

Compensatory Production Plan *Rabi 2014*



ICAR - CRIDA

ICAR - Central Research Institute for Dryland Agriculture, Hyderabad
Natural Resource Management Division
Indian Council of Agricultural Research, New Delhi

Compensatory Production Plan

Rabi 2014

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Front cover (clockwise) : Wheat with zero tillage, Blackgram in rice fallows,

Chickpea cv. Digvijay, Lucerne

Back cover: Rainwater harvesting in farm pond - Smt. Kesarbai's farm, NICRA village, Kochariya, Bhilwara Dist. Rajasthan

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SECRETARY & DIRECTOR GENERAL

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FOREWORD

Indian agriculture is predominantly dependent on monsoon rainfall. About 75% of the country's annual rainfall is received in four months (June to September) which is critical to the *kharif* crop season that accounts for nearly 50% of foodgrain and 65% of oilseeds production. Any variation in rainfall therefore directly affects *kharif* crop performance. Studies indicate that the negative impacts of deficit rainfall are more pronounced than the positive impacts of excess rainfall during the *kharif* season. Substantial decrease in *kharif* crop yields is often associated with drought years. The monsoon season of 2014 was quite unique as both the onset of monsoon was delayed and its progress across the country was erratic. As a result, rainfall was either deficient or scanty in more than 50% of the districts in the country in June, July and August months. This had an adverse impact on the progress in sowing of foodgrain crops (millets & pulses) in *kharif* which declined by about 2.5 million ha. Farmers increasingly opted for remunerative crops and increased the area under cotton and soybean by about 2 million ha with the late receipt of rains. Decline in area under millets in rainfall deficit states is likely to result in shortage of fodder to livestock. This entails special measures for enhancing fodder production by opting for dual purpose grain/fodder crops in unsown areas where conditions are conducive for early *rabi* sowing.

Deficit rainfall in *kharif* also impacts the production in *rabi* season as rainfall at the end of the monsoon season provides profile soil moisture and irrigation water for *rabi* crops. The likely fallout of reduced water storage in some reservoirs and poor groundwater recharge in several districts on production in the post-rainy season calls for additional interventions for increasing the *rabi* production prospects. Evidence for resilience of Indian agriculture to drought conditions comes from the recent deficit rainfall experience in 2012 where *rabi* output exceeded *kharif* output by about 9 million tonnes. Over the years, several drought prone states have demonstrated that adoption of appropriate practices and technologies contributed significantly towards cushioning the fluctuations in foodgrain production.

The Central Research Institute for Dryland Agriculture (CRIDA), drawing on its experiences from the coordinated research network centers (AICRPDA & AICRPAM) spread across the country and village-level technology demonstrations under NICRA project, has put together a *rabi* production plan especially focusing on rainfed districts in the country. The aim is to build the resilience of farmers through adoption of appropriate interventions in the *rabi* crops to compensate for the likely dip in performance of rainfed crops during *kharif*. Suggested measures include adoption of appropriate crops and varieties and practices/technologies related to crop-water-nutrient management for enhancing productivity of *rabi* crops. I am hopeful that the measures compiled in this document shall be useful to the line departments in implementing the strategy for enhancing agricultural production and productivity during *rabi* 2014-15. I compliment the entire team at CRIDA and NRM division for this timely imitative.

(S. AYYAPPAN)

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1.0 Background

The south west monsoon accounts for nearly 75% of the annual rainfall that occurs during the four month period of June to September. Timely onset and good distribution of rainfall are critical for achieving optimum crop yields during *kharif* season. Any deviation from normal monsoon pattern affects crop production, fodder availability to livestock and causes huge losses to farmers. Adequate rainfall during south-west monsoon not only supports production of major commodities like nutritious cereals, oilseeds and pulses but also determines the success of *rabi* crops through carryover of sufficient moisture in the soil profile (NRAA, 2013).

Drought is the most common weather aberration and is experienced by one part or the other in India. In the last 12 years, large tracts in the country experienced erratic monsoon rainfall leading to widespread drought during 2002, 2009 and 2012. The advancement of monsoon in 2012 witnessed intermittent delays and the coverage over the entire country by the monsoon could happen only by 15th August. In 2009, despite early onset of monsoon and its coverage over the entire country by 15th July, the year recorded the lowest mean annual rainfall of less than 700 mm. In 2012, the onset of monsoon was delayed up to 2 weeks with subsequent slow progress towards north-west with frequent breaks leading to deficit rainfall situation till end of July and late withdrawal of monsoon by three weeks in September. In all these three drought / deficit rainfall years, negative departures during the south west monsoon period affected *kharif* agricultural production (Venkateswarlu *et al.*, 2011).

The probability of the monsoon being erratic is 40% of the time which implies that in 4 out of 10 years there is likelihood of adverse impact on crop production in the absence of appropriate strategy to deal with such eventualities. Monsoon failures result in drought which has serious implications for small and marginal farmers and livelihoods of the rural poor. Rainfed areas constitute nearly 58% of the net cultivated area, account for 40% of the country's food production, support 40% of human and 60% of the livestock population. These areas are the most vulnerable to monsoon failures. The frequency of deficient rainfall (75% of normal or less) is once in 5 years in West Bengal, Madhya Pradesh, Konkan, Bihar and Odisha; once in 4 years in south interior Karnataka, eastern Uttar Pradesh and Vidarbha; once in 3 years in Gujarat, east Rajasthan and western Uttar Pradesh; once in 2.5 years in Tamil Nadu, J & K and Telangana; and once in 2 years in West Rajasthan.

