

**Contingency Plan for Farmers of Jammu Region in
Response of Forecast of Delayed Southwest Monsoon
for the Year 2023**



By

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Introduction

Weather and climate play a key role in agricultural production. Rainfall behaviour in dry farming areas is erratic and uncertain. The deviations in rainfall behaviour commonly met with in dry areas include delayed onset, early withdrawal and intermediary dry spells during rainy season. The adverse effect of these rainfall aberrations on crop growth vary with the degree of deviation and the crop growth stage at which such deviations occur. Suitable manipulations in crop management practices are needed to minimize such adverse effects of abnormal rainfall behaviour. These management decision, constitute contingency planning. Such management practices done after crop establishment and in the middle of crop growth are called mid season or mid term corrections. Aberrant weather is a common feature of rainfed agriculture. Four important aberrations in the rainfall behaviour have been more commonly observed are:

1. The commencement of rains may be quite early or considerably delayed.
2. Dry spell immediately after sowing.
3. There may be prolonged breaks during the southwest monsoon season during which most of the dry land crops are grown and
4. Rains may terminate earlier than normal cessation date or may continue beyond the normal rainy season.

Contingency cropping is growing of a suitable crop in place of normally sown highly profitable crop of the region due to aberrant weather conditions. In dryland agriculture, contingency of growing another crop in place of normally grown crop arises due to delay in the onset of monsoon. Depending upon the date of receipt of rainfall, crops are selected. It is assumed that the rainfall for the subsequent period is normal and depending upon the economic status of the farmer, certain amount of risk is taken to get good profits if season is normal or better than normal. Contingency cropping is highly location specific due to variation in amount and distribution of rainfall. Especially in arid regions, the spatial distribution of rainfall is highly variable. It is common to observe that rainfall received varies from field to field in the same location. Temperature gradually falls from August onwards reaching minimum in November and December. Contingency plan and midterm corrections vary with the type and time of occurrence of rainfall aberration. Crops have to be selected with suitable crop duration to coincide with the length of the growing season. Generally short duration pulses may suit the situation. However if the monsoon turns to be extraordinarily good, opportunity is lost if only short duration crops are sown. Farmers with economic strength and motivation for high profits with some amount of risk can go for crops of long duration. The long duration crops with flexibility or elasticity in yield are more suitable.

Aberrant weather and contingency crop planning

I. Early (2nd to 3rd week of June) and normal (4th week of June to 2nd week of July) on set of monsoon

- In early on-set of monsoon go for sowing of medium to short varieties of pearl millet. Whereas in normal on-set situation go for sowing in the order of bajra, guar, moth bean, mung bean, sesame etc.
- Fertilizer placement as per recommendations + insecticide application
- Inter/mix cropping of pearl millet with *kharif* legumes in appropriate ratios
- Short to medium duration crops and their varieties
- Safe removal of excess water

II. Monsoon delayed after 15th July up to 3rd week of July

- Short duration varieties of bajra and *Kharif* legumes
- Fertilizer placement + insecticides application
- Weed control and crust breaking
- Proper IPM measures
- Seed treatment in the order of FIB
- Wider spacing of crops with proper interculture operations

III. After 4th Week of July upto 1st week of August

- Divert more area to pulses and oil seeds with mixed cropping of both the crops along with use of short duration varieties
- No fertilizer application but use insecticide for termite control
- Seed treatment with FIB
- Thiourea spray (0.05%)
- High seed rate by 15-20%
- Mixed/inter cropping of early maturing varieties of bajra with mung, moth, guar and cowpea
- Dry sowing of clusterbean in single grain sandy soils

IV. Rains after 10th of August: Abstain sowing of kharif crops but go for moisture conservation measures and stale seed bed preparation for growing of rabi crops on conserved moisture and under certain agroecological situations (tank bed/*Khadin*/heavy to medium soils).

V. Long dry spells during crop growth period

- Drought is in early seedling stage re-sowing of crops with seed treatment
- Dry period after 30-45 days of growth: Thinning of excess plants, moisture conservation in between the rows, with mulching and mechanical means.

- Life saving irrigation
- Crop failure in *kharif* if occurs after mid August: Do not go for re-sowing but conserve soil moisture for rabi crop.

VI. Early withdrawal of monsoon (by 15th to 20th of August)

- Removal of weeds and their use for mulching
- In the mixed cropping system remove the most sensitive crop first and use as fodder for animals.
- Life saving irrigation if feasible.
- In tank bed go for early sowing of rabi crops like *taramera*, chickpea, linseed etc. *In-situ* moisture conservation measures.

VII. Mid season corrections for crops already sown.

- Breaking of crust and weed management by mechanical means.
- Removal of alternate rows of dryland crops and making use for animal feeding.
- Effective pest and disease management
- Life saving irrigation to the crops in areas of water availability.
- Spray of thiourea 0.05% on the standing crop.
- Mulching in row spaces as per feasibility.

In recent past, the increased frequency of extreme climatic events has caused enormous damage to agriculture sub-sectors particularly in the Indian subcontinent and the states like Jammu and Kashmir. The District Agricultural Contingency Plans (DACP) are technical documents which serves as ready reckoner for line departments and farming community on prevailing farming systems and technological interventions to manage various weather aberrations such as droughts, floods, cyclones, hailstorms, heat and cold waves addressing different sectors of agriculture. The contingency plans are useful for preparedness and real time implementation towards sustainability of agriculture production system in the events of weather aberrations and extreme climatic events. District level contingency plans contain integrated information on agriculture and allied sectors i.e., horticulture, livestock, poultry, fisheries and technological solutions for all the major weather related aberrations including extreme events viz., droughts, floods, heat wave, cold wave, untimely and high intensity rainfall, frost, hailstorms, pest and disease outbreaks and are aimed to be utilized by district authorities.

The rise in temperature of the earth surface and in atmosphere, fluctuations in rainfall, flooding due to high intense rainfall events, frequent droughts, high velocity winds, sea level rise due to melting of glacier, etc., are all the clear evidences of climate change phenomenon These extreme weather events are climatic anomalies which have major impact on food and nutritional security of human and animal populations. In recent times the frequency of these events is

increasing causing enormous damage not only to agriculture but also to other sectors like horticulture, livestock, poultry and fisheries.

The overall implementation strategy of contingency plans involves (a) initial preparedness (b) real time response to weather aberrations and (c) relief and rehabilitation. Implementation of DACPs, in the face of abnormal weather conditions, with extensive planning and collective actions among stakeholders can show positive results in off-setting of sowing area reduction under deficient monsoon rainfall.

However, in the present document four scenarios with respect delayed monsoon have been considered based on recent forecast advisory issued by IMD. The normal onset of monsoon in Jammu region is 27th of June ± 8 days. However, as per the as per the information of AICRPAM, SKUAST-J, four scenarios with week's lag time have been developed in reference to normal onset of monsoon. Information furnished for expected monsoon scenarios is presented as preparedness and contingency plans in respect of cereals, pulses, fruit crops, vegetables, engineering measures for soil and water conservation, seed availability and rainfall analysis.

Overview of rainfall analysis of Jammu region

In Jammu region, the onset of normal monsoon were observed from 4th week of June to 1st week of July month at different locations, however the date of onset varies with the locations and are given in table 1.

Table 1. Normal onset dates of monsoon at different locations of Jammu region

Zone	District	Normal onset date of Monsoon
Subtropical	Jammu	29 th June \pm 8 days
	Samba	29 th June \pm 8 days
	Kathua	29 th June \pm 8 days
Intermediate	Rajouri	30 th June \pm 7 days
	Katra	29 th June \pm 8 days
Temperate	Banihal	01 st July \pm 10 days
	Batote	01 st July \pm 10 days
	Bhaderwah	01 st July \pm 10 days

The pre monsoon/ monsoonal rainfall started from the 26th standard meteorological week (SMW) and thereafter every SMW received various amounts of rainfall at different location and presented in table 2.

Table 2. Week wise normal rainfall amount of different stations of Jammu region

Dates & month	SMW	Jammu	Samba	Katra	Rajouri	Banihal	Batote	Bhaderwah
25 th Jun to 01 st July	26	55.4	42.6	55.4	26.1	16.9	29.4	22.1
02 to 08 th July	27	95.0	56.8	95.0	34.3	13.1	30.9	25.8
9-15.July	28	107.1	74.5	107.1	45.8	23.1	43.0	33.5
16-22.July	29	130.7	75.4	130.7	55.2	21.2	36.5	37.0
23-29.July	30	165.4	71.5	165.4	69.6	23.1	37.1	36.6
30 th July to 05 Aug	31	152.1	97.3	152.1	55.7	23.1	34.2	36.8
06-12.Aug	32	179.1	84.4	179.1	45.1	24.5	30.7	30.0
13-19.Aug	33	128.3	63.0	128.3	47.4	28.4	29.7	27.8
20-26.Aug	34	111.1	78.2	111.1	32.5	19.7	34.4	21.9
27 th Aug. to 02 Sept	35	87.1	45.2	87.1	27.0	28.2	30.5	17.7
03 to 09 Sept	36	90.9	60.5	90.9	38.8	25.6	30.6	24.0
10 th to 16 th Sept	37	47.1	36.1	47.1	22.6	16.7	23.4	15.4
17 th to 23 rd Sept	38	29.9	16.8	29.9	14.4	15.3	17.9	19.6
24 th to 30 th Sept	39	26.4	22.1	26.4	8.4	13.8	21.6	21.0
01 st to 07 th Oct.	40	7.9	5.0	7.9	6.6	7.4	5.5	5.5
08 th to 14 th Oct.	41	11.2	3.3	11.2	5.2	10.0	8.2	11.6

The normal month wise rainfall of different locations over Jammu region are given in Table 3

