Block Level Contingency Plan for Weather Aberrations in Sangamner Block of Ahmednagar District of Maharashtra

BUILDING RESILIENCE TO CLIMATE VARIABILITY

CENTRAL RESEARCH INSTITUTE FOR DRYLAND AGRICULTURE - केराकृअनुस - 1985

WOTR water gives life

About WOTR

The WOTR Group consists of 4 not-for-profit institutions – the Watershed Organisation Trust (WOTR); the Sampada Trust (ST) for women's empowerment and micro-finance; Sanjeevani Institute for Empowerment and Development (SIED) which is the implementation wing of WOTR; and Sampada Entrepreneurship and Livelihoods Foundation (SELF) that has recently been set up to promote social enterprises and livelihoods.

Outreach: Since its inception in 1993, WOTR has carried out developmental work, also in partnership with other agencies in over 2,500 villages in six states – Maharashtra, Andhra Pradesh, Madhya Pradesh, Rajasthan, Jharkhand and Odisha (Orissa). It has organized over 1,100 watershed development (which are also climate adaptation projects), covering nearly 700,000 hectares and impacting over 1,000,000 people. Its involvement in over 8,300 women's Self Help Groups (SHGs), micro-finance, trainings and other initiatives have benefitted over 100,000 women. Similarly, over 320,000 people from 27 states in India and 35 countries have participated in WOTR's Training and Capacity Building programs.

Climate Change Adaptation: As of now, WOTR's Climate Change Adaptation project is currently being implemented in 65 villages of Maharashtra, Madhya Pradesh and Andhra Pradesh covering an area approximately of 41,000 ha (410 km^2), directly benefitting over 63,000 people from around 12,000 households.

WOTR's Approach: Aware of the fragility of ecosystems and our symbiotic link with it, WOTR has historically applied a systems-based approach to watershed development, focusing on people-centric participatory interventions. With more-than-normal weather variations now being experienced, WOTR has moved into **Ecosystem-Based Adaptation (EBA)** – an emerging approach that helps vulnerable communities build resilience of their degraded ecosystems and livelihoods threatened by climate change impacts. This approach also generates significant multiple benefits – social, economic and cultural.

Since 2008, WOTR has been reorienting, re-organising and equipping itself with respect to focus, strategy and interventions in order to specifically address the challenges (and opportunities) posed by climate change to vulnerable rural communities. In the process, WOTR has introduced a bottom-up, holistic and integrated approach with appropriate interventions, towards **Adaptation and Resilience Building.**

Constantly learning from experience, we have been **rethinking conventional development**. We have introduced **Systems Thinking and Complexity Analysis** in program design and are developing strategies to incorporate these into action plans, leading to new **tools and frameworks** while adapting the existing ones. This helps us move to **Framework-Based Management**, in contrast to activity based project design and management.

Applied Research is a constant companion. The WOTR team, guided by experts, helps local communities become researchers – observing, measuring, and assessing for themselves not only problems but also the improvements that a project brings about. And having tested methodologies, WOTR disseminates the learning through **Capacity Building Events** to reach implementers and donors, far and wide, so as to benefit rural communities across India and countries in the South.

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AUTHORS

Mrs. Prajakta Amitkumar Patil

- Agricultural Research Officer, WOTR, Pune from August 2012 Onwards.
- Senior Research Fellow, IMD (Agrimet), Pune (January 2011 to August 2012)
- Assistant Professor of Agronomy, Krishna College of Agriculture, Karad (August 2005-May 2010)

Dr. K.V. Rao

- Senior Scientist at CRIDA from January 2006 onwards
- Scientist (Senior Scale) at CRIDA, 2001-2005
- Scientist at CRIDA 1997-2001
- Scientist at CIAE, Bhopal (January 1997-December 1997)
- OIC, ARIS since 2003

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Prajakta Patil
Agricultural Research Officer,
Watershed Organisation Trust (WOTR), Pune-9

Dr. K.V. Rao
Principal Scientist (SWC),
CRIDA, Hyderabad

FOREWORD

Farmers are already experiencing climate variability – the precursor and manifestation of a profound long term shift underway in climate dynamics – and they are largely unprepared for it. Centuries of farming wisdom, born of closely observing and responding to broadly stable and predictable weather patterns, is proving unable to anticipate and provide a plan for unfamiliar changes in temperature, rainfall and the increasing incidence of extreme weather events.

In the drought-prone Sangamner Taluka of the Ahmednagar District, in the last 10 years (2001-2010) alone, there have been 65 days when the temperature exceeded 40° C as compared to 40 days in the preceding decade (1991-2000). The last 40 years weather data shows longer periods of dry spells, late onset and early withdrawal of monsoon. Drought, for example, which usually occurred once in a five year period before 1980 has now been observed occurring twice in five years during the last 30 years (1981 to 2010). The amount, intensity and frequency of rainfall limit the choice of crops a farmer can plant; choices which are predicated on uncertainly and unknown variables – practically a gamble, a throw of the dice.

This unpredictability and severity of weather behaviour – the "unknown-ness" – that confounds the farmer, reduces his ability to adapt and also, often so, exceeds his capacity to cope with it. Farmers need to get timely and reliable weather forecasts together with crop-specific advisories in order to enable them to cope with erratic weather behaviour. In particular, they need alternatives and management advice to handle different contingencies arising from extreme or unforeseen meteorological occurrences.