In order to understand the impact of deviations in rainfall during the monsoon period (June to September) on productivity of crops, the latter was regressed on the deviations in monthly rainfall and time trend using the data for the period 1976-2010 using all India on production and productivity. The analysis showed that rainfall during July was more critical to the productivity of crops. A one per cent increase over normal in the rainfall during July was found to increase productivity of pearl millet by about 2.25 kg/ha. Conversely, one per

cent decrease in the rainfall would be accompanied by a productivity fall of about 2.25 kg/ha. Similar rainfall-productivity relationship was observed in case of soybean, cotton, groundnut. Deviations in September rainfall were also found to have positive significant relationship with productivity of sorghum, pigeonpea and soybean. It was also found that rainfall during September also had a significantly positive effect on productivity of *rabi* crops like chickpea, rapeseed and mustard (Table 1).

Table. 1. Impact of deviation in monthly rainfall on productivity of crops (All India)

Crop	Time trend	Jun	Jul	Aug	Sep	R ²	Top five States
Sorghum	6.50	NS	NS	NS	1.80	0.53	Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Rajasthan
Pearl millet	19.28	NS	2.25	5.08	NS	0.82	Rajasthan, Uttar Pradesh, Gujarat, Haryana, Maharashtra
Maize	38.77	2.62	NS	NS	NS	0.92	Andhra Pradesh, Karnataka, Bihar, Maharashtra, Rajasthan
Coarse cereals	22.42	NS	NS	2.21	NS	0.89	Above states
Pigeonpea	-2.11	NS	NS	-1.45	2.00	0.40	Maharashtra, Karnataka, Madhya Pradesh, Uttar Pradesh, Gujarat
Groundnut	12.99	NS	4.92	NS	NS	0.62	Andhra Pradesh, Tamil Nadu, Gujarat, Rajasthan, Karnataka
Soybean	12.65	NS	4.23	NS	2.39	0.70	Madhya Pradesh, Maharashtra, Rajasthan, Andhra Pradesh, Karnataka
Sunflower	5.06	NS	NS	NS	NS	0.33	Karnataka, Andhra Pradesh, Maharashtra, Odisha, Haryana
Cotton	8.02	NS	1.48	NS	NS	0.75	Gujarat, Maharashtra, Andhra Pradesh, Haryana, Madhya Pradesh
Rice	31.66	1.96	3.39	NS	NS	0.96	West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Bihar

Similarly, analysis of relationship of crop productivity (kg/ha) with monthly rainfall (June to September) for both *kharif* and *rabi* crops indicated the impact of rainfall in major producing states. Crop productivity data (1986 to 2010) in different states (season-wise) was used along with rainfall data for the same period. Time trend (productivity increase in kg/ha/year) was included in the analysis to account for yield increase due to technology developemnt over time. In all cases, R^2 value was higher than 0.86 (Table 2).

Tabl. 2. Relationship of crop productivity with monthly rainfall

State	Crop (<i>kharif</i>)	Relationship with month (kg/ha/mm)
Andhra Pradesh (undivided)	Maize	4.05 (Sep)
	Soybean	4.99 (Jun) 2.29 (Jul)
	Groundnut	2.33 (Jun)
	Sunflower	0.89 (Aug) - 0.79 (Sep)
Bihar	Rice	1.46 (Jun)
	Maize	- 0.94 (Jul)
Gujarat	Pearlmillet	2.34 (Jun) 0.99 (Jul)
	Groundnut	3.4 (Jun) 0.99 (Jul)
	Cotton	0.56 (Aug) 0.70 (Sep)
Karnataka	Sorghum	1.27 (Jun) - 0.61 (Jul)
Maharashtra	Maize	3.53 (Sep)
	Pearlmillet	0.34 (Sep)
	Pigeonpea	0.94 (Sep)
	Cotton	0.39 (Sep)
Rajasthan	Sorghum	1.32 (Aug)
	Sunflower	3.01 (Sep)
Uttar Pradesh	Rice	1.72 (Sep)