Table 3. Normal monthly Rainfall at different locations of Jammu Region

Month	Jammu	Samba	Kathua	Katra	Rajouri	Banihal	Batote	Bhaderwah
Jan	48.2	48.3	52.0	95.5	63.2	149.0	155.2	112.8
Feb.	54.3	51.0	71.7	126.7	95.2	242.6	237.6	194.1
March	74.9	64.3	62.2	138.3	88.4	229.8	269.8	159.5
April	30.6	26.4	31.2	62.7	44.6	130.1	133.1	128.2
May	20.1	23.3	34.2	54.9	32.3	87.9	113.8	97.8
June	94.1	92.6	154.6	120.9	82.5	67.2	101.5	76.5
July	311.7	311.8	335.8	525.5	233.8	81.6	149.3	150.6
Aug	330.2	321.7	363.8	572.6	183.4	98.4	157.2	125.9
Sept	143.8	146.4	109.5	229.7	91.5	98.0	120.2	104.5
Oct.	20.4	18.8	27.7	34.6	25.1	46.9	39.8	38.9
Nov	6.4	5.7	16.5	17.1	17.6	46.7	46.2	34.8
Dec.	21.1	21.7	26.7	95.5	28.9	82.2	82.4	59.1

Table 4. Annual and Crop Seasonal Rainfall at different locations of Jammu Region

	Annual (mm)	Kharif season (mm)	Rabi season (mm)
Jammu	1175.1	870.4	241.6
Samba	1085.9	838.7	197.5
Kathua	1274.8	864.9	236.8
Katra	2077.9	1488.7	469.6
Rajouri	979.8	610.2	371.0
Bhaderwah	1296.8	527.2	766.8
Batote	1617.1	510.3	987.6
Banihal	1343.0	427.2	914.8

Among various locations the highest rainfall recorded at Katra location during different SMW followed by Jammu. About 72 to 78 percent of annual rainfall under subtropical 70 to 75 percent under intermediate and 40 to 55 percent in temperate zone of Jammu region received during South West Monsoon season (June to September).

The rainfall probability of different amounts of rainfall (10, 20, 30, 40, 50 & 75 mm) at different locations of Jammu region is given in table 5 to 11.

Table 5. Conditional rainfall probability (%) of different amounts at Jammu station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	85	78	58	46	41	31
27	87	85	68	53	46	46
28	92	90	87	75	65	56
29	97	90	82	75	68	63
30	95	90	82	78	63	53
31	99	95	87	85	78	68
32	95	95	82	65	56	51
33	95	95	85	68	63	56
34	90	78	70	65	58	56
35	80	68	51	46	39	29
36	80	68	53	43	39	31
37	70	60	51	41	34	19
38	65	46	34	21	14	12
39	48	29	21	21	17	12
40	21	14	9	4	2	2
41	29	21	17	12	7	4

Table 6. Conditional rainfall probability (%) of different amounts at Samba station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	83	72	58	47	38	27
27	91	80	66	47	41	41
28	97	94	88	72	61	52
29	97	86	80	77	75	66
30	94	94	83	77	69	61
31	97	94	86	80	69	63
32	91	91	80	72	66	61
33	97	91	80	63	55	50
34	86	80	75	72	61	55
35	80	75	61	50	38	27
36	83	75	58	50	44	38
37	77	61	47	41	33	16
38	63	47	30	19	11	11
39	44	27	22	22	16	11
40	19	13	8	5	2	2
41	19	13	5	0	0	0

Table 7. Conditional rainfall probability (%) of different amounts at Rajouri station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	82	68	48	37	31	24
27	100	93	75	48	20	10
28	100	100	89	72	51	41
29	96	89	72	55	51	41
30	96	89	72	68	58	58
31	86	82	72	65	51	41
32	96	86	72	58	48	34
33	82	75	58	51	44	37
34	72	62	51	37	34	31
35	79	72	62	37	27	20
36	82	68	44	27	20	13
37	75	68	44	31	17	6
38	44	34	17	10	3	3
39	44	34	13	10	6	6
40	44	27	10	6	0	0
41	41	20	3	3	0	0

Table 8. Conditional rainfall probability(%) of different amounts at Katra station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	93	83	72	69	48	34
27	97	88	83	79	62	55
28	100	95	90	81	76	67
29	97	97	97	93	88	76
30	100	100	97	97	97	90
31	100	97	97	93	90	86
32	100	97	93	90	86	81
33	100	100	95	93	81	76
34	100	93	90	81	74	69
35	97	93	81	67	55	53
36	88	86	81	79	74	60
37	81	76	55	44	41	32
38	83	55	46	37	27	16
39	53	44	27	16	11	6
40	30	20	11	9	6	2
41	51	23	20	13	13	9

Table 9. Conditional rainfall probability (%) of different amounts at Banihal station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	70	45	33	17	9	9
27	78	49	13	9	7	3
28	82	66	45	27	17	15
29	88	58	37	25	17	9
30	90	58	39	29	17	17
31	78	62	37	21	13	7
32	86	49	39	27	21	19
33	82	60	47	31	23	13
34	68	43	23	15	13	9
35	72	41	27	21	17	11
36	50	35	23	17	13	9
37	60	43	31	23	17	11
38	56	41	23	17	13	13
39	47	29	15	11	9	7
40	33	15	13	7	7	5
41	47	33	13	9	7	7

Table 10. Conditional rainfall probability (%) of different amounts at Batote station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	89	73	45	28	15	10
27	93	73	54	39	26	13
28	93	86	65	54	34	28
29	95	73	54	45	34	23
30	91	71	60	54	43	36
31	91	78	63	47	30	21
32	89	80	47	36	26	23
33	95	67	43	32	17	15
34	93	71	43	30	21	17
35	76	45	34	23	19	17
36	67	56	30	26	19	13
37	69	45	30	26	19	17
38	65	28	15	10	10	10
39	56	30	13	8	8	6
40	28	15	6	4	4	4
41	52	23	15	4	4	2

Table 11. Conditional rainfall probability (%) of different amounts at Baderwah station

SMW	Upto 10 (mm)	20 (mm)	30 (mm)	40 (mm)	50 (mm)	75(mm)
26	80	62	33	26	17	8
27	86	66	44	31	22	4
28	93	82	60	40	24	17
29	91	84	66	44	33	20
30	93	84	71	46	35	24
31	95	88	73	53	31	24
32	91	80	55	44	31	17
33	88	73	48	28	22	13
34	88	68	28	13	8	6
35	84	51	28	15	11	6
36	66	48	35	24	15	8
37	73	40	22	13	11	6
38	68	42	20	11	11	8
39	53	28	20	15	13	13
40	35	13	6	4	2	2
41	51	31	20	8	8	6

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ANNEXURE

Contingency Plan for Farmers of Jammu Region in Response of Forecast of Delayed Southwest Monsoon for the Year 2023

Contingency Plan for Cereals under different Scenarios

Agro-climatic zones of Jammu region:

- (I) Subtropical plains: Altitude upto 800m amsl Major Areas: Jammu, Samba, Kathua and some parts of Udhampur district
 (II) Intermediate zone: 800-1500m amsl Major Areas: Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur district
 (III) Temperate zone: 1500-2400 m amsl Major Areas: Higher hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban district

Normal date of onset of monsoon: 29th June (26th SMW)

Normal withdrawal of monsoon: 18th September (38th SMW)

Crop	Agro-climatic zone	Monsoon Scenarios				
		Under normal conditions	Monsoon delayed by one week (up to 7th July)	Monsoon delayed by two weeks (up to 15th July)	Monsoon delayed by three weeks (up to 21th July)	Monsoon delayed by four week (up to 28th July)
Maize	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	<p>Hybrids (90-100 days) Double dekalb, Kanchan-517, Kanchan 612</p> <p>Composites (90-105 days) Mansar (C-2), Trikuta, C-8, JMC-3</p> <p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • 2-3ploughings with desi plough • Application of FYM/green-manuring/vermi-compost/ compost, etc (to increase water holding capacity) about 10-15 days before expected date of sowing • Compartmentalization 	<p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • Compartmentalization of fields • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity • Sowing across the slopes. • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <ul style="list-style-type: none"> • Dry sowing can be followed. • As sowing window for maize crop is first week of July to 3rd week of 	<p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • Compartmentalization of fields • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity • Sowing across the slopes. • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <p>Sole Maize Intercropping of maize (Hybrid: Double dekalb, Kanchan-517) + cowpea (C-152, PS-42, Lobia super</p>	<p>Contingency Plan</p> <p>Dry sowing of maize can be followed, so that after getting rainfall, it will germinate. Apply fertilizer by 'Pora' method. Increase sowing depth of maize. ☐Furrow sowing across the slope.</p> <ul style="list-style-type: none"> • Foliar spray of nutrients NPK (19:19:19) to partially alleviate moisture stress. • Thinning of plant stand to rationalize available moisture. 	<p>Contingency Plan</p> <ul style="list-style-type: none"> • Maize crop is not recommended for sowing however, Maize + Cowpea for fodder purpose, sesame (RT-2,RT-351,RT-346) or Green gram (IPM 2-3, JAUM-936) or cowpea (Lobia super 60) or Jowar/Bajra/ Sorghum (fodder purpose) as contingent crops. Maize (African tall) + cowpea