The Watershed Organisation Trust (WOTR) has made a modest beginning in providing this kind of support to farmers in a localized area – the Sangamner and Akole Talukas, in collaboration with the Indian Meteorological Department (IMD), the Central Institute for Dryland Agriculture (CRIDA) and the Mahatma Phule Krishi Vidyapeeth (MPKV) and with the financial support of the National Bank for Agriculture and Rural Development (NABARD) and the Swiss Development Cooperation (SDC).

WOTR has installed Sixteen Automated Weather Stations (AWSs) in twenty contiguous project villages (having a "catchment" of 2683 farming households) which collect weather data on an hourly basis. Of these at present, eight are telemetrically connected to WOTR, who after harmonising the data forwards the same to the IMD. The IMD then sends to WOTR 3-day weather forecasts, village wise. Based on these forecasts, WOTR draws upon its GIS-enabled farmer data base to provide situation and crop-specific advisories to farmers through SMSs and through Wall Papers. Feedback is then obtained from participating farmers and the knowledge base is further fine-tuned and improved.

We are pleased to offer a Contingency Crop Plan for the farmers of Sangamner Block. We hope that this will help them be better prepared to cope with unseasonal or extreme weather behavior, reduce risk and, to an extent, "climate-proof" their farming efforts.

I would like to thank Dr. L.S. Rathore, Director General, IMD; Dr. B. Venkateswarlu, Director General , CRIDA; Dr. N. Chattopadhyay, Head Agrimet, IMD Pune; Dr. S.K. Roy Bhowmik, DDGM (NWP), IMD New Delhi; Dr. K.V. Rao, Principal scientist (SWC), CRIDA, Prof. A.A. Shaikh and Prof. T.S. Bhondave of the College of Agriculture, Pune who have consistently provided us with expert guidance and institutional support. This Contingency Plan would not have materialized but for the persistence and dedication of Crispino Lobo and Prajakta Patil of WOTR.

This effort is a work-in-progress and as we gain from interaction and feedback from the participating farmers, we will further improve our approach and methodologies to strengthen the resilience and capacities of farmers to do farming that is "climate-smart". We welcome feedback and suggestions that would help us further this quest.

Dr. Marcella D'Souza
Executive Director,
WatershedOrganisation Trust,
Pune 411009

PREFACE

In large parts of Maharashtra, agriculture depends heavily on south west monsoon as it contributes 75% of the rainfall. Timely onset and distribution of rainfall are critical for realizing the maximum yields under rainfed conditions. Adequate amount of rainfall during the south west monsoon period not only supports production of major crops such as cereals, pulses, oilseeds but also determines the success of rabi crops through carrying out sufficient moisture during the rabi season. However, delay in onset of monsoon and intermittent dry spells at different stages of crop growing season limit the production and productivity of rainfed areas threatening food security of poor households. When the onset of monsoon gets delayed, farmers face difficulties in timely planting and do not realize economic yields. Whenever, there is deficient in rainfall during the kharif season as in 2012 in Mahsrashtra, the agricultural production gets effected significantly.

It has been widely believed that due to the climate change, the variability is going to increase in the years to come. There is enough evidence now that shows increased frequency of droughts as well as high intensity rainfall are affecting agriculture production. We are increasingly witnessing drought and flood like situations during the same season. Contingency plans, which look at these adverse weather events, needs to be prepared for situations such as drought, flood, heat wave, cold wave, etc. to make informed decisions for addressing the variability. With the active support from Ministry of Agriculture, Government of India, CRIDA prepared such contingency plans at district level for different states of India.

I am happy to note that WOTR (Watershed Organisation Trust) has prepared contingency plans at block level under the climate change adaptation project which is being implemented in 53 villages of Maharashtra covering an area of 33,242 ha (332 sq.kms), directly benefitting 52,000 people from 9,800 households. The preparation of contingency plans at the block level would go a long way in formalizing them at more decentralized locations such as blocks and is an essential component considering the divergence in crop production systems and natural resources available. The dissemination of information through advisories to farmers on what steps to take in the event of droughts, floods, etc is an important activity to optimize productivity and for securing sustainable livelihoods. The publication on contingency plans of Sangamner covers all aspects related to drought, heat wave, cold wave, floods and covers interventions related to crops.

I am sure this publication will be immensely useful to all the stakeholders at the block and the village level for taking decisions and operationalising the contingency plans in the cluster. I compliment the efforts of WOTR and their staff for bringing out this useful publication.

B. Venkateswarlu,
Director, CRIDA, Hyderabad
Date: 20, May 2013
Place: Pune

INTRODUCTION

The South West S-W monsoon account for nearly 75% of the precipitation received in the country and therefore exerts a strong influence on *kharif* food grain crops production (and also on rabi crops), farmers' income and ultimately on the national economy. The frequency and quantum of rainfall as well as temperature regimes varies in various parts of the country, as well as even within the same agro-ecological zone. The objective of working out this contingency plan for the Kharif season in Sangamner Block of the Ahmednagar District is to help farmers better face the challenges of weather aberrations and variability that they experience during the crop season.