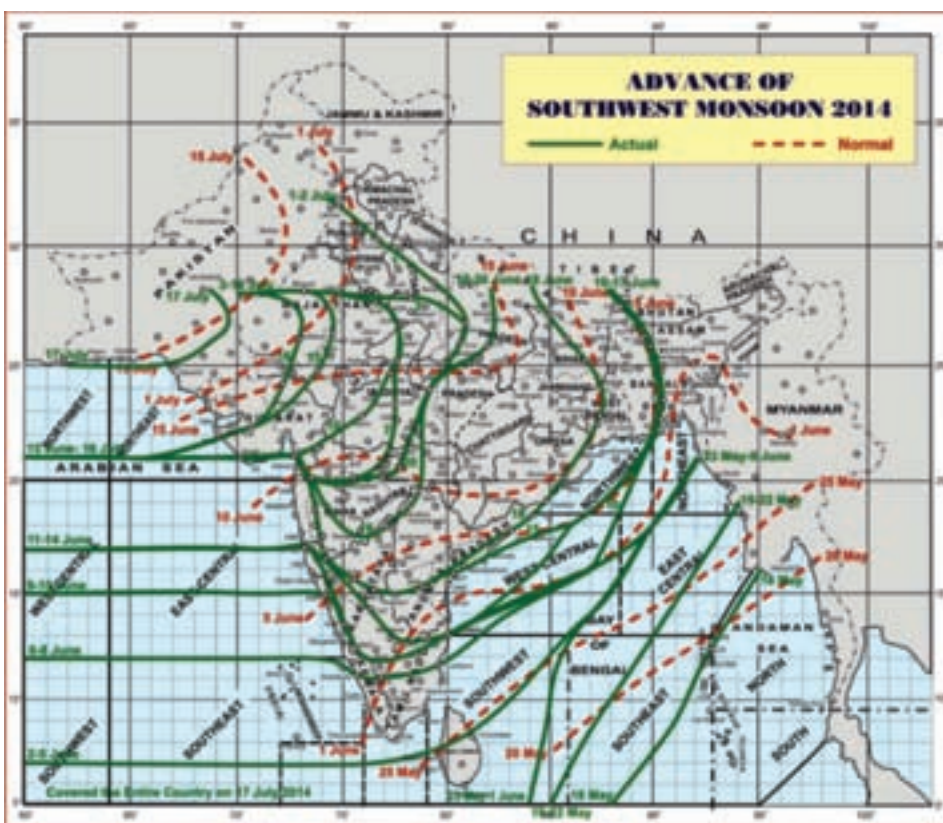
2.0 Performance of Monsoon 2014

Every year rainfall occurs during June, July, August and September in the country due to the moist laden southwest monsoon (SWM) winds. These four months are called as SWM season. The onset of monsoon generally takes place over Kerala by 1st June and subsequently progresses north and westwards to cover various regions of the country. Rainfall in the month of July and its distribution is very crucial for realizing agriculture productivity and production. The Indian Summer Monsoon is characterized by large spatio-temporal variability on various scales. The pattern of variability in every year is unique.

During 2014, advancement of monsoon and the amount of rainfall has shown large spatial variability. This ultimately impacted on the sowing of major *kharif* crops in the country.

2.1. Onset of 2014 Monsoon and its progress

- The normal date of onset of SW monsoon over Kerala is 1st June (Fig. 1).



(Source:IMD)

Fig. 1. Actual dates of monsoon onset in 2014

- South-west monsoon set in over Kerala on 6th to 8th June and covered Assam by 10th to 17th June. Further, monsoon advanced into coastal Karnataka on 9th to 10th June on 11th to 14th June it covered Goa, parts of Karnataka, Rayalaseema and coastal Andhra Pradesh. On 15th to 16th June monsoon further advanced to parts of southern Gujarat Mumbai and further advanced on 18th June to parts of coastal Odisha, Gangetic West Bengal, Sub-Himalayan West Bengal and Sikkim and Bihar.
- Thereafter, the advance of monsoon took a slow pace and covered parts of Maharashtra, North Interior Karnataka, Telangana, remaining parts of Odisha, Jharkhand, Chhattisgarh, West Madhya Pradesh and parts of East Uttar Pradesh by 19th to 30th June.
- By 1st to 2nd July monsoon advanced into remaining parts of East Uttar Pradesh, parts of West Uttar Pradesh, Uttarakhand, Himachal Pradesh, parts of Haryana and Punjab. from 3rd to 16th July, monsoon advanced into West and North West parts of the country including parts of Gujarat, Rajasthan, West Madhya Pradesh, remaining parts of Punjab and Haryana.
- On 17th July Monsoon has covered entire country

2.2 Rainfall characteristics of 2014

The average daily rainfall over the country as a whole is given in Fig. 2. The day to day rainfall at all India level and four broad geographical regions level indicated thatt:

- During this monsoon, the daily all India rainfall was below average for 77 days, normal rains for 12 days and above average for 33 days from the onset to 19th September 2014. During 21st June to 11th July and 8th to 29th August leaving four days in between, daily rainfall was below average. Good spell of rains received from 30th August to 9th September and above average rainfall from 20th to 22nd September. Overall The rainfall situation for the country as whole stands normal at -12% departure over long period average (LPA).
- The daily rainfall over the four broad geographical regions is given in Fig. 3. Except few spells of above normal rainfall, the daily rainfall over east and north east India remained below average from onset to 19th September but attained normal rainfall situation as per IMD norms with -12% departure over LPA, whereas the daily rainfall over South peninsula, rainfall picked up by 6th July onwards and this region is normal at -7% departure over LPA and Central India received rainfall during July and August and became normal (-10%)
- The most seriously affected region was north west India, where the deficit is 21%.