		<p>of fields.</p> <ul style="list-style-type: none"> • Application of FYM, green manures, compost, vermi-compost, etc also increase in-situ water holding capacity • Sowing across the slopes. • Maize crop should be sown with the onset of monsoon. • Line sowing followed by thinning. 	<p>July, so we can sow the same variety of maize on onset of monsoon even if it is late by one week.</p> <ul style="list-style-type: none"> • Intercropping of maize+ blackgram /greengram in 1:1 row ratio. • Hoeing and weeding should be done and weeds should be used as mulch. 	<p>60). Intercropping of maize (local) + cowpea (C-152, PS-42, Lobia super 60). Dry sowing of maize can be followed, so that after getting rainfall, it will germinate. Amount of fertilizer N is to be reduced by 50% and P2O5 and K2O both is to be reduced by 25%. Reduce the inter-row distance from 75 to 60 cm and sow by 'Kera' method to facilitate hoeing/weeding. Maize : Cowpea = 8 : 1</p> <ul style="list-style-type: none"> • Dry sowing of maize can be followed, so that after getting rainfall, it will germinate. Apply fertilizer by 'Pora' method. Sowing of Maize : Cowpea in the ratio of 8 : 1 • Intercropping of maize+ blackgram /greengram in 1:1 row ratio. • Hoeing and weeding should be done and weeds should be used as mulch. 	<ul style="list-style-type: none"> • Hoeing and weeding should be done and weeds should be used as mulch. 	<p>(EC-4216, Type-2) Bajra (WCC-75, ICMS-7703) + cowpea (EC-4216, Type-2), Jowar + cowpea (EC-4216, Type-2) As such, the land may be utilized for succeeding Toria (RSPT-1, RSPT-2) during 1st week of September.</p>
	Intermediate zone (Parts of Rajouri,	Hybrids (90-100 days) Double dekalb, Kanchan-	Preparedness • Repair of field bunds • Compartmentalization	Preparedness • Repair of field bunds • Compartmentalization	Preparedness • Application of FYM, green	Preparedness • Application of FYM, green

	<p>Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)</p>	<p>517, Kanchan 612</p> <p>Composites (90-105 days) Mansar (C-2), Trikuta, C-8, JMC-3</p> <p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • 2-3ploughings with desi plough • Application of FYM/green-manuring/vermi-compost/ compost, etc (to increase water holding capacity) about 10-15 days before expected date of sowing • Compartmentalization of fields. • Application of FYM, green manures, compost, vermi-compost, etc also increase in-situ water holding capacity • Sowing across the slopes. • As sowing window for maize crop is first week of May to 4th week of May, so we can sow the same variety of maize on local rains. 	<p>of fields</p> <ul style="list-style-type: none"> • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity • Sowing across the slopes <p>Contingency Plan</p> <ul style="list-style-type: none"> • Thinning of plant population should be done for judicious use of available soil moisture. • Hoeing and weeding should be done and weeds should be used as mulch. • Intercropping of maize+ blackgram /greengram in 1:1 row ratio. 	<p>of fields</p> <ul style="list-style-type: none"> • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity • Sowing across the slopes. • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <ul style="list-style-type: none"> • Maize: Hybrid: Kanchan-517, Pro-agro-4794, Composite: C2, C6. Maize + Rajmash (Local) Maize (C-15, Rehmat, Local tall) + Rajmash (Local) in the ratio 8:1. <p>Use 35-40 kg seed /ha Ploughing/Ridges and furrow/ /sowing should be done across the slope to conserve moisture. For achieving the optimum plant population in crust prone areas, amendments like Branker leaves, FYM etc. should be used.</p> <ul style="list-style-type: none"> • Intercropping of maize+ blackgram /greengram in 1:1 row ratio. • Hoeing and weeding 	<p>manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity</p> <ul style="list-style-type: none"> • Sowing across the slopes. • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <ul style="list-style-type: none"> • Maize: Hybrid: Kanchan-517, Pro-agro-4794, Composite: C2, C6. Maize + Rajmash (Local) Maize (C-15, Rehmat, Local tall) + Rajmash (Local) in the ratio 8:1. Use 35-40 kg seed /ha Ploughing/Ridges and furrow/ /sowing should be done across the slope to conserve moisture. For achieving the optimum plant population in crust prone areas, amendments like Branker leaves, 	<p>manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity</p> <ul style="list-style-type: none"> • Sowing across the slopes. • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <ul style="list-style-type: none"> • Maize crop is not recommended for sowing however, maize+ cowpea/sorghum crops can be sown for fodder purpose. • Fodder purpose: Maize (African Tall) + cowpea (EC-4216, HF-642-1, Type-2), Jowar (M P Charri) + cowpea (EC-4216, HF-642-1, Type-2). Unlike grain purpose maize, seed rate for fodder maize would be
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				should be done and weeds should be used as mulch.	FYM etc. should be used. <ul style="list-style-type: none"> • Intercropping of maize+ blackgram /greengram in 2:1 row ratio. • Foliar spray of nutrients NPK (19:19:19) to partially alleviate moisture stress or Use foliar application of urea (1%) during dry spells before silking instead of top N dressing. • Thinning of plant stand to rationalize available moisture. • Hoeing and weeding should be done and weeds should be used as mulch. 	50 kg/ha. Seed rate of fodder sorghum would be 50 kg/ha.
Temperate zone (Higher hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	<p>Hybrids (90-100 days) Double dekalb, Kanchan-517, Kanchan 612, Pro-agro 4794, Bio-seed, Plant gene-2320 + Rajmash (Local)</p> <p>Composites</p>	<p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • Compartmentalization of fields with proper provision of drainage. • Application of FYM, green manures, compost, vermi-compost, etc also 	<p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • Compartmentalization of fields • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water 	<p>Preparedness</p> <ul style="list-style-type: none"> • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity • Sowing 	<p>Preparedness</p> <ul style="list-style-type: none"> • Application of FYM, green manures, compost, vermi-compost, etc also increase <i>in-situ</i> water holding capacity 	

		<p>(90-105 days) Mansar (C-2), Trikuta, C-8, JMC-3 + Rajmash (Local)</p> <p>Preparedness</p> <ul style="list-style-type: none"> • Repair of field bunds • 2-3ploughings with desi plough • Application of FYM/green-manuring/vermi-compost/ compost, etc (to increase water holding capacity) about 10-15 days before expected date of sowing • Compartmentalization of fields with proper provision of drainage. • Application of FYM, green manures, compost, vermi-compost, etc also increase in-situ water holding capacity • Sowing across the slopes. • Maize crop should be sown during the month of April on receipt of moisture through local rains. • Line sowing followed by thinning. 	<p>increase <i>in-situ</i> water holding capacity</p> <ul style="list-style-type: none"> • Sowing across the slopes <p>Contingency Plan</p> <ul style="list-style-type: none"> • As sowing window for maize crop is 1st fortnight of April to 2nd fortnight of April, so we can sow the same variety of maize on local rains. • Thinning of plant population should be done for judicious use of available soil moisture. • Hoeing and weeding should be done and weeds should be used as mulch. • Intercropping of maize+ blackgram /greengram in 1:1 row ratio. 	<p>holding capacity</p> <ul style="list-style-type: none"> • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <p>Maize(Composite: C2, C6, Him-123) + Rajmash (Local), Maize (C-15, Local tall) + Rajmash (Local),Maize (Local Tall) + Moong (Pusa Baisakhi), Maize + cucumber (local trailing type).</p> <ul style="list-style-type: none"> • Maize (8 lines) : Rajmash (1 line). Sowing should be done across the contours to conserve moisture. • For maize + rajmash, fertilizer dose (N = 60, P₂O₅ = 40, and K₂O = 20 kg/ha) should be reduced by 25% (i.e. N = 45; P₂O₅ = 30; and K₂O = 15 kg/ha). • For maize + pulse, apart from reducing the dose of P₂O₅ and K₂O by 25%, the dose of N should be reduced by 50%. • Intercropping of maize+ blackgram /greengram in 1:1 row ratio. • Maize (Composite: C2, C6) + potato (kufri 	<p>across the slopes.</p> <ul style="list-style-type: none"> • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <p>Maize (Composite: C-5, C-8) + Rajmash (Local) Maize (GS-2) + Cowpea (C- 152, PS-42, CH-86-1) Maize (GS-2) + Mash (Pant U- 19, PU-30).</p> <ul style="list-style-type: none"> • Maize (8 lines) : Rajmash (1 line)For maize + rajmash, fertilizer dose (N = 60, P₂O₅ = 40, and K₂O = 20 kg/ha) should be reduced by 25% (i.e. N = 45; P₂O₅ = 30; and K₂O = 15 kg/ha). For maize + pulse, apart from reducing the dose of P₂O₅ and K₂O by 25%, the dose of N should be reduced by 50%. One row of pulse in between two rows of maize. • Maize (Composite: C2, C6) + potato (kufri badshah, kufri sinduri etc). • Foliar spray 	<ul style="list-style-type: none"> • Sowing across the slopes. • Use of blade harrow for <i>In-situ</i> moisture conservation. <p>Contingency Plan</p> <ul style="list-style-type: none"> • Maize crop is not recommended for sowing however, maize/sorghum crops can be sown for fodder purpose. • Millets or lesser millets viz., Fagopyrum (Buck wheat), or Fox tail (Kangni) or <i>Elusine corocana</i> (Kodo millet) Cheena (Red Cheena) are recommended under such situation. N : P₂O₅ for cheena is 30 : 30 kg/ha, respectively.
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				<p>badshah, kufri sinduri etc).</p> <ul style="list-style-type: none"> • For achieving the optimum plant population in crust prone areas, amendments like Branker leaves and FYM etc should be used. • Use 35-40 kg seed /ha Ploughing/Ridges and furrow/ /sowing should be done across the slope to conserve moisture. • Use foliar application of urea (1%) during dry spells before silking in case of sole crop of maize. • Hoeing and weeding should be done and weeds should be used as mulch. 	<p>of nutrients NPK (19:19:19) to partially alleviate moisture stress or Use foliar application of urea (1%) during dry spells before silking instead of top N dressing.</p> <ul style="list-style-type: none"> • For achieving the optimum plant population in crust prone areas, amendments like Branker leaves and FYM etc should be used. • Thinning of plant stand to rationalize available moisture. • Hoeing and weeding should be done and weeds should be used as mulch. 	
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Dr. A.P.Singh
Professor/Chief Scientist (Agronomy)

Contingency Plan for Pulse Crops under different scenarios

Agro-climatic zones of Jammu region:

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|---|---|
| (i) Subtropical plains: Altitude upto 800m amsl | Major Areas: Jammu, Samba, Kathua and some parts of Udhampur district Rajouri, Ramban |
| (ii) Intermediate zone: 800-1500m amsl | Major Areas: Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur district |
| (iii) Temperate zone: 1500-2400 m amsl | Major Areas: Parts of higher hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban district |