The Watershed Organisation Trust (WOTR) has been working in the Sangamner Block since the last 20 years, organizing communities regenerate the watersheds they live in and adopt sustainable agricultural practices. As part of its Climate Change Adaptation project being implemented in 20 villages of this block, WOTR, in collaboration with the Central Research Institute for Dry land Agriculture (CRIDA) has undertaken a study to develop contingency strategies to help the farmer cope with unexpected weather events and build a measure of resilience to nature's vagaries. This Kharif Contingency Plan is the outcome of this effort.

The Need for Block level Contingency Plans:

- Ahmednagar district comes under the scarcity zone of Maharashtra. However, despite similarities in dominant cropping pattern, agriculture practices adopted by the local farming community tend to vary according to variation in weather conditions within the district.
- Many a time, the weather aberrations that are experienced at the micro or block level are not experienced in an adjacent area or even a neighboring block of the same district.
- Block level contingency plans can be helpful in providing short and medium term support during adverse meteorological events and can build the capacities of farmers to cope with climate-induced stresses.
- Planning and projections against varied climate-related contingency scenarios can help farmers purchase appropriate inputs (seeds, bio-fertilizers, fertilizers, organic manures etc.) when required, in a timely manner
- When coping with weather-induced contingencies, it is important to adopt a holistic coping strategy involving a variety of measures. Such holistic planning increases the chances of riding out extreme stresses. Inclusion of use of various formulating which serves as a low cost input technology/indigenously prepared organic formulations such as Jeevamrit and Amritpani.

Methodology Adopted:

For preparing this Contingency Plan, thirty years weather data of Sangamner Block has been studied for all major weather-related aberrations including extreme events *viz.*, droughts, high temperature, low temperatures, high intensity rainfall, frost and hailstorm together with cropping systems followed and crop varieties grown. Based on this, the sowing window for important five crops was decided. Moreover, data on soil profile, land use systems and irrigation sources has been used to develop coping strategies for different meteorological events such as untimely rains, dry spells, cold waves etc. However, since Sangamner block is largely subjected to periodic drought, dry spells, irregular and deficient rainfall, we have focused our planning on addressing this risk and hazard for crops grown in rainfed and irrigated conditions. In this regard, the following scenarios have been considered:

***Kharif*: Drought situations in Rainfed conditions:**

1) Early season drought (delay in onset of monsoon by 2, 4, 6 and 8 weeks).
2) Normal rain onset followed by 15-20 days dry spell.
3) Midseason drought (long dry spell)
4) Terminal drought (early withdrawal of monsoon)
5) Unusual rains.

***Rabi*: Drought situations in Irrigated conditions:**

1) Delayed receipt of rains by N-W monsoon
2) Limited water supply through wells & farm ponds
3) Insufficient ground water recharge due to low rainfall in monsoon
4) Continuous high rainfall in a short span leading to water logging

Sangamner Crop Profile:

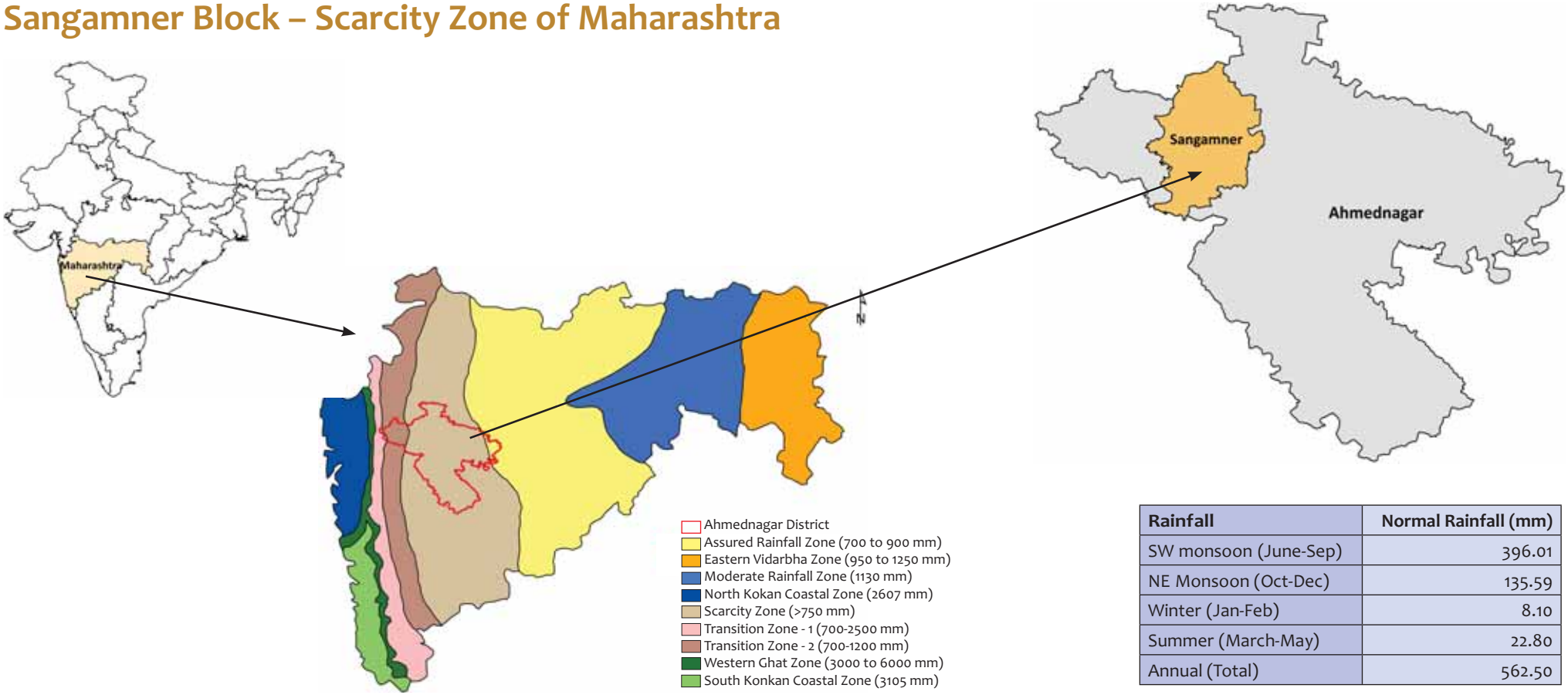
Kharif is an important cropping season while Bajra, Sorghum, Pulses, Groundnut, Maize, Soybean, Sunflower, Onion and Tomato are major crops. Short duration pulses followed by *Rabi* Sorghum in mid September are remunerative on deep soils during normal rainfall year. Suitable intercropping systems have been suggested based on crop canopy cover and integrated nutrient and pest management (INPM) aspects. Onion and Tomato are important vegetable crops for which improved planting methods and plant geometry has been suggested.