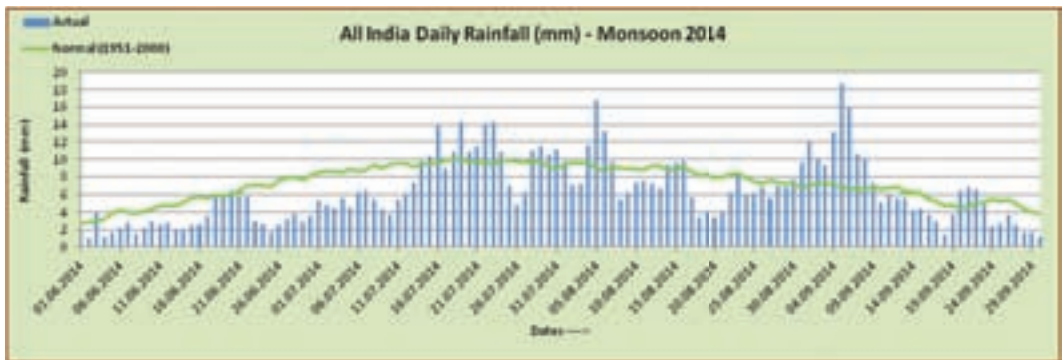
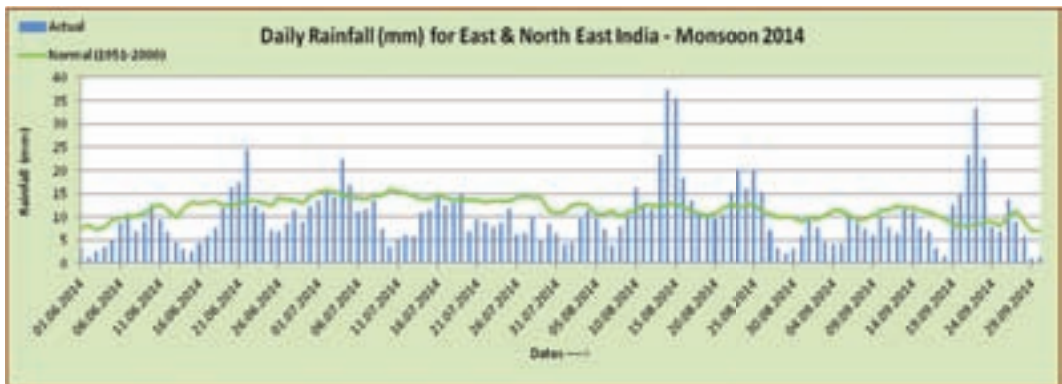
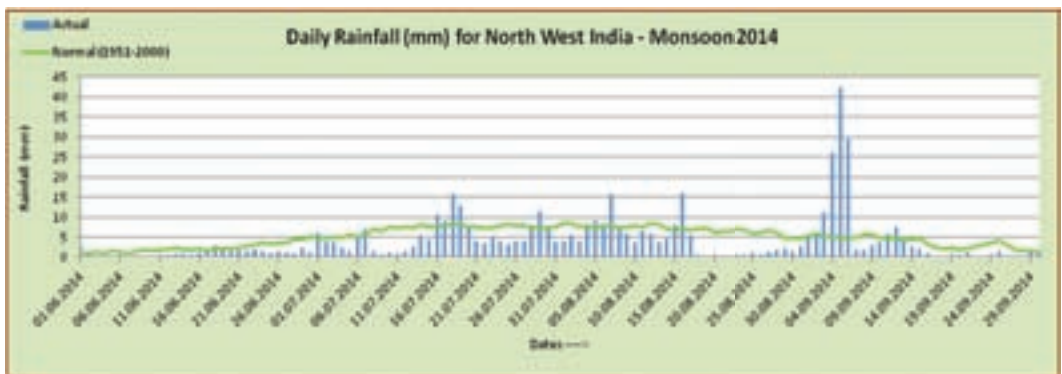


Fig. 2. Daily mean rainfall over the country as a whole during South-west Monsoon (SWM) 2014