Conditions			Suggested Contingency Measures						
Agro-climatic zone	Pulse crop	Varieties/ Cropping system	Status of pulses Crop(s) under normal conditions	Monsoon delay by one week (up to 7th July)	Monsoon delay by two weeks (up to 15th July)	Monsoon delay by three weeks (up to 21th July)	Monsoon delay by four week (up to 28th July)	Agronomic measures	Remarks on implementatio n
Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur district Rajouri, Ramban districts)	Moongbean Urdbean, Cowpea, Arhar Horsegram Rajmash	Moong:*IPM-2-3, Pusa-0672, SML668, PM-6 Mash* : PU-31, Uttara, KUG-469) Cowpea*:CS-152, Pant Lobia -3, PL-4, Arhar* : PA-291, UPAS-120, AL-832 Horsegram *: VLG-19 Rajmash : VL-series varieties * Local varieties/races can be used for	Rainy season pulse crops to be sown with the onset of monsoon.	Sowing can be delayed by one week without any adverse impact on yield	Sowing can be delayed by two weeks with slight reduction in economic yield and enhance seed rate by 5-10% for proper germination	Sowing can be delayed by three weeks with reduction in economic yield and enhance seed rate by 5-10% for proper germination	1.Recommended only for fodder purpose and not for grain Purpose 2. Enhance seed rate by 15-25% for proper germination	-Cultural weed management : one weeding and hoeing after one month of sowing with hand hoe, khurpa, wheel hoe -Use 4.38 Kg/kanal DAP to fulfill the nutrition requirement of the crop	1.Ensure proper moisture at the time of sowing. 2. Drain out excess rain water 3. Proper take care of weed management

		<p>sowing during adverse climatic conditions</p> <p>Intercropping of Pulses</p> <ul style="list-style-type: none"> ➤ Maize+ Moongbean ➤ Maize+ Mash ➤ Maize+ Cowpea ➤ Mixed cropping ➤ Til and mash 							
<p>Intermediate zone (Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)</p>	<p>Urdbean, Cowpea Rajmash</p>	<p>Mash : PU-31, Uttara, Cowpea*:CS-152,PL-3,PL- 4, Rajmash : Chinta, Bhaderwah local</p> <p>Local races /varieties like chinta selection/ Bhaderwah local Rajmash</p> <p>Intercropping of Pulses</p> <ul style="list-style-type: none"> ➤ Maize+ Moongbean ➤ Maize+ 	<p>Rainy season pulse crops to be sown with the onset of monsoon.</p>	<p>Sowing can be delayed by one week without any adverse impact on yield</p>	<p>Sowing can be delayed by two weeks with slight reduction in economic yield and enhance seed rate by 5-10% for proper germination</p>	<p>Sowing can be delayed by three weeks with reduction in economic yield and enhance seed rate by 5-10% for proper germination</p>	<p>1.Recommended only for fodder purpose and not for grain Purpose</p> <p>2. Enhance seed rate by 15-25% for proper germination</p>	<p>-Cultural weed management : one weeding and hoeing after one month of sowing with hand hoe, khurpa, wheel hoe</p> <p>-Use 4.38 Kg/kanal DAP to fulfill the nutrition requirement of the crop</p>	<p>1.Ensure proper moisture at the time of sowing.</p> <p>2. Drain out excess rain water</p> <p>3. Proper take care of weed management</p>

		<ul style="list-style-type: none"> ➤ Mash ➤ Maize+ ➤ Cowpea ➤ Mixed cropping ➤ Til and mash 							
Temperate zone (Parts of higher hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	Rajmash Urdbean	Mash : PU-31, Uttara, Rajmash : Chinta, Bheaderwah local *Local races /varieties like chinta selection/ Bheaderwah local Intercropping of Pulses <ul style="list-style-type: none"> ➤ Maize+ Mash ➤ Maize+ Rajmash ➤ Mixed cropping ➤ Til and mash 	Rainy season pulse crops to be sown with the onset of monsoon/residual moisture of the local rains	Sowing can be delayed by one week without any adverse impact on yield	Sowing can be delayed by two weeks with slight reduction in economic yield and enhance seed rate by 5-10% for proper germination	Sowing can be delayed by three weeks with reduction in economic yield and enhance seed rate by 5-10% for proper germination	1. Recommended only for fodder purpose and not for grain Purpose 2. Enhance seed rate by 15-25% for proper germination	-Cultural weed management : one weeding and hoeing after one month of sowing with hand hoe, khurpa, wheel hoe -Use 4.38 Kg/kanal DAP to fulfill the nutrition requirement of the crop	1. Ensure proper moisture at the time of sowing. 2. Drain out excess rain water 3. Proper take care of weed management

*** Local varieties/races can be used for sowing during adverse climatic conditions**

Under high reaches like Temperate zone: Sowing of Rajmash (local races /varieties like chinta selection/Bheaderwah local Rajmash and PU-31 as well as local races of Mash can be used for sowing under delayed rain situations besides normal climatic situations following full recommended package of practices.

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Contingency plan for fruit Crops under different scenarios

Agro-climatic zones of Jammu region:

- (i) Subtropical plains: Altitude upto 800m amsl Major Areas: Jammu, Samba, Kathua and some parts of Udhampur district
 (ii) Intermediate zone: 800-1500m amsl Major Areas: Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur district
 (iii) Temperate zone: 1500-2400 m amsl Major Areas: Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban district

Fruit crop	Agro-climatic zone	Under normal conditions	Monsoon delay by one week (up to 7th July)	Monsoon delay by two weeks (up to 15th July)	Monsoon delay by three weeks (up to 21st July)	Monsoon delay by four week (up to 28th July)
Mango	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	Under normal monsoon conditions in Jammu's subtropical plains, go for new planting of mango as it takes the benefit from the adequate water supply for growth and development.	Varieties: Amarpali, Deshari, Chausa, Kesar Langar <ul style="list-style-type: none"> • Delay the new planting in subtropical areas. • Maintain pit digging, proper leveling of pit areas for catchment of rainy water. • Application of organic and inorganic mulches for increase the soil moisture . 	Varieties: Amarpali, Deshari, Chausa, Kesar Langar <ul style="list-style-type: none"> • The delay of monsoon may potentially affect mango fruit production, requiring such as reduce the fruit size, colour etc., adjustments in irrigation schedules is necessary. • Delay the new planting of mango. • Application of organic and inorganic 	Varieties: Amarpali, Deshari, Chausa, Kesar Langar <ul style="list-style-type: none"> • Delay the new planting. • Application of organic and inorganic mulches. • Sod culture practices can be adopted . 	Similar cultural practices can be adopted in the late monsoon weeks.

				<p>mulches.</p> <ul style="list-style-type: none"> Enhance the more catchment areas of rainy water. 		
	<p>Intermediate zone Intermediate zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)</p>	<p>Under normal monsoon conditions in Jammu's intermediate zone, go for new planting of mango as it takes the benefit from the adequate water supply for growth and development.</p>	<p>Varieties:Amarpali, Deshari, Chausa, Kesar Langar</p> <ul style="list-style-type: none"> Delay the new planting in subtropical areas. Maintain pit digging, proper leveling of pit areas for catchment of rainy water. Application of organic and inorganic mulches for increase the soil moisture. 	<p>Varieties:Amarpali, Deshari, Chausa, Kesar Langar</p> <ul style="list-style-type: none"> The delay of monsoon may potentially affect mango fruit production, requiring such as reduce the fruit size, colour etc., adjustments in irrigation schedules is necessary. Delay the new planting of mango. Application of organic and inorganic mulches. Enhance the more catchment areas of rainy water. 	<p>Varieties:Amarpali, Deshari, Chausa, Kesar Langar</p> <ul style="list-style-type: none"> Delay the new planting. Application of organic and inorganic mulches. Sod culture practices can be adopted . 	<p>Similar cultural practices can be adopted in the late monsoon weeks.</p>

<p>Guava</p>	<p>Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)</p>	<p>Under normal monsoon conditions in Jammu's subtropical plains, go for new planting of guava as it takes the benefit from the adequate water supply for growth and development.</p>	<p>Cultivars: L49 and Allahabad Surkha and Allahabad safeda and Sweta etc.,</p> <ul style="list-style-type: none"> • Use the insect trap for control insects. • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. 	<p>Cultivars: L49 and Allahabad Surkha and Allahabad safeda and Sweta etc.,</p> <ul style="list-style-type: none"> • Use the insect trap for control insects. • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. 	<p>Cultivars: L49 and Allahabad Surkha and Allahabad safeda and Sweta etc.,</p> <ul style="list-style-type: none"> • Use the insect trap for control insects. • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting <p>Maintain pit digging, proper leveling of pit area for catchment of rainy water.</p>	<ul style="list-style-type: none"> • Implement supplemental irrigation to ensure adequate water supply. • Monitor soil moisture and adjust irrigation schedules accordingly. • Implement mulching to conserve soil moisture. • Implement integrated pest management strategies. • Monitor trees for signs of stress or disease. • Provide shade or cover to protect fruits from sunburn. • Increase nutrient application for plant vigor and stress tolerance.
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	<p>Intermediate zone Intermediate zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)</p>	<p>Under normal monsoon conditions in Jammu's intermediate zone, go for new planting of guava as it takes the benefit from the adequate water supply for growth and development.</p>	<p>Cultivars: L49 and Allahabad Surkha and Allahabad safeda and Sweta etc.,</p> <ul style="list-style-type: none"> • Use the insect trap for control insects. • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. 	<p>Cultivars: L49 and Allahabad Surkha and Allahabad safeda and Sweta etc.,</p> <ul style="list-style-type: none"> • Use the insect trap for control insects. • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. 	<p>Cultivars: L49 and Allahabad Surkha and Allahabad safeda and Sweta etc.,</p> <ul style="list-style-type: none"> • Use the insect trap for control insects. • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting <p>Maintain pit digging, proper leveling of pit area for catchment of rainy water.</p>	<ul style="list-style-type: none"> • Implement supplemental irrigation to ensure adequate water supply. • Monitor soil moisture and adjust irrigation schedules accordingly. • Implement mulching to conserve soil moisture. • Implement integrated pest management strategies. • Monitor trees for signs of stress or disease. • Provide shade or cover to protect fruits from sunburn. • Increase nutrient application for plant vigor and stress tolerance.
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						<ul style="list-style-type: none"> • Sod culture practices can be adopted to main the soil moisture.
Phalsa	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	Under normal monsoon conditions in Jammu's subtropical plains, go for new planting of Phalsa as it takes the benefit from the adequate water supply for growth and development.	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture. • Monitor for • pests and diseases. 	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Monitor for • pests and diseases. 	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Monitor for • pests and diseases. • Application of irrigation and harvesting properly. 	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Monitor soil moisture regularly and adjust irrigation schedules accordingly.
	Intermediate zone Intermediate zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of	Under normal monsoon conditions in Jammu's subtropical plains, go for new planting of Phalsa as it takes the benefit from	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new planting • Maintain pit digging, proper leveling of pit 	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new 	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly. • Delay the new 	<ul style="list-style-type: none"> • Soil moisture conservation measures- organic mulching irrigation schedules accordingly.