Agro-Climatic Zone:
Maharashtra state has been divided into nine broad Agro-Climatic Zones. Sangamner block of Ahmednagar district comes under the Western Maharashtra Scarcity Zone. This area suffers from the twin problems of low productivity and high instability as a result of inadequate and unpredictable rainfall. The annual rainfall is less than 600mm. The bimodal rainfall distribution has been observed out of which one peak has been observed during June-July and second during month of September. High temperature values and high wind velocity result in high potential evaporation values leading to moisture deficit.

Soils of the Sangamner block have been classified as Shallow (22.5 cm), Medium (22.5-90cm) and Deep soils (above 90cm).The contingency crop planning has been done for these major three soil types.

Soil moisture conservation techniques:
Different soil moisture conservation techniques have been suggested as water is an important input for agriculture. These include cultural, mechanical and chemical measures. Cultural moisture conservation methods include stubble mulch and intercropping systems, Amritpani, Jeevamrit, Amritkhadya, etc. Mechanical moisture conservation methods include frequent hoeings, weedings *etc.* while chemical measures include anti-transpirant sprays.

Sangamner Block – Scarcity Zone of Maharashtra



Rainfall	Normal Rainfall (mm)
SW monsoon (June-Sep)	396.01
NE Monsoon (Oct-Dec)	135.59
Winter (Jan-Feb)	8.10
Summer (March-May)	22.80
Annual (Total)	562.50

State: Maharashtra

Crop Contingency Plan for: Sangamner Block, Ahmednagar District

1.0 Sangamner Agriculture Profile

1.1	**Agro-Climatic /Ecological Zone**			
	Agro Ecological Sub Region (ICAR)	Deccan Plateau, Hot Semi-Arid Eco-Region		
	Agro-Climatic Region (Planning Commission)	Western Plateau and Hills Region (IX)		
	Agro Climatic Zone (NARP)	Western Maharashtra Scarcity Zone (MH-6)		
	Geographic coordinates of Sangamner block	**Latitude**	**Longitude**	**Altitude**
		19°46' 46.56"N to 19°12' 10.44"N	73°40' 01.92" E to 74°49'13.79" E	804 m MSL
1.2	**Rainfall**	**Normal Rainfall (mm)**	**Normal onset of monsoon**	**Normal Cessation**
	SW monsoon (June-Sep)	396.01	Second week of June	Fourth week of September
	NE Monsoon (Oct-Dec)	135.59		
	Winter (Jan-Feb)	8.10		
	Summer (March-May)	22.80		
	Annual (Total)	562.50		

1.3	**Land use pattern of the district**	**Geographical area**	**Cultivable area**	**Forest area**	**Land under non-agriculture use**	**Cultivable wasteland**
	Area (ha)	166232.23	99637.00	32000.00	18948.00	15313.00

(Source: Third Report on 'Monitoring and Evaluation of Artificial Recharge of Ground Water Programme/Schemes/Projects in Rainfed Regions of Maharashtra'; National Rainfed Area Authority, Planning Commission, GoI, New Delhi, November 2011)

1.4	Sowing window for major crops in the region	Pearl millet	Soybean	*Rabi* Sorghum	Gram	Wheat
	Kharif – Rainfed	15th June to 15th July	15th June to 15th July	–	–	–
	Kharif – Irrigated	15th June to 15th July	15th July to 25th July	–	–	–
	Rabi – Rainfed	–	–	15th September to 15th October	15th September to 25th September	1st November to 15th November
	Rabi – Irrigated	–	–	--	20th October to 10th November	1st November to 15th November

1.5 Major contingencies to be considered in the Sangamner Block are as below:

S.No.	Major contingencies that this area 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 intrusion	--	--	√
9	Pests and disease outbreak (specify)	--	--	--
10	Others (specify)	--	--	--

1.6 Recommended Organic Manure for Different Crops.

S.No.	Crop	Compost (t/ha)	Vermi-compost (t/ha)
1	Pearl millet (bajara)	7.5	5
2	Sorghum	12.5 to 15	7.5
3	Wheat	12.5 to 15	7.5
4	Maize	12.5 to 15	7.5
5	Soybean	12.5 to 15	7.5
6	Tomato	12.5 to 15	7.5
7	Onion	15	10

Note: The compost and vermin-compost are considered as bulky organic manures and hence recommend to apply in the field two to three weeks before sowing.