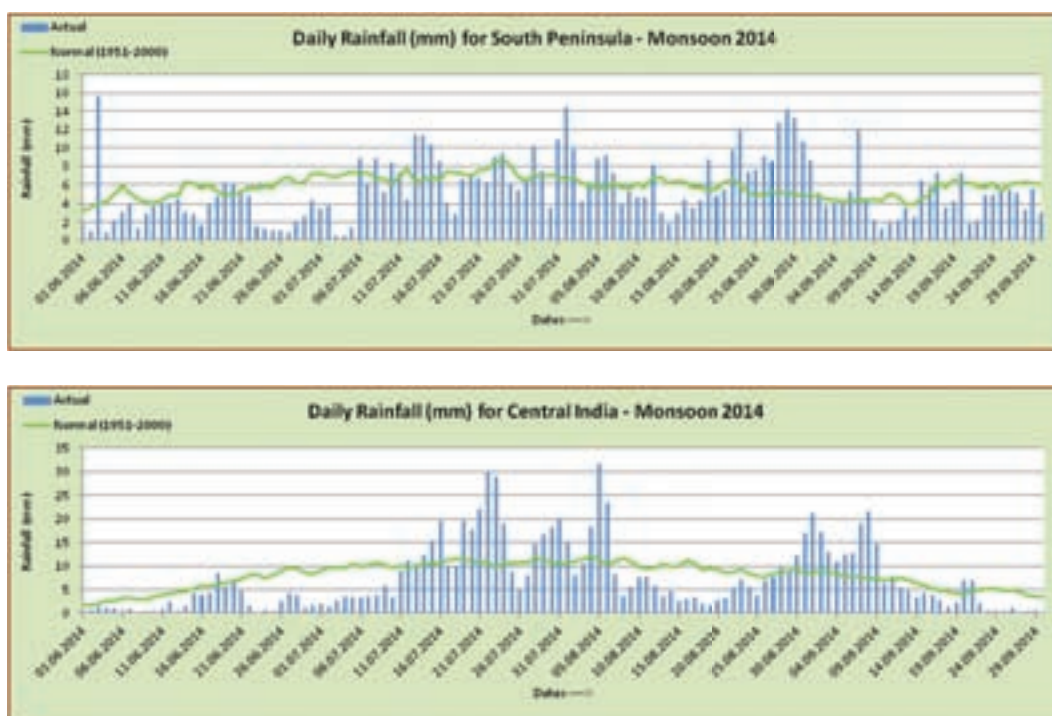


Fig. 3. Daily mean rainfall (mm) in different homogeneous regions of the country during SWM 2014

- For the country as a whole and all the four homogeneous regions, the seasonal rainfall departures up to 30th September over the LPA are given in Table 3.

Table 3. Summary of rainfall over four homogeneous regions (30.09.2014)

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	777.5	886.9	-12
North-west India	483.1	615.0	-21
Central India	879.7	974.2	-10
Southern Peninsula	665.4	715.7	-7
East & North-east India	1267.7	1437.8	-12

- Disaggregated meteorological sub-division wise rainfall presents a different scenario which indicates that out of 36 meteorological subdivisions, the rainfall was excess in 1 (3% of area of the country covered by subdivision), normal in 23 (67% area of the country covered by subdivisions) and deficient in 12 (30% area of the country covered by subdivisions) subdivisions.

- The sub-divisions having deficient rainfall are Nagaland, Manipur, Mizoram and Tripura (NMMT), east and west Uttar Pradesh, Haryana, Chandigarh and Delhi, Punjab, Himachal Pradesh, Uttarakhand, east Madhya Pradesh, Marathwada, coastal Andhra Pradesh, Rayalaseema and Telangana.
- The percent departure of rainfall India as a whole on weekly basis as well as for the cumulative percent departure of rainfall for the entire country is given in Fig. 4 and Fig. 5 respectively. The week by week departure of rainfall from LPA which indicates that except the weeks ending with 23rd, 31st July, 6th August 3rd and 10th September, percent departure of rainfall from the LPA was negative during all remaining weeks. Cumulative rainfall for the country as a whole indicates that percent departure of rainfall for the country as a whole has been negative throughout the rainy season with greater deficit in the first part of the season. Rainfall deficit during the critical July month leads to impact on the sowings of major crops throughout the country.

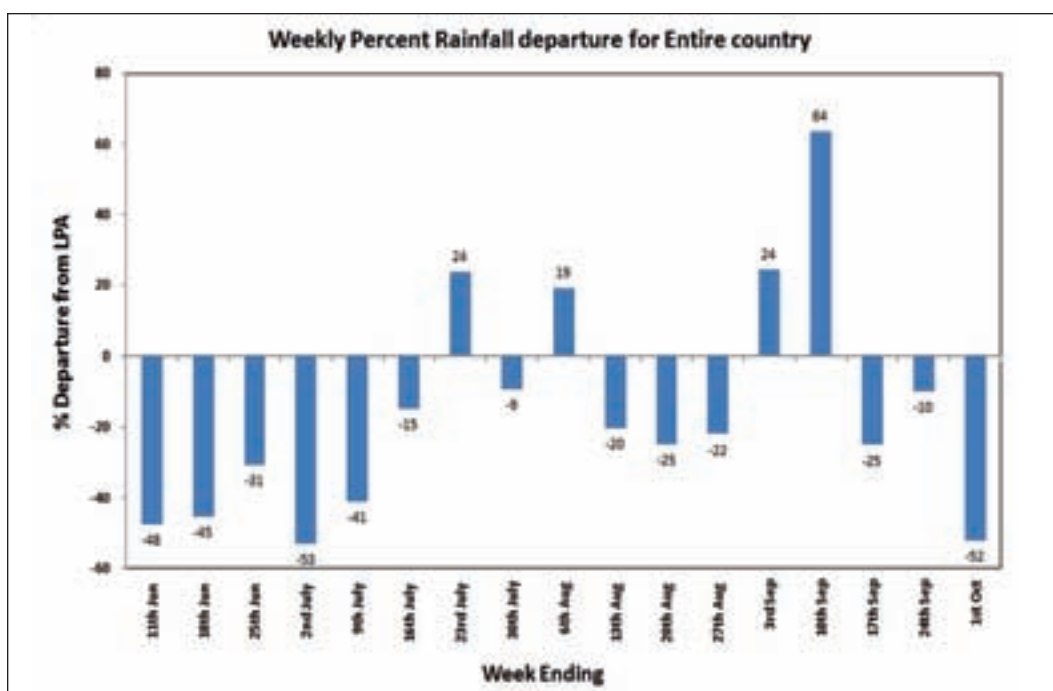


Fig. 4: Weekby week rainfall departure (%) from long period average (LPA)