	Kathua & Udhampur districts)	the adequate water supply for growth and development.	<p>area for catchment of rainy water.</p> <ul style="list-style-type: none"> • Sod culture practices can be adopted to main the soil moisture. • Monitor for pests and diseases. 	<p>planting</p> <ul style="list-style-type: none"> • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Monitor for pests and diseases. 	<p>planting</p> <ul style="list-style-type: none"> • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Monitor for pests and diseases. • Application of irrigation and harvesting properly. 	<ul style="list-style-type: none"> • Monitor soil moisture regularly and adjust irrigation schedules accordingly.
	Temperate zone (Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
Litchi						
	Sub-tropical zone fruit crop it is not recommended in temperate areas or intermediate zone	Litchi is one of most important fruit crops in subtropical areas of Jammu plains and July is the right time of planting.	<p>Litchi cultivars: Early: Muzaffarpur, Early seed less1 Mid-Early: Dehradun Rosa Scented, Shahi, Calcutta.</p> <ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of moisture deficit due to delayed monsoon. • Monitor soil moisture 	<p>Litchi cultivars: Early: Muzaffarpur, Early seed less1 Mid-Early: Dehradun Rosa Scented, Shahi, Calcutta.</p> <ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of 	<p>Litchi cultivars: Early: Muzaffarpur, Early seed less1 Mid-Early: Dehradun Rosa Scented, Shahi, Calcutta.</p> <ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of moisture deficit 	Same cultural practices can be adopted in the late monsoon wee

			<p>regularly and adjust irrigation schedules accordingly.</p> <ul style="list-style-type: none"> • Apply mulching techniques to conserve soil moisture and reduce evaporation. New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture. 	<p>moisture deficit due to delayed monsoon.</p> <ul style="list-style-type: none"> • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture. 	<p>due to delayed monsoon.</p> <ul style="list-style-type: none"> • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Consider intercropping with drought-tolerant crops to maximize land utilization. 	
Citrus	Subtropical plains (Jammu, Samba,	Citrus is one of most important fruit crops in subtropical areas of	<ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of moisture deficit due to delayed monsoon. 	<ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of 	<ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of 	Same cultural practices can be adopted in the late monsoon wee

	Kathua and some parts of Udhampur districts)	Jammu plains and July is the right time of planting.	<ul style="list-style-type: none"> • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. • New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture. Implement drip irrigation and mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Explore supplemental irrigation options. • Delaying new planting of citrus viz., Sweet organge, lime and lemon. 	<p>moisture deficit due to delayed monsoon.</p> <ul style="list-style-type: none"> • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. • New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture. Impleme nt drip irrigation and mulching to conserve soil 	<p>moisture deficit due to delayed monsoon.</p> <ul style="list-style-type: none"> • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. • New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture. Impleme nt drip irrigation and mulching to conserve soil 	
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				moisture. <ul style="list-style-type: none"> • Monitor orchards for pests and diseases, and apply appropriate treatments. • Explore supplemental irrigation options. • Delaying new planting of citrus viz., Sweet orange, lime and lemon. 	moisture. <ul style="list-style-type: none"> • Monitor orchards for pests and diseases, and apply appropriate treatments. • Explore supplemental irrigation options. • Delaying new planting of citrus viz., Sweet orange, lime and lemon. 	
	Intermediate zone Intermediate zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)	Citrus is one of most important fruit crops in Intermediate zone of Jammu plains and July is the right time of planting.	<ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of moisture deficit due to delayed monsoon. • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. • New planting should be delayed or can be planted under assured irrigation conditions. • Maintain pit digging, proper leveling of pit area for catchment of rainy water. 	<ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of moisture deficit due to delayed monsoon. • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. • New planting 	<ul style="list-style-type: none"> • Implement supplemental irrigation to off set the effect of moisture deficit due to delayed monsoon. • Monitor soil moisture regularly and adjust irrigation schedules accordingly. • Apply mulching techniques to conserve soil moisture and reduce evaporation. New planting should be 	Same cultural practices can be adopted in the late monsoon wee

			<ul style="list-style-type: none"> • Sod culture practices can be adopted to main the soil moisture.Implement drip irrigation and mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Explore supplemental irrigation options. • Delaying new planting of citrus viz., Sweet organge, lime and lemon. 	<p>should be delayed or can be planted under assured irrigation conditions.</p> <ul style="list-style-type: none"> • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture.Implement drip irrigation and mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Explore supplemental irrigation options. • Delaying new planting of citrus viz., Sweet organge, lime and lemon. 	<p>delayed or can be planted under assured irrigation conditions.</p> <ul style="list-style-type: none"> • Maintain pit digging, proper leveling of pit area for catchment of rainy water. • Sod culture practices can be adopted to main the soil moisture.Implement drip irrigation and mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Explore supplemental irrigation options. • Delaying new planting of citrus viz., Sweet organge, lime and lemon. 	
	Temperate zone (Higher	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended

	Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)					
Aonla	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	Aonla is one of most important fruit crops in Sub tropical plains of Jammu and July is the right time of planting. Its plants can tolerate high temperature and plant can survived under drought conditions.	Varieties: NA7, NA6, Banarsi, Chakaiya <ul style="list-style-type: none"> • Mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Delay the new planting. • Maintain pit digging, proper leveling of pit areas for catchment areas of rainy water. 	Varieties: NA7, NA6, Banarsi, Chakaiya <ul style="list-style-type: none"> • Mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Delay the new planting. • Maintain pit digging, proper leveling of pit areas for catchment areas of rainy water. 	Varieties: NA7, NA6, Banarsi, Chakaiya <ul style="list-style-type: none"> • Mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Delay the new planting. • Maintain pit digging, proper leveling of pit areas for catchment areas of rainy water. • Provide shade and windbreaks to mitigate heat stress. 	Same cultural can be adopted in the late weeks of monsoon
	Intermediate zone Intermediate	Aonla is one of most important fruit crops in	Varieties: NA7, NA6, Banarsi, Chakaiya	Varieties: NA7, NA6, Banarsi, Chakaiya	Varieties: NA7, NA6, Banarsi, Chakaiya	Same cultural can be adopted in the late weeks of

	zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)	Intermediate zone of Jammu and July is the right time of planting. Its plants can tolerate high temperature and plant can survived under drought conditions.	<ul style="list-style-type: none"> • Mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Delay the new planting. • Maintain pit digging, proper leveling of pit areas for catchment areas of rainy water. 	<ul style="list-style-type: none"> • Mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Delay the new planting. • Maintain pit digging, proper leveling of pit areas for catchment areas of rainy water. 	<ul style="list-style-type: none"> • Mulching to conserve soil moisture. • Monitor orchards for pests and diseases, and apply appropriate treatments. • Delay the new planting. • Maintain pit digging, proper leveling of pit areas for catchment areas of rainy water. • Provide shade and windbreaks to mitigate heat stress. 	monsoon
	Temperate zone (Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	Temperate zone (Higher Hills of Rajouri, Poonch,	In temperate zone Fruit crops viz., apple, pear plum, apricot walnut and persimmon, at	<ul style="list-style-type: none"> • Application of organic and inorganic mulches Cowpea straw, paddy straw black polythene sheet etc., 	<ul style="list-style-type: none"> • Application of organic and inorganic mulches Cowpea straw, paddy 	<ul style="list-style-type: none"> • Application of organic and inorganic mulches Cowpea straw, paddy 	<ul style="list-style-type: none"> • Application of organic and inorganic mulches Cowpea straw,

	Kathua, Kishtwar and Ramban districts) Fruit crops viz., apple, pear plum, apricot walnut and persimmon	bearing stage, application of organic and inorganic mulches and adopt sod culture practices and other cultural practices to maintain the fruit orchards.	<ul style="list-style-type: none"> • Conserve soil moisture through sod cultural practices Apply irrigation • Use of Antitranspirants or Materials causing stomatal closure • Growth hormones like Succinic acid, Ascorbic acid and cycocel (CCC) • Use of Plant Growth Regulators (PGRs) b) Cytokinin's and Salicylic acid reduce the water stress. 	straw black polythene sheet etc. <ul style="list-style-type: none"> • Conserve soil moisture through sod cultural practices • Apply irrigation for reduce the water stress. 	straw black polythene sheet etc. <ul style="list-style-type: none"> • Conserve soil moisture through sod cultural practices • Apply irrigation for reduce the water stress. 	paddy straw black polythene sheet etc. <ul style="list-style-type: none"> • Conserve soil moisture through sod cultural practices • Apply irrigation for reduce the water stress.
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Contingency Plan for vegetable crops under different scenarios

Agro-climatic zones of Jammu region:

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|--|---|
| (i) Subtropical plains: Altitude up to 800m amsl | Major Areas: Jammu, Samba, Kathua and some parts of Udhampur district |
| (ii) Intermediate zone: 800-1500m amsl | Major Areas: Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur district |
| (iii) Temperate zone: 1500-2400 m amsl | Major Areas: Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban district |

Vegetable crop	Agro-climatic zone	Status of vegetable Crop(s) under normal conditions	Monsoon delay by one week (up to 7th July)	Monsoon delay by two weeks (up to 15th July)	Monsoon delay by three weeks (up to 21st July)	Monsoon delay by four weeks (up to 28th July)
Okra	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	Recommended varieties are Jammu Okra-05 (Seli Special), Pusa Sawani, Varsha Uphaar, Arka Anamika <ul style="list-style-type: none"> • Line sowing and proper thinning to be done 	<ul style="list-style-type: none"> • Sowing can be delayed by one week without any adverse impact on yield • Overnight seed soaking before sowing is helpful in increasing germination. • Gap filling or re-sowing in case of mortality • Increase sowing depth <p>Sowing by zero-tillage to save moisture</p>	<ul style="list-style-type: none"> • Sowing can be delayed by two weeks with slight reduction in economic yield • Soil moisture conservation measures- organic mulching • Application of increase quantity of organic manure 	<ul style="list-style-type: none"> • Sowing can be delayed by three weeks with 25-50% reduction in economic yield • Foliar spray of micronutrients, KCl or KNO₃ partially alleviate moisture stress • Thinning of plant stand to rationalize available moisture 	<ul style="list-style-type: none"> • Not recommended to sow okra crop in August • Short duration vegetables crops can be sown • Kknolkhol var. G-40, White Vienna, KOM and radish var. Japanese white, Pusa Chetki, • Amaranthus var. Pusa Chhoti Chulai, Pusa Badi Chulai
	Intermediate zone (Rajouri, Poonch, Kishtwar, Ramban, Reasi and	<ul style="list-style-type: none"> • Recommended varieties are Jammu Okra-05 (Seli Special), Pusa Sawani, Varsha Uphaar, Arka Anamika 	<ul style="list-style-type: none"> • Sowing can be delayed by one week without any adverse impact on yield • Overnight seed soaking before sowing is helpful in 	<ul style="list-style-type: none"> • Sowing can be delayed by two weeks with slight reduction in economic yield • Soil moisture conservation 	<ul style="list-style-type: none"> • Sowing can be delayed by three weeks with 25-50% reduction in economic yield • Foliar spray of micronutrients, KCl or KNO₃ partially alleviate 	<ul style="list-style-type: none"> • Not recommended to sow okra crop in August • Short duration vegetables crops can be sown • Knolkhol var. G-40, White Vienna, KOM

	parts of Kathua & Udhampur districts)	<ul style="list-style-type: none"> • Line sowing and proper thinning to be done 	<p>increasing germination.</p> <ul style="list-style-type: none"> • Gap filling or re-sowing in case of mortality • Increase sowing depth <p>Sowing by zero-tillage to save moisture</p>	<p>measures- organic mulching</p> <ul style="list-style-type: none"> • Application of increase quantity of organic manure 	<p>moisture stress</p> <ul style="list-style-type: none"> • Thinning of plant stand to rationalize available moisture 	<ul style="list-style-type: none"> • Radish var. Japanese white, Pusa Himanii, Pusa Rreshmi • Leafy vegetables: Palak var. All Green, Jammu Spinachbeet-07
	Temperate zone (Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	Not recommended	Not recommended	Not recommended	Not recommended	<ul style="list-style-type: none"> • Short duration vegetables crops can be sown • Knolkhol var. G-40, White Vienna, KOM • Radish var. Japanese white, Pusa Himanii, Pusa Rreshmi • Leafy vegetables: Palak var. All Green, Jammu Spinachbeet-07
Brinjal	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	<ul style="list-style-type: none"> • Long fruited cultivars like Pusa Purple Long, Pusa Kranti, Punjab Sadabahar, Shamli, PPL-74 are better than round fruited cultivars • Rainy season brinjal crop to be sown during first week of June and transplanted in July. 	<ul style="list-style-type: none"> • Long fruited cultivars like Pusa Purple Long, Pusa Kranti, Punjab Sadabahar, Shamli, PPL-74 are better than round fruited cultivars • Transplanting can be delayed by one week without any adverse impact on yield • Increase transplanting depth • Mulching around 	<ul style="list-style-type: none"> • Transplanting can be delayed by two weeks with slight reduction in economic yield • Delayed application of N dose • Apply organic mulching in the field 	<ul style="list-style-type: none"> • Transplanting can be delayed by three weeks with reduction in economic yield • Thinning of plant stand to rationalize available moisture • Removal of weeds from field 	<ul style="list-style-type: none"> • Not recommended to sow brinjal crop in August • Short duration vegetables crops can be sown • Like knolkhol var. G-40, White Vienna, KOM and radish var. Japanese white, Pusa Chetki, • Amaranthus var. Pusa Chhoti Chulai, Pusa Badi Chulai

			plant to conserve moisture loss			
	Intermediate zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)	<ul style="list-style-type: none"> Long fruited cultivars like Pusa Purple Long, Pusa Kranti, Punjab Sadabahar, Shamli, PPL-74 are better than round fruited cultivars Rainy season brinjal crop to be sown during first week of June and transplanted in July. 	<ul style="list-style-type: none"> Long fruited cultivars like Pusa Purple Long, Pusa Kranti, Pusa Purple Cluster are better than round fruited cultivars Transplanting can be delayed by one week without any adverse impact on yield Increase transplanting depth Mulching around plant to conserve moisture loss 	<ul style="list-style-type: none"> Transplanting can be delayed by two weeks with slight reduction in economic yield Delayed application of N dose Apply organic mulching in the field 	<ul style="list-style-type: none"> Transplanting can be delayed by three weeks with reduction in economic yield Thinning of plant stand to rationalize available moisture Removal of weeds from field 	<ul style="list-style-type: none"> Not recommended to sow brinjal crop in August Not recommended to sow brinjal crop in August Short duration vegetables crops can be sown Like knolkhol var. G-40, White Vienna, KOM and radish var. Japanese white, Pusa Chetki,
	Temperate zone (Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	Not recommended	Not recommended	Not recommended	Not recommended	<ul style="list-style-type: none"> Short duration vegetables crops Knolkhol var. G-40, White Vienna, KOM Radish var. Japanese white, Pusa Himanii, Pusa Rreshmi Leafy vegetables: Palak var. All Green, Jammu Spinachbeet-07
Cucurbits (Sponge gourd, Bitter gourd, Cucumber Pumpkin)	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur)	<ul style="list-style-type: none"> Cucumber var. Japanese Long Green, Poinsette, Kheera Local Sponge gourd var. Pusa Chikni, Pusa Supriya, Local 	<ul style="list-style-type: none"> Cucumber var. Japanese Long Green, Poinsette, Kheera Local Sponge gourd var. Pusa Chikni, Pusa Supriya, Local 	<ul style="list-style-type: none"> Cucumber var. Japanese Long Green, Poinsette, Kheera Local Sponge gourd var. Pusa Chikni, Pusa Supriya, Local 	<ul style="list-style-type: none"> Cucumber var. Japanese Long Green, Poinsette, Kheera Local Sponge gourd var. Pusa Chikni, Pusa Supriya, Local Bitter gourd var. Pusa 	<ul style="list-style-type: none"> Not recommended to sow cucurbits in August Short duration vegetables crops Like knolkhol var. G-40, White Vienna, KOM and radish var. Japanese

etc.)	districts)	<ul style="list-style-type: none"> • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Rainy season cucurbits to be sown during first week of June and transplanted in July 	<ul style="list-style-type: none"> • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Transplanting can be delayed by one week without any adverse impact on yield • Re-sowing in case of mortality • Increase sowing depth and add plenty of FYM in pits 	<ul style="list-style-type: none"> • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Transplanting can be delayed by two weeks with slight reduction in economic yield • Application of increase quantity of organic manure 	<p>Domusami, Punjab-14, Pusa Vishesh</p> <ul style="list-style-type: none"> • Transplanting can be three weeks with substantial reduction in economic yield • Foliar spray of KNO₃ partially alleviate moisture stress 	<ul style="list-style-type: none"> • white, Pusa Chetki • Amaranthus var. Pusa Chhoti Chulai, Pusa Badi Chulai
	Intermediate zone(Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)	<ul style="list-style-type: none"> • Cucumber var. Japanese Long Green, Poinsette, Kheera Local • Pumpkin var. Pusa Vishwas, Arka Chandan, Arka Suryamukhi • Sponge gourd var. Pusa Chikni, Pusa Supriya, Local • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Rainy season cucurbits to be sown during first week of June and transplanted in July 	<ul style="list-style-type: none"> • Cucumber var. Japanese Long Green, Poinsette, Kheera Local • Pumpkin var. Pusa Vishwas, Arka Chandan, Arka Suryamukhi • Sponge gourd var. Pusa Chikni, Pusa Supriya, Local • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Transplanting can be delayed by one week without any adverse impact on yield • Re-sowing in case of mortality • Increase sowing depth and add plenty 	<ul style="list-style-type: none"> • Cucumber var. Japanese Long Green, Poinsette, Kheera Local • Pumpkin var. Pusa Vishwas, Arka Chandan, Arka Suryamukhi • Sponge gourd var. Pusa Chikni, Pusa Supriya, Local • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Transplanting can be delayed by two weeks with slight reduction in economic yield • Application of increase quantity 	<ul style="list-style-type: none"> • Cucumber var. Japanese Long Green, Poinsette, Kheera Local • Pumpkin var. Pusa Vishwas, Arka Chandan, Arka Suryamukhi • Sponge gourd var. Pusa Chikni, Pusa Supriya, Local • Bitter gourd var. Pusa Domausami, Punjab-14, Pusa Vishesh • Transplanting can be three weeks with substantial reduction in economic yield • Foliar spray of KNO₃ partially alleviate moisture stress 	<ul style="list-style-type: none"> • Not recommended to sow cucurbits in August • Short duration vegetables crops • knolkhol var. G-40, White Vienna, KOM • Radish var. Japanese white, Pusa Chetki

			of FYM in pits	of organic manure		
	Temperate zone (Higher Hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	Not recommended	Not recommended	Not recommended	Not recommended	<ul style="list-style-type: none"> • Short duration vegetables crops • Knolkhol var. G-40, Purple Vienna • Radish var. Japanese white, Pusa Himanii, Pusa Reshmi • Leafy vegetables: Palak var. All Green, Jammu Spinachbeet-07 • Methi: Jammu Fenugreek-07 • Coriander:Jammu Coriander-07