2.0 Strategy for weather related contingencies

2.1 *Kharif* – Drought

2.1.1 Rainfed situation: Monsoon onset delayed by 2 weeks (i.e by 4th week of June)

Condition	Suggested Contingency measures				
Early season drought	**Major soil type**	**Normal crop/ cropping system**	**Change in crop/cropping system including variety**	**Crop Management and Soil Moisture Conservation Measures**	**Source for purchase of different inputs**
Delay by 2 weeks (onset by 4th week of June)	Shallow grey soils	Pearl millet	Pearl millet (Shraddha, Saburi, Shanti), local Sole or Pearl millet (Shraddha, Saburi, Shanti, local) + Pigeon pea (No.148, N-290-21,Vipula) (2:1)	Seed treatment with *Azotobacter* for pearl millet and rhizobium for pigeon pea @ 25 g/kg of seed Application of Compost @20 t/ha (Basal application of 25 kg K_2O per ha for pearl millet)	MPKV, Rahuri Private co.-op. Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
		Green Gram	J-781, PM-2 and Vaibhav, local	Seed treatment with *Rhizobium* @ 25 g/kg of seed Resistant to powdery mildew	
		Tomato	Phule Raja, Bhagyashree, Dhanashree, Rajashree	1) For one m^2 of nursery area apply 5kg well rotten FYM and 20 g each of N, P and K fertilizer. Also apply 200 g of neem cake or 2.5g carbofuran and 10-25 g *Trichoderma* 2) To avoid damping off disease treat the seeds with *Trichoderma* @ 5-10 g/Kg seed or carbendazim @ 2g/Kg seed. 3) The treated seeds are dried in shade for 30 minutes and then sown sparsely along the lines at ½ cm depth. It is then covered with top soil.	
	Medium deep black soils	Soybean	Soybean (JS-335, DS-228, JS-9305, local) Intercropping with Pigeon pea (Vipula) (6:2)	Soybean seed treatment with Thiram + Carbendazim @ 2 g each/kg seed. Soyabean seed treatment with *Rhizobium* @ 25 g/ kg of seed Treat pigeon pea seed with *Trichoderma* @ 5 g per kg of seed	
		Maize	Manjri, African tall, Karveer, Rajashree, Navjyot, Prabhat, local	Follow moisture conservation techniques: weeding, hoeing, mulching Inter-cropping with Green gram/ Cowpea/Soybean	
		Onion	Nasik Red, Phule Samarth, Baswant-780	Seed treatment with Thiram (2g/1Kg seed) to control onion damping off.	
	Deep black soils	Soybean	Soybean/Soybean +Pigeonpea (6:2) or (8:2) intercropping	Soybean seed treatment with Thiram + Carbendazim @ 2 g each/kg Soybean seed treatment with *Rhizobium* @ 25 g/ kg of seed Treat pigeon pea seed with trichoderma @ 5 g per kg of seed.	
		Onion	Nasik Red, Phule Samarth, Baswant -780	Seed treatment with Tebuconazole 28.3%, (100 mg/100 g seed) to control onion smut. Protective irrigation	

2.1.2 Rainfed situation: Delayed onset of monsoon by 4 weeks (by 2nd Week of July)

Condition	Suggested Contingency measures				
Early season drought	**Major soil types**	**Normal crop/ cropping system**	**Change in crop/cropping system including variety**	**Crop management and Soil Moisture Conservation Measures**	**Source for purchase of different inputs**
Delay by 4 weeks (onset by 2nd week of July)	Shallow grey soils	Pearl millet	Pearl millet (Shraddha, Saburi, Shanti) , local Sole or Pearl millet (Shraddha, Saburi, Shanti, local) + Pigeonpea (No.148, N-290-21,Vipula) (2:1)	Spacing for Pearl millet:45cm X 45cm (wide spacing) Spacing for pigeon pea: 45cm*30 cm Basal application of 25 kg K2O per ha for pearl millet Two light hoeings 30 and 45 DAS (Days After Sowing)	MPKV, Rahuri Private, co.-op Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
		Green Gram	J-781, PM-2 and Vaibhav, local	Seed treatment with *Rhizobium* for @ 25 g/ kg of seed Resistant to powdery mildew	
		Tomato	Phule Raja: (100-110days) Bhagyashree: (100-110 days) Dhanashree: (110-120 days) Rajashree: (110-120 days)	Seed treatments with Trichoderma Preparation of nursery seedlings by providing irrigation. To avoid damping off disease treats the seed with Tricoderma @ 5-10 g/Kg seed or carbendazim 2g/Kg seed. The treated seeds are dried in shade for 30 minutes and then sown sparsely along the lines in ½ cm depth and then covered by the topsoil.	
	Medium deep black soils	Soybean	Soybean (JS-335, DS-228, JS-9305, local) Soybean + Pigeon pea (Vipula) (6:2) Intercropping	Soybean seed treatment with Thiram + Carbendazim @ 2 g each/kg seed. Soybean seed treatment with *Rhizobium* @ 25 g/ kg of seed Treat pigeon pea seed with *Trichoderma* @ 5 g per kg of seed	
		Maize	Manjri, African tall, Karveer, Rajashree, Navjyot, Prabhat, local	Sowing with wide plant spacing (60*45cm^2) For moisture conservation- mulching and frequent hoeing.	
		Onion	Phule Samarth, Baswant -780, N-2-41, local varieties –(Nasik Red)	Seed treatment with Thiram (2g/1Kg seed) to control onion damping off.	
	Deep black soils	Soybean	Soybean Soybean + Pigeon pea (6:2) Intercropping	Soybean seed treatment with Thiram + Carbendazim 2 g each/kg/seed Treat pigeon pea seed with *trichoderma* @5 g per kg of seed	
		Onion	Phule Samarth, Baswant-780, N-2-41, local varieties – (Nasik Red)	Seed treatment with Thiram (2g/1Kg seed) to control onion damping off.	