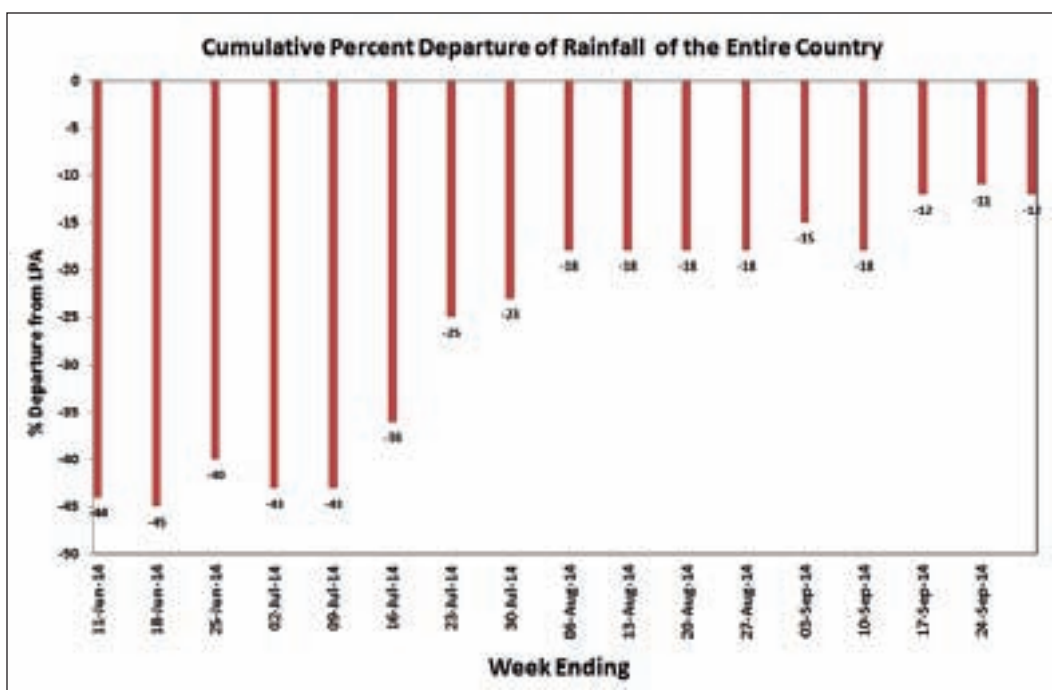


Fig. 5: Cumulative rainfall departure (%) from long period average (LPA)

2.3 Regions showing severe deficient rainfall

- The distribution of rainfall is more important especially for *kharif* crops than the overall total rainfall. The meteorological subdivision wise summary of rainfall and the number of weeks with excess, normal, deficient, scanty or no rainfall from 1st June 2014 to 30th September 2014 is given Table 4. Meteorological subdivisions which experienced most severe week wise departure of rainfall during 2014 are given in Table 5.
- Twelve meteorological sub divisions viz. Nagaland, Manipur, Mizoram and Tripura (NMMT), east & west Uttar Pradesh, Haryana, Chandigarh and Delhi, Punjab, Himachal Pradesh, Uttarakhand, East Madhya Pradesh, Marathwada, Coastal Andhra Pradesh, Rayalaseema and Telangana are the most affected subdivisions with deficit ranging from -23 to -56%. Number of districts that are seriously affected are 68 out of 71 in Uttar Pradesh, 16 out of 20 in Punjab and all 31 districts in Haryana, Chandigarh and Delhi. These districts falling under either deficient or scanty category.