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Contingency plan for water harvesting structures, restoring irrigation infrastructure under different scenarios

Agro-climatic zones of Jammu region:

(i) Subtropical plains: Altitude upto 800m amsl Major Areas: Jammu, Samba, Kathua and some parts of Udhampur district

(ii) Intermediate zone:800-1500m amsl Major Areas:Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur district

(iii) Temperate zone:1500-2400 m amsl Major Areas: Parts of Pats of higher hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban district

Water harvesting and moisture conservation measures	Agro-climatic zone/Districts	Under normal conditions	Monsoon delayed by one week (up to 7th July)	Monsoon delayed by two weeks (up to 15th July)	Monsoon delayed by three weeks (up to 21th July)	Monsoon delayed by four week (up to 28th July)
Water harvesting structures, Restoring irrigation structures	Subtropical plains (Jammu, Samba, Kathua and some parts of Udhampur districts)	<ul style="list-style-type: none"> • Disiltation of water harvesting ponds • Disiltation of recharging structures • Repair of contour bunds • Repair of peripheral bunds • Renovation/repair of gabion structures • Renovation/repair of check dams • Renovation of in-situ moisture conservation measures • Deep tillage • Renovation/repair 	<ul style="list-style-type: none"> • Mulching • Sowing across the slope • Gully plugging • Pre sowing/Life saving irrigation using harvested water/tube well • Trenching • Bunding • Peripheral bunding 	<ul style="list-style-type: none"> • Irrigation through micro irrigation using harvested water • Sowing across the slope • Sowing using aqua seed drill • Alternate furrow irrigation • Vertical mulching 	<ul style="list-style-type: none"> • Deep tillage • Sowing across the slope • Pre sowing/Protective irrigation using harvested water/tube well • Mulching 	<ul style="list-style-type: none"> • Utilization of water of water harvesting pond for pre sowing irrigation using harvested water/tube well • Mulching • Repair of peripheral bunds • Continuous contour trenching • Staggered trenching

		of bench terracing				
	Intermediate zone (Rajouri, Poonch, Kishtwar, Ramban, Reasi and parts of Kathua & Udhampur districts)	<ul style="list-style-type: none"> • Disiltation of water harvesting ponds • Disiltation of recharging structures • Repair of contour bund • Repair of peripheral bunds • Renovation/repair of gabion structures • Renovation/repair of check dams • Renovation of in-situ moisture conservation measures • Deep tillage • Renovation/repair of bench terracing 	<ul style="list-style-type: none"> • Mulching • Sowing across the slope • Gully plugging • Life saving/pre sowing irrigation using harvested water/tube well • Trenching • Bunding • Peripheral bunding 	<ul style="list-style-type: none"> • Irrigation through micro irrigation using harvested water • Sowing across the slope • Sowing using aqua seed drill • Alternate furrow irrigation • Vertical mulching 	<ul style="list-style-type: none"> • Deep tillage • Sowing across the slope • Protective/Pre sowing irrigation using harvested water/tube well • Mulching 	<ul style="list-style-type: none"> • Utilization of water of water harvesting pond for protective/life saving irrigation using harvested water/tube well • Mulching • Repair of peripheral bunds • Continuous contour trenching • Staggered trenching
	Temperate zone (Parts of higher hills of Rajouri, Poonch, Kathua, Kishtwar and Ramban districts)	<ul style="list-style-type: none"> • Disiltation of water harvesting ponds • Disiltation of recharging structures • Repair of contour bund • Repair of peripheral bunds • Renovation/repair 	<ul style="list-style-type: none"> • Mulching • Sowing across the slope • Gully plugging • Life saving/Pre sowing irrigation using harvested water/tube well • Trenching • Bunding • Peripheral 	<ul style="list-style-type: none"> • Irrigation through micro irrigation • Sowing across the slope • Sowing using aqua seed drill • Alternate furrow irrigation • Vertical mulching • Renovation/repair of bench terracing 	<ul style="list-style-type: none"> • Deep tillage • Sowing across the slope • Protective/life saving irrigation using harvested water/tube well • Mulching • Renovation/repair of bench terracing 	<ul style="list-style-type: none"> • Utilization of water of water harvesting pond for pre sowing/protective irrigation using harvested water/tube well • Mulching • Repair of peripheral bunds

		of gabion structures <ul style="list-style-type: none"> • Renovation/repair of check dams • Renovation of in-situ moisture conservation measures • Deep tillage • Bench terracing 	bundling <ul style="list-style-type: none"> • Renovation/repair of bench terracing 			<ul style="list-style-type: none"> • Continuous contour trenching • Staggered trenching • Renovation/repair of bench terracing
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Salient points for conservation of rainwater and water use efficiency

- Repair and renovation soil and water conservation measures/structures to minimize runoff in result of rains from the catchment
- Promotion/construction of water harvesting ,recharging structures and roof water harvesting structures
- Promotion of micro irrigation for improving water use efficiency
- Promotion/construction of in situ soil and moisture conservation measures like contour bunds/compartmental bunds, peripheral bunds, continuous contour trenches and staggered trenches
- Promotion of deep tillage prior to monsoon
- Promotion/construction of drainage line treatment works like gabion structures, check dams

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Professor and Head, Soil and Water Engg.

Sources of seed for contingency plan under different scenarios

- Farmers are advised to approach the Joint Director (Inputs), Directorate of Agriculture, Talab Tillo, Jammu for seed of different *kharif* crops and varieties and Nodal officer (MSP, Chatha/Pulse Seed Hub), SKUAST Jammu for university released varieties. Farmers may also get the pertinent seed from the local market.
- For maize seed, farmers may approach Joint Director (Inputs), Directorate of Agriculture, Talab Tillo, Jammu and may also get the required seed from the local market.
- For seed of university released varieties of *Kharif* vegetable i.e. Okra, bitter melon, pumpkin, cucumber and other cucurbits, which require less water, the farmers may approach Division of Vegetable Science, SKUAST-Jammu or Joint Director (Inputs), Directorate of Agriculture, Talab Tillo, Jammu or may also get the required seed from the local market.
- For planting material of fruit crops, farmers are advised to contact Incharge, ACHR, Udheywala Campus, SKUAST-Jammu or Incharge, RHRSS, Raya, SKUAST-Jammu or Department of Horticulture in their respective districts.

Crop Management Practices for Drought

Drought is temporary reduction in water or moisture availability significantly below the normal amount for a specific period. It is a climatic anomaly characterized by deficient supply of moisture resulting either from sub-normal rainfall, erratic rainfall distribution, higher water need or a combination of all the 3 factors. Droughts, in general, are extreme hydrologic events causing acute water shortages which persist long enough to trigger detrimental effects on human, vegetation, animals and ecosystem over a considerable area. To a meteorologist, drought is the absence of rain, while to the agriculturist it is the deficiency of soil moisture in the crop root zone to support crop growth and productivity. Based on the criteria, concept of its utilization and different schools of thought, drought is broadly categorized into meteorological drought, hydrological drought, agricultural drought and socio-economic drought. In rainfed areas, drylands are more prone to 'drought'. Since last one decade of 21st Century, it has been observed that monsoon rains are deviating much from its predictions and the states/regions which never experience such a natural calamity comes under mild to acute drought-prone regions. In cases of field crops and other vegetation, it creates moisture-stress conditions when the amount of water needed for evapotranspiration exceeds the total amount of moisture available in soil. To define, drought is taken to have occurred over an area where the annual average rainfall is less than 50–75% of the normal south–west (S–W) monsoon rains. Delayed onset of S–W monsoon rains or early receding of monsoon rains towards half–way of the season or long gaps between 2 heavy and effective rains during rainy season are the general phenomenon of agricultural drought in India. The India Meteorological Department (IMD) generally predicts the monsoon status (weak or normal) 3–4 months before for each state/region.

Drought and its significance

Drought can be defined in many ways, such as, 'a period of dry weather'; 'a condition of abnormal dry weather resulting in a serious hydrological imbalance, with consequences such as losses of standing crop and shortage of water needed by people and livestock'; and 'a creeping situation of scarcity without recharging of resources'. Droughts are categorized in a number of ways as we have various measures to identify drought conditions in a particular space and time. The meteorological drought, which is most widely accepted, is based on the degree of dryness and the duration of dry period. It defines drought conditions when precipitation deficit is more than 25% to its normal in a particular region. If the precipitation deficit is more than 50% of long– term average, it is called severe drought.

Agricultural drought

Agricultural drought is a period of dryness affecting the soil-moisture status and preventing the growth of plants. Drought creates a condition when the amount of water needed for transpiration and evaporation exceeds the total amount of moisture available in soil. It is the result of the moisture stress in soils and plants during crop growth. In India, crops grown under

arid and semi-arid conditions are often prone to the situations of agricultural drought. The intensity of drought may be moderate or severe depending on the deviations of seasonal rainfall. In other words, it commences with the inability of plant roots to obtain soil moisture rapid enough to maintain the internal water balance of the crop. Distribution of rainfall also counts in determining the drought. Delayed onset of S-W monsoon rains or early receding of monsoon rains towards half way of the season or long gaps between two heavy and effective rains during rainy season are the general phenomenon of agricultural drought in India.

