer level. Harvest the top fodder (Khejari, Neem, Subabul, Acasia, Pipol etc) and create fodder banks at village level Establishment of silvi-pastoral system in CPRs with ***Stylosanthus hamata*** and ***Cenchrus ciliaris*** as grass with ***Leucaena leucocephala*** as tree component Top dressing of N in 2-3 split doses @ 20-25 kg N/ha in CPRs with the monsoon pattern for higher biomass production Increase area under short duration fodder crops of sorghum/bajra/maize(UP chari, MP chari, HC-136, HD-2, GAINT BAJRA, L-74, K-677, Ananad/African Tall, Kisan composite, Moti, Manjari, B1-7 etc.,) on farmers fields with some input subsidy Avoid burning of wheat straw	Harvest and use all the failed crop (Sorghum, Mothbean, Clusterbean, Greengram Wheat, Groundnut etc.,) material as fodder and feed the Livestock. Use judiciously the karabi, Preserved sewan /Dhaman /Bharut, Wheat straw, Lopped Khejari High productive animals should be Supplemented with tree fodder Available feed and fodder should be cut from CPRs and stall fed in order to reduce the energy requirements of the animals **In case of Severe drought:** UMMB, hay, concentrates and vitamin & mineral mixture should be transported to the drought affected villages All the hay should be enriched with 2% Urea molasses solution or 1% common salt solution and fed to LS Herd should be split and supplementation should be given only to the highly productive and breeding animals Provision of emergency grazing/feeding (Cow-calf camps or other special arrangements to protect high productive & breeding stock) Available kitchen waste should be mixed with dry fodder while feeding Arrangements should be made for mobilization of small ruminants across the districts where no drought exits Unproductive livestock should to be culled during severe drought Create transportation and marketing facilities for the culled and unproductive animals (10000-20000 animals) Subsidized loans should be provided to the livestock keepers for procurement of feed	Flushing the stock to recoup Replenish the feed and fodder banks

	Harvesting and collection of perennial vegetation particularly grasses which grow during monsoon Proper drying, bailing and densification of harvested grass Capacity building and preparedness of the stakeholders and official staff for the extreme events		
Heat & Cold wave	Arrangement for protection from **heat wave** i) Provision shed with bamboo/thatched material ii) Plantation around the shed iii) H_2O sprinklers / foggers in the shed **iv)** Application of white reflector paint on the roof **Cold wave :** Covering all the wire meshed walls / open area with gunny bags/ polyethylene sheets (with a mechanism for lifting during the day time and putting down during night time)	Allow the animals early in the morning or late in the evening for grazing during heat waves Allow for grazing between 10AM to 3PM during cold waves Feed green fodder/silage / concentrates during day time and roughages / hay during night time in case of heat waves Add 25-50 ml of edible oil in concentrates and fed to the animal during cold waves Put on the foggers / sprinkerlers during heat weaves and heaters during cold waves In severe cases, vitamin 'C' and electrolytes should be added in H_2O during severe heat waves. Apply / sprinkle lime powder in the animal shed during cold waves to neutralize ammonia accumulation	Feed the animals as per routine schedule Allow the animals for grazing (normal timings)
Health and Disease management	Procure and stock emergency medicines and vaccines for important endemic diseases of the area All the stock must be immunized for endemic diseases of the area Surveillance and disease monitoring network to be established at Joint Director (Animal Husbandry) office in the district Adequate refreshment training on draught management to be given to VAS, Jr.VAS, LI with regard to health & management measures. Procure and stock multivitamins & area specific mineral mixture	Carryout deworming to all animals entering into relief camps Identification and quarantine of sick animals Constitution of Rapid Action Veterinary Force Performing ring vaccination (8 km radius) in case of any outbreak Restricting movement of livestock in case of any epidemic Rescue of sick and injured animals and their treatment Organize with community, daily lifting of dung from relief camps	Keep close surveillance on disease outbreak. Undertake the vaccination depending on need Keep the animal houses clean and spray disinfectants Farmers should be advised to breed their milch animals during July-September so that the peak milk production does not coincide with mid summer
Insurance	Encouraging insurance of livestock	Listing out the details of the dead animals	Submission for insurance claim and availing insurance benefit Purchase of new productive animals

Drinking water	Identification of water resources Desilting of ponds Rain water harvesting and create water bodies/watering points (when water is scarce use only as drinking water for animals) Construction of drinking water tanks in herding places/village junctions/relief camp locations Community drinking water trough can be arranged in shandies /community grazing areas	Restrict wallowing of animals in water bodies/resources Provide clean drinking water	Bleach (0.1%) drinking water / water sources Provide clean drinking water

2.5.2 Poultry

	Suggested contingency measures		
	Before the event[a]	**During the event**	**After the event**
Drought			
Shortage of feed ingredients	Storing of house hold grain like wheat, sorghum, bajra etc, Culling of weak birds	Supplementation only for productive birds with house hold grain Supplementation of shell grit (calcium) for laying birds	Supplementation to all
Drinking water	Rain water harvesting	Sanitation of drinking water	Give sufficient water as per the bird's requirement
Health and disease management	Culling of sick birds. Deworming and vaccination against RD and IBD	Mixing of Vit. A,D,E, K and B-complex including vit C in drinking water	Hygienic and sanitation of poultry house Disposal of dead birds by burning / burying with line powder in pit
Heat wave			
Shelter/environment management	Provision of proper shelter with good ventilation	In severe cases, foggers/water sprinklers/wetting of hanged gunny bags should be arranged Don't allow for scavenging during mid day	Routine practices are followed
Health and disease management	Deworming and vaccination against RD and IBD	Supplementation of house hold grain Provide cool and clean drinking water with electrolytes and vit. C In hot summer, add anti-stress probiotics in drinking water or feed	Routine practices are followed
Cold wave			
Shelter/environment management	Provision of proper shelter Arrangement for brooding Assure supply of continuous electricity	Close all openings with polythene sheets In severe cases, arrange heaters Don't allow for scavenging during early morning and late evening	Routine practices are followed

Health and disease management	Arrangement for protection from chilled air	Supplementation of grains Antibiotics in drinking water to protect birds from pneumonia	Routine practices are followed

2.5.2 Fisheries: Not Applicable.