Table 4. Subdivision-wise weekly rainfall distribution during SWM 2014

S.No.	States	Cumulative Rainfall			Distribution of number of Districts							
		1 st Jun to 30 th September			* 1 st Jun to 30 th September							
		Actual (mm)	Normal (mm)	Departure (%)	E	N	D	S	NR	ND	TOTAL	TOTAL
1	And. & Nic. Islands	1619	1683	-4	0	3	0	0	0	0	3	3
2	Arunachal Pradesh	1748	1768	-1	2	5	4	1	0	4	16	16
3	Assam & Meghalaya	1635	1793	-9	3	25	5	0	0	1	34	34
4	Naga, Mani, Mizo, Trip.	1119	1497	-25	1	8	5	2	0	17	33	33
5	SHW. Bengal & Sikkim	1865	2006	-7	1	2	1	0	0	0	4	4
6	Gangetic W. Bengal	1001	1168	-14	0	15	4	0	0	0	19	19
7	Odisha	1257	1150	9	8	22	0	0	0	0	30	30
8	Jharkhand	930	1092	-15	1	12	11	0	0	0	24	24
9	Bihar	849	1028	-17	2	20	14	2	0	0	38	38
10	Uttar Pradesh	429	834	-49	1	2	42	26	0	0	71	71
11	Uttarakhand	898	1229	-27	0	3	10	0	0	0	13	13
12	Hary. Chand. & Delhi	203	466	-56	0	0	17	14	0	0	31	31
13	Punjab	244	492	-50	0	4	9	7	0	0	20	20
14	Himachal Pradesh	522	825	-37	0	4	5	3	0	0	12	12
15	Jammu & Kashmir	633	535	18	11	5	2	1	1	2	22	22
16	Rajasthan	441	440	0	4	23	6	0	0	0	33	33
17	Madhya Pradesh	759	964	-21	2	19	29	0	0	0	50	50
18	Gujarat	616	687	-10	3	17	9	0	0	0	29	29
19	Konkan & Goa	2753	2914	-6	0	2	0	0	0	0	2	2
20	Maharashtra	630	789	-20	0	21	14	0	0	0	35	35
21	Chhattisgarh	1104	1147	-4	1	15	2	0	0	0	18	18
22	Andhra Pradesh	379	490	-23	0	5	8	0	0	0	13	13
23	Telangana	499	755	-34	0	1	9	0	0	0	10	10
24	Tamil Nadu & Pondicherry	315	317	-1	7	14	13	0	0	2	36	36
25	Karnataka	1467	1417	4	9	17	4	0	0	0	30	30
26	Kerala	2163	2040	6	0	14	0	0	0	0	14	14
27	Lakshadweep	955.3	998.5	-4	0	1	0	0	0	0	1	1
Total					56	279	223	56	1	26	641	641

E- Excess; N=Normal, D=Deficient (since districts have been taken some of the subdivisions were merged into states like WUP+EUP=UP) S-Scanty; NR-No Rain; ND- No Data

Table 5. Meteorological sub-divisions which experienced most severe week wise departure of rainfall during 2014

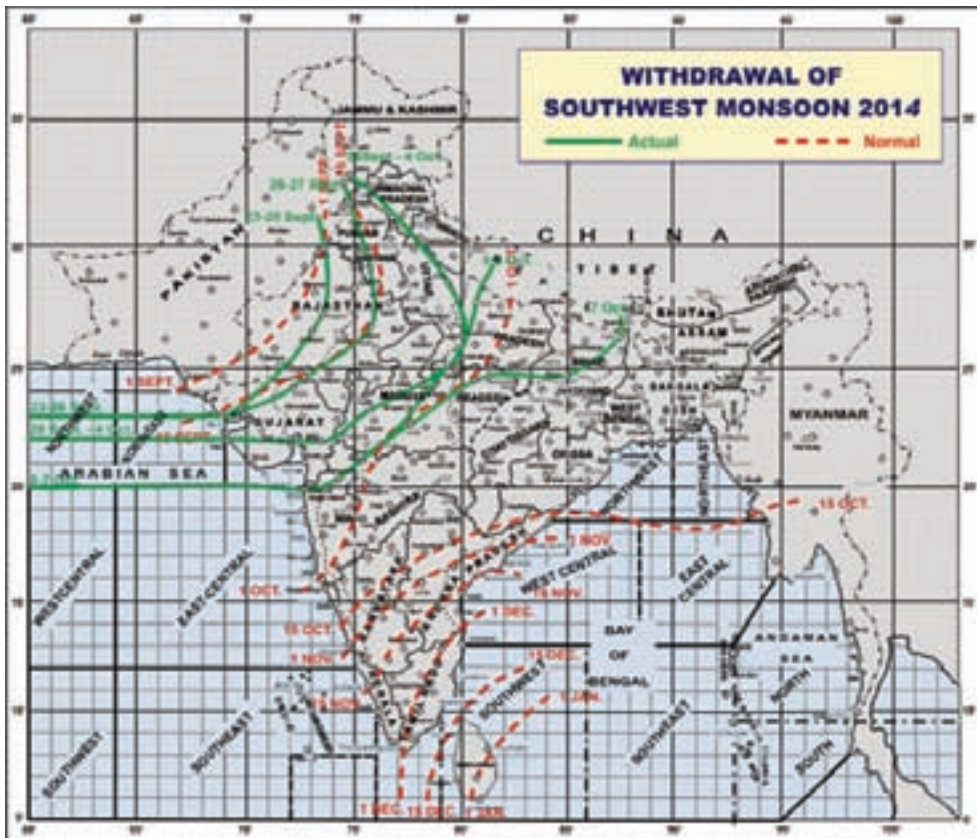
S.No.	MET. SUBDIVISIONS	11 JUN 2014	18 JUN 2014	25 JUN 2014	02 JUL 2014	09 JUL 2014	16 JUL 2014	23 JUL 2014	30 JUL 2014	06 AUG 2014	13 AUG 2014	20 AUG 2014	27 AUG 2014	03 SEP 2014	10 SEP 2014	17 SEP 2014	24 SEP 2014	01 OCT 2014
1	A & N ISLAND	25	91	-63	-74	37	95	-53	21	-36	14	-38	-17	-15	59	65	-77	-71
2	ARUNACHAL PRADESH	-6	-73	-2	-19	-17	-26	7	-50	-30	91	103	164	-77	-22	-47	28	29
3	ASSAM & MEGHALAYA	10	-68	23	-28	-33	-32	-43	-37	-41	-12	76	35	-63	-26	-48	262	-18
4	N M M T	-80	-53	-21	-52	-72	-44	-53	-17	-56	-47	14	-36	-16	6	-22	73	-41
5	SHWB & SIKKIM	97	-48	33	-6	-10	-45	-46	-48	-53	-21	44	79	-52	-17	-40	64	-31
6	GANGETIC WEST BENGAL	-85	-47	31	14	1	-28	-23	-28	-1	11	37	-40	-1	-55	-65	97	-79
7	ORISSA	-80	-70	-57	-20	-47	55	126	20	181	-39	-46	-36	46	62	-14	21	-93
8	JHARKHAND	-74	-55	28	-14	53	-52	15	-46	-1	41	-3	-48	-28	-50	-7	11	-94
9	BIHAR	-20	-64	34	-27	70	-82	-26	-55	-53	-20	161	-25	-73	-80	12	2	-38
10	EAST U.P.	-94	-26	-15	-65	40	-74	9	-56	-22	-51	-37	-90	-72	-65	-8	-64	-69
11	WEST U.P.	-100	-14	-73	-63	-80	-78	46	-52	-26	-78	-82	-99	-68	-3	-39	-86	-99
12	UTTARAKHAND	-87	-29	-59	-52	-63	11	99	-6	-25	-36	8	-96	-34	-49	-57	-80	-13
13	HAR. CHD & DELHI	-100	59	-64	-55	-59	-93	-8	-65	-59	-74	-98	-100	-38	75	-51	-99	-99
14	PUNJAB	-100	-74	-41	3	-75	-80	-51	-43	-72	-64	-74	-98	-63	209	-35	-96	-94
15	HIMACHAL PRADESH	-98	-25	-46	5	-63	-24	-33	-35	-56	-45	42	-96	-48	16	-80	-86	-64
16	JAMMU & KASHMIR	-98	-58	-47	2	-50	-32	-54	-65	-71	-40	123	-80	55	792	-96	-77	-41
17	WEST RAJASTHAN	-98	-85	-15	-68	-84	-80	25	75	32	79	-95	-85	33	235	64	-100	-100
18	EAST RAJASTHAN	-94	-45	-45	-90	-83	-37	17	47	50	176	-96	-80	34	55	99	-98	-100
19	WEST MADHYA PRADESH	-97	-18	-76	-93	-72	31	90	32	15	-14	-95	-66	38	92	-13	-84	-94
20	EAST MADHYA PRADESH	-98	39	-14	-75	-64	-30	82	-55	83	-53	-91	-84	-23	0	-40	-84	-100
21	GUJARAT REGION	-99	-65	-96	-99	-94	-58	27	117	18	-62	-74	-41	31	207	23	-96	-90
22	SAURASHTRA & KUTCH	-99	82	-98	-99	-98	-38	-11	101	148	-27	-70	-62	199	130	1	-98	-79