Important hints for maximizing crop yield during drought:

Dry spells, apart from limiting soil moisture for plant use, pose serious threat to uptake of nutrients thereby affecting crop yield. Occurrence of dry spells during the growing season which cause deficiency of soil moisture therefore, poses the greatest threat to food security in this region. Dry spell occurrence has not only reduced the yield of crops in this region but have in many case lead to complete loss during extended period of occurrence, leading to drought. Under such situations where ever possible; The following strategies can be used:

- Grow short duration drought tolerant and early maturing crop varieties.
- Grow local races/ crop varieties during moisture stress situations.
- Use of rain guns for supplementing artificial moisture to the crop as life saving irrigation.

Techniques to reduce evaporation and transpiration loss for effective drought management

Reducing evaporation losses

Soil moisture is the most limiting factor in rainfed agriculture. It is lost as evaporation from the soil surface and as transpiration from the plant surfaces. Evaporation has to be arrested as it is not directly related to productivity whereas transpiration can be reduced to some extent without affecting productivity of plants. The evaporation losses can be reduced by:

- Mulches
- Antitranspirants
- Wind breaks
- Weed control

Mulches

About 60 to 75 per cent of the rainfall is lost through evaporation. These evaporation losses can be reduced by applying mulches. Mulch is any material applied on the soil surface to check evaporation and improve soil water. Application of mulches results in additional benefits like soil conservation, moderation of temperature, reduction in soil salinity, weed control and improvement of soil structure.

Types of mulches: Soil mulch or dust mulch:

If the surface of the soil is loosened, it acts as mulch for reducing evaporation. This loose surface soil is called soil mulch or dust mulch. Intercultivation creates soil mulch in a growing crop.

Stubble mulch: Crop residues of previous crops, are left on the soil surface as a stubble mulch. The advantages of stubble mulch farming are protection of soil from erosion and reduction of evaporation losses.

Straw mulch: If straw is available then it can be used for conservation of moisture.

Plastic mulch: Plastic materials like polyethylene, polyvinyl chloride are also used as mulching materials.

Vertical mulching: To improve infiltration and storage of rainwater in these soils, vertical mulches are formed. It consists of digging narrow trenches across the slope at intervals and placing the straw or crop residues in these trenches. The pruned plant material is placed in contour trenches formed between rows or in trenches around the plants in concentric circles each year in one circle.

Reducing transpiration losses: Antitranspirants : About 99 per cent of the water absorbed by the plants is lost in transpiration. If transpiration is controlled, it may help in maintenance of favourable water balance. Antitranspirant is any material applied to transpiring plant surfaces for reducing water loss from the plant. These are of four types: Stomatal Closing Reflective Growth retardant

Stomatal Closing type: Most of the transpiration occurs through the stomata on the leaf surface. Phenyl mercuric acetate (PMA) as antitranspirants by inducing stomatal closing. These might reduce the photosynthesis also simultaneously. PMA was found to decrease transpiration to a greater degree than photosynthesis.

Reflectant Type: These are white materials which form a coating on the leaves and increase the leaf reflectance (albedo). By reflecting the radiation, they reduce leaf temperatures and vapour pressure gradient from leaf to atmosphere and thus reduce transpiration.

Application of 5 per cent kaolin spray reduces transpiration losses.

A diatomaceous earth product (celite) also increases reflection of solar radiation from crop canopy

Growth Retardant: These chemicals reduce shoot growth and increase root growth and thus enable the plants to resist drought. They may also, induce stomatal closure; like Cycocel : Antitranspirants generally reduce photosynthesis. Therefore, their use is limited to save the crop from death under severe moisture stress. If crop survives, it can utilise the rainfall that is received subsequently

Weed Control:

Prompt weed control eliminates the competition of weeds with crops for limited soil moisture. Transpiration rate from weeds is more compared to crops. Effective weed control under drought like situations in agriculture leads to increasing availability of soil moisture to crops.

During excess rainfall the regular drainage shall be done from the fields for proper growth and other plant activities since pulses are susceptible to stagnation of water and this can affect the crop to a large extent.

Agricultural drought–mitigation strategy

In India, the IMD generally predicts in the month of January or February every year, normal or less rainfall or drought-like situation in a particular state or region of the country. On the basis of this information, the Government at the centre and state level becomes active and draw guideline to face the forthcoming drought, if any, and a disastrous situation is averted so that minimum losses occur particularly for food, fodder and fibre production in the affected areas. The severity of the drought depends on its duration, degree of water deficiencies and the size of the affected area. Drought has significant consequences in terms of reduction of agricultural production, energy generation, livestock and human population migration and thus resources are required for mitigation the resulting hazards.

Integrated approach to mitigate drought effects has been summarized below:

- During drought, to provide water for drinking purposes and life–saving irrigation to major field crops the water availability in the major reservoirs in the country is to be checked well in advance. For each irrigation reservoir, prepare a separate water budget. Monitoring of the expected damage to groundwater regime is also equally important. During drought period and in drought–prone areas, it is necessary to regulate the water supply to water–intensive industries.
- Relief measures are also required for providing livelihood environment to upkeep the cattle wealth during and after drought as natural calamity. It includes, fodder availability and transport to the affected areas and monitoring of fodder. Fodder cultivation is to be encouraged in all possible regions/states of the country.
- In drought–prone areas, it becomes necessary to generate additional employment through labour–intensive works for water harvesting etc. at the village level.
- Public health and cattle health care should also be on priority and to monitor for the supply of disinfect drinking water to prevent spread of water–borne diseases and plans to cope–up with likely epidemic. Immunization and surveillance of public and livestock health measures be taken.
- General public should come forward to learn more about various natural calamities including droughts. Side by side, they are to be advised to know about available natural resources of a particular region and planning to minimize the risk by diversifying production technology to sustain better livelihood.
- There is a need to give more emphasis on better extension programmes to disseminate the modern technology for crop husbandry in drought–prone areas.
- Due to Global Warming, there are chances of unpredictable weather conditions and drought occurrence frequency even in high rainfall areas of Indian sub–continent. Therefore, there is

a need to give serious thought on household strategies and farming system approach to manage drought and to provide alternate income sources to the farmers. For example, horticulture, tree plantation, poultry farming, bee-keeping, mushroom farming etc. are recommended for certain households. Investments in the processing of farm products generate income and diminish the risk of high dependence on water.

- Diversification of cropping system is needed in selected regions to save water and its efficient management. The low water-requiring crops and varieties and perennial component of vegetation including agro-forestry, agri-horticulture, medicinal and aromatic plants may be expanded and promoted in drought prone areas as income and employment-generating options.
- Adoption of resource-conservation technologies (RCTs) and conservation agriculture (CA) practices may be helpful in enhancing resource use efficiency, crop productivity and farm profitability. These technologies also assist in mitigating the stress of drought and climate change.
- Estimate indicates that by 10% increase in WUE, country can gain about 50 million tonnes of additional foodgrains from the existing irrigated areas. Therefore, strategy should also be towards development of technology to improve the WUE for future. Minor irrigation projects, their planning and execution are the probable examples in this direction.
- To mitigate drought like situation, it is ideal to have integrated watershed approach for maximizing rain water use. Judicious use of limited irrigation water, rainwater harvesting and its recycling, retaining precipitation in-situ and minimize run-off is necessary for combating drought.
- Alternative cropping strategy/contingent crop planning is to be planned and implemented as per the nature of the drought. This is to be supplemented by providing extra electrical power, seeds of recommended crops, varieties and fertilizers etc. at subsidized rates.
- Life-saving practices/mid-way corrections should come in practice including adoption of agronomic practices, viz. thinning, mulching and use of antitranspirants mainly to reduce the transpiration and evaporation losses during the water-stress periods. For saving the field crops from drought the agronomic measures suggested are as follows:
 - ✓ Reduction in plant population (up to the extent of 15%) so as to minimize the transpiration losses.
 - ✓ Need based intercultural operations in the form of dust mulching to check the evaporation losses and for efficient soil moisture utilization.
 - ✓ Spray of anti-transpirants like Kaolin (6%), Cycocel (0.03%) on the standing crops is recommended to check transpiration losses and to give green look to the crop for a longer period.
 - ✓ Application of agricultural polymers like Pusa hydrogel @ 2.5 kg/ha to reduce the moisture stress in the plants.
 - ✓ Doses of fertilizer may be reduced or its application may be delayed depending on the soil-moisture status for good crop growth.

- ✓ Adoption of mechanical weed control with energy efficient farm implements and thereby intercultural operations mainly to minimize the evapotranspiration losses in the standing kharif crops.
- ✓ To control/minimize the insect and pest incidence and impact on drought affected crops, crop specific and appropriate integrated pest management (IPM) practices may be adopted.
- ✓ Agronomic practices, viz. thinning, mulching, use of anti-transpirants, efficient nutrient, weed and moisture management and timely plant protection are effective to save the late sown crops like pearl millet. Follow economy in water use, so that larger area may be covered with life-saving irrigation.
- ✓ Arrangements are to be made for supplying quality seeds of non-traditional crops recommended for cultivation during drought-affected *kharif* season.
- ✓ Mulching with dry leaves, grasses and other organic farm waste also helps in lowering the subsurface temperature and checking evaporation losses.
- ✓ Green fodder sorghum crop should not be harvested before 45 days to avoid toxicity to cattle. Rather, it was advised for briquetting of fodder for bulk transportation from surplus to deficit areas.
- ✓ Conserve water either in-situ or *ex-situ*. In-situ practices like field leveling, bunding, trenching, terracing and fallow ploughing are necessary to arrest run-off losses of water and top soil.
- ✓ *Ex-situ* water-harvesting practices like farm ponds, community tanks, watersheds and pools are the water banks which can prove a life saver.
- ✓ Formulation of crop-weather-watch-group comprising farmers, media, bankers, government officials and scientists to monitor and to act as advisor to the farmer to use the crop-life saving techniques and alternative cropping programmes.

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