2.1.3 Rainfed situation: Delayed onset of monsoon by 6 weeks (by 4th Week of July)

Condition	Suggested Contingency Measures				
Early season drought (delayed onset of monsoon)	**Major soil type**	**Normal crop/ cropping system**	**Change in crop/cropping system including variety**	**Crop management and Soil Moisture Conservation Measures**	**Source for purchase of different inputs**
Delay by 6 weeks (Onset by 4th week of July)	Shallow grey soils	Pearl millet	Pearl millet for fodder (Giant Bajra)	One hoeing and weeding before 30 DAS* Increase nitrogenous fertilizer (25%dose)	Seed source MPKV, Rahuri Private, co.-op Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
		Green Gram	PM-2 and Vaibhav	One hoeing and weeding before 30 DAS	
		Tomato	Pearl millet for fodder (Giant Bajra)	One hoeing and weeding before 30 DAS Increase nitrogenous fertilizer (25% dose)	
	Medium deep black soils	Soybean	Sunflower (SS-56/Bhanu)	Hoeing at 30 DAS Opening of conservation furrows in between two rows of sole sunflower for water/moisture	
		Maize	Maize (fodder -African tall)	Increase nitrogenous fertilizer (25% dose) Protective irrigation along with jeevaamrut	
		Onion	Fodder Sorghum (Phule Amruta/MP Chari/CSV-21F)	Application of 20: 20 N:P2O5 kg/ha as basal and remaining 20 kg N per ha at 30 DAS with sufficient soil moisture	
	Deep black soils	Soybean	Sunflower (SS-56/Bhanu)	Hoeing at 30 DAS Opening of conservation furrows in between two rows of sole sunflower for water/moisture	
		Onion	Fodder Sorghum (Phule Amruta/MP Chari/CSV-21F)	Application of 20: 20 N:P2O5 kg/ha as basal and remaining 20 kg N per ha at 30 DAS with sufficient soil moisture	

*DAS- Days After Sowing

2.1.4 Rainfed situation: Delayed onset of monsoon by 8 weeks (by 2nd Week of August)

Early season drought (delayed onset)	Major soil type	Normal crop/ cropping system	Change in crop/cropping system including variety	Crop management and Soil Moisture Conservation Measures	Source for purchase of different inputs
Delay by 8 weeks 2nd week of August	Not Applicable for the Region				

2.1.5 Rainfed situation: Normal onset of monsoon followed by 15-20 days Dry spell.

Condition	Suggested Contingency measures			
	Major soil types	**Normal crop/cropping system**	**Crop management and Soil Moisture Conservation Measures**	**Source for purchase of different inputs**
Normal onset followed by 15- 20 days dry spell after sowing leading to poor germination/ crop stand etc.	Shallow grey soils	Pearl millet	Mulching will be helpful to retain the soil moisture – hoeings for soil mulch Removal of the weeds (Hoeing at 20 DAS and weeding at 30 DAS (Days After Sowing) Application Of Amritpani @ 200 litres/acre as a spray.	Seed source MPKV, Rahuri Private, co.-op Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
		Green Gram	Weeding to minimize weed population Application of Amritpani @ 200 litres/acre as a spray.	
		Tomato	Weeding, stubble mulching Protective irrigation along with Jeevamrit*	
	Medium deep black soils	Soybean	In case of less than 40 % germination, Follow re-sowing with wider spacing of 45 cm with sufficient soil moisture Hoeing at 25 DAS	
		Maize	Gap filling/Re-sowing with wider spacing of 50x50 cm or 60X45cm Hoeing at 25 DAS Application Of Amritpani @ 200 litres/acre as a spray.	
		Onion	Maintain the soil moisture by plastic or stubble mulch Protective irrigation through sprinkler Application of Amritpani @ 200 litres/acre as a spray.	
	Deep black soils	Soybean	In case of less than 40 % germination, Follow re-sowing with wider spacing of 45 cm with sufficient soil moisture Hoeing at 25 DAS Application Of Amritpani @ 200 litres/acre as a spray.	
		Onion	Maintain the soil moisture by plastic or stubble mulch Protective irrigation through sprinkler Application of Amritpani @ 200 litres/acre as a spray.	

*Jeevamrit: Given along with irrigation water @200 lit/ha as a source of biofertilizer which helps to enhance the water holding capacity of soil.

2.1.6 Rainfed situation: Mid-Season Drought: At Vegetative Stage

Condition	Suggested Contingency Measures			
Mid season drought (long dry spell, consecutive 2 weeks rainless (< 2.5 mm) period) at vegetative stage	**Major soil types**	**Normal crop/ cropping system**	**Crop management and soil moisture conservation measures**	**Source for purchase of different inputs**
	Shallow grey soils	Pearl millet	Mulching will be helpful to retain the soil moisture Repeated hoeing is best as soil mulch Use of 8% kaolin spray as an anti-transpirant. Removal of the weeds for controlling loss of water through transpiration from weed canopy.	Anti-transpirants are available at Agro service centers of the region
		Green Gram	Weeding to minimize weed population Use of 8% kaolin spray as an anti-transpirant.	
		Tomato	Weeding to minimize weed population Protective irrigation at an interval of 5-6 days along with jeevamrit	
	Medium deep black soils	Soybean	Protective irrigation along with Jeevamrit, spraying of anti-transpirant Amritpani spray, hoeing and weeding	
		Maize	Mulching will be helpful to retain the soil moisture-hoeing is best for soil mulch, Use of 8% kaolin spray as an anti-transpirant. Removal of last two leaves from the plant Removal of the weeds for controlling loss of water through transpiration from weed canopy. Hoeing/Weeding	
		Onion	Protective irrigation along with Jeevamrit, spraying of Amritpani	
	Deep black soils	Soybean	Protective irrigation along with Jeevamrit	
		Onion	Protective irrigation along with Jeevamrit	

2.1.7 Rainfed situation: Mid-Season Drought: At Flowering/Fruiting stage

Condition	Suggested Contingency Measures			
Mid season drought (long dry spell)	**Major soil types**	**Normal crop/cropping system**	**Crop management and soil moisture conservation measures**	**Source for purchase of different inputs**
At flowering/fruiting stage	Shallow grey soils	Pearl millet	Weed control: removal of last two- three leaves (which shows senescence) from the plant and put in rows as mulch Use of 8% kaolin spray Protective irrigation	Anti-transpirants are available at Agro service centers of the region
		Green gram	Use of 8 % kaolin spray as an anti-transparent. protective irrigation	
		Tomato	Weeding, stubble mulching Protective irrigation at an interval of 5-6 days Spraying of Amritpani	
	Medium deep black soils	Soybean	Protective irrigation, hoeing, mulching Use of 8% kaolin spray	
		Maize	Weed control, removal of last two-three leaves (which shows senescence) from the plant and put in rows as mulch. Use of 8% kaolin spray Protective irrigation	
		Onion	Protective irrigation	
	Deep black soils	Soybean	Protective irrigation	
		Onion	Protective irrigation	

2.1.8 Rainfed situation: Mid season Drought: At Flowering/Fruiting stage

Condition	Suggested Contingency Measures				
Terminal drought (Early withdrawal of monsoon)	**Major soil types**	**Normal crop/ cropping system**	**Crop management**	**Crop planning for rabi season**	**Source for purchase of different inputs**
	Shallow grey soils	Pearl millet	In case of poor grain filling, harvest for fodder	No *rabi* crop	Source MPKV, Rahuri Private, co.-op Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
		Green gram	Protective irrigated conditions	Wheat under protective irrigated conditions	
		Tomato	Amritpani spraying @ 200 litres/acre	Chick pea (Vijay/Virat/Digvijay/local)	
	Medium deep black soils	Soybean	Protective irrigated conditions Application of Jeevamrit	Chick pea (Vijay/Virat/Digvijay/local)/Safflower (Bhima/local)/Sunflower (SS-56/local)	
		Maize	Harvest the crop when the cob is in the milky stage for fodder purpose-65 DAS (2nd week of September)	Chick pea (Vijay/Virat/Digvijay/local)/Safflower (Bhima)/Sunflower (SS-56)	
		Onion	protective irrigated conditions Application of Jeevamrit	Chick pea (Vijay/Virat/Digvijay/local)/Safflower (Bhima)/Sunflower (SS-56)	
	Deep black soils	Soybean	-do-	Wheat (Tapovan, Trimbak, Godavari)	
		Onion	-do-	Wheat (Tapovan, Trimbak, Godavari)	

3.1 *Rabi* – Drought

3.1.1 Draught – Irrigated situation: Delayed receipt of rains from N-W monsoon

Condition	Suggested Contingency Measures				
Delayed receipt of rains from N-W monsoon in October monsoon)	**Major soil type**	**Normal crop/ cropping system**	**Change in crop/cropping system**	**Crop management and Soil Moisture Conservation Measures**	**Source for purchase of different inputs**
	Shallow grey soils	*Rabi* Sorghum	Phule Yashoda, Phule Anuradha, Phule Vasudha, Maldandi	Seed treatment with *Azotobacter* @ 25 g/kg of seed to control smut deseases in sorgham.	Seed source MPKV, Rahuri Private, co.-op Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
	Medium deep black soils	Wheat	Wheat (Tapovan, Trimbak, Godavari) and/Gram (Vijay, Digvijay, Virat)	Irrigate at critical stage specifically at crown root initiation (21-24 DAS) Sowing window: 15 November to first week of December	
		Gram	Vijay, Digvijay, Virat, local varieties	Seed treatment with rhizobium culture @ 25 g/kg of seed	
		Maize	African tall, Karveer, local	Spacing: 45x45 cm^2. Sowing on ridges and furrows.	
		Onion	N-2-4-1, Phule Samarth, Phule Suvarna	Sprinkler irrigation as a protective irrigation.	



3.1.2 *Rabi*: Limited Water Supply through Well and Farm pond

Condition	Major soil types	Normal crop/ cropping system	Suggested Contingency Measures		
			Change in crop/cropping system	Major farming situation	Source for purchase of different inputs
Limited water supply through well and farm ponds	Shallow grey soils	*Rabi*-Sorghum	Short duration varieties: Phule Yashoda, Phule Anuradha, Phule Vasudha, Maldandi	Use of Jeevamrit at the time of protective irrigation	Seed source: Central campus MPKV, Rahuri MPKV, Rahuri Private, co.-op Distributors 1. Laxmi Agroservice centre, Sakur phata, Sangamner 2. Shramik Agroservice centre, Sangamner 3. Sanjeevani Agroservice centre, Sakur phata, Sangamner
	Medium deep black soils	Wheat	Intercropping with mustard and rajgira	Short duration varieties: Tapovan, Trimbak, Godavari for wheat	
		Gram	Adopt spacing of 1) rainfed conditions =30x10 cm^2 2) irrigated conditions= 45x10cm^2	Selection of short duration gram varieties : Vishal, Vikas, Local	
		Onion	Planting on broad bed furrows	Varieties: local, Phule Samarth	
		Maize	African tall, Karveer	Sowing on ridges and furrows	

3.1.3 *Rabi*: Insufficient groundwater recharge in open wells due to low rainfall in monsoon

Condition	Major soil types	Normal crop/ cropping system	Suggested contingency measures
Insufficient groundwater recharge due to low rainfall	Shallow grey soils	*Rabi* Sorghum	Protective irrigation as per the water availability as follows: 1) One: At primordial stage:(30-35 DAS) 2) Two: - First at primordial stage: (30-35 DAS); - Second at boot stage (50-60 DAS) 3) Three: Same as above & third at flowering (80-85 DAS) 4) Four: Same as above & fourth at grain filling (95 DAS)
	Medium deep black soils	Wheat	As per the availability of no. of irrigations: 1) One: At late tillering (40-45 DAS) 2) Two: First at CRI (20-25 DAS); Second at flag leaf (65 DAS) 3) Three: -First at CRI (20-25 DAS); - Second at late tillering (40-45 DAS); -Third at flag- leaf stage (65 DAS)
		Gram	Two light irrigations: first at branching and second at pod filling stage are helpful to increase the yield Or light sprinkler irrigation at branching and pod filling stage are beneficial
		Maize	Sprinkler irrigation at an interval of 8-10 days
		Onion	Micro sprinkler irrigation at an interval of 8-10 days

3.1.4 *Rabi*: Continuous high rainfall in a short span leading to water logging

Condition	Suggested Contingency Measures			
Continuous high rainfall in a short span leading to water logging	**Vegetative stage**	**Flowering stage**	**Crop maturity stage**	**Post harvest**
Pearl millet	Drain out excess water Give second dose of N at optimum soil moisture (at field capacity moisture content level)	Drain out excess water	Harvest at physiological maturity stage	After harvest shift to safe place in order to protect from wetting of grain. Sun drying of the produce up to 10-12% moisture content
Soybean	Drain out excess water	As above	As above	As above
Maize	Drain out excess water Give second dose of N at optimum soil moisture (at field capacity moisture content level)	As above	As above	As above
Onion	As above	As above	As above	After harvest shift to safe place in order to protect from wetting of bulbs. Storage in traditional 'chawl' and improved 'Kanda Chawl' storage structures
Pomegranate	1. Cleaning and maintenance of the basins 2. Draining out excess of water from the field, orchards and basins 3. Drenching of orchard with copper fungicides 4. Treating the stems - 10% Bordeaux paste, Geru paste with systemic insecticide 5. Spraying with Amrit Pani or 2% Urea Spray			

3.2 Floods
Not applicable in the region.

3.3 Extreme events
Heat wave/cold wave/frost/hailstorm/cyclone: Not applicable.

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Schweizerische Eidgenossenschaft
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Watershed Organisation Trust (WOTR)
'The Forum', 2nd Floor, S.No. 63/2B, Padmavati Corner,
Pune Satara Road, Parvati, Pune 411009, India.
Phone: +91-20-24226211 • Fax: +91-20-24213530
Email: info@wotr.org • Website: www.wotr.org

Central Research Institute for Dryland Agriculture
Director, CRIDA (ICAR), Santoshnagar, Hyderabad 500059, India
Phone : +91-40-24532243, 24530161 • Fax: +91-40-24531802, 24535336
E-mail: admin@crida.in • Website: www.crida.in or http://crida.in

Design: fatherofshr@gmail.com Print: Mudra