23	KONKAN & GOA	-81	-4	-70	-95	-41	96	10	37	56	-33	-63	-26	128	104	8	-64	-43
24	MADHYA MAHARASHTRA	-42	-71	-74	-96	-65	-30	67	87	55	-48	-51	126	112	96	-66	-74	-67
25	MARATHWADA	-64	-79	-77	-95	6	-32	-60	-59	-51	-83	-78	60	97	-3	-68	-81	-98
26	VIDARBHA	-84	11	-87	-87	-70	10	156	-27	-29	-79	-84	-23	100	165	-48	-73	-100
27	CHHATTISGARH	-94	-51	-36	-48	-65	23	131	-31	91	-35	-64	-53	48	49	-39	57	-99
28	COASTAL ANDHRA PRADESH	-70	-90	-88	-54	7	-2	-58	42	-61	-38	-27	-5	57	-15	32	-1	-79
29	TELANGANA	-83	-38	-73	-82	-32	-27	-69	-12	-61	-79	-86	10	124	44	-1	-53	-92
30	RAYALASEEMA	5	-85	-89	8	25	31	-88	-63	-87	-44	-19	117	-27	-46	12	-66	-68
31	TAMILNADU & PONDICHERRY	-9	-86	-30	204	-1	-10	-65	-62	-16	78	144	-7	-51	-52	-39	6	10
32	COASTAL KARNATAKA	-65	5	-21	-86	-66	67	0	-8	130	41	-62	16	164	69	12	-58	-26
33	N.I. KARNATAKA	-16	-67	-55	-84	41	-10	-15	-13	5	-47	-3	227	178	-17	-23	-31	-59
34	S.I. KARNATAKA	-60	-46	12	-67	-60	66	66	32	134	-2	3	112	82	21	-61	-22	100
35	KERALA	-17	-27	12	-69	-80	68	10	-9	180	12	-65	73	312	33	-32	-71	10
36	LAKSHADWEEP	38	-40	-93	-13	-45	-45	-77	-77	-35	115	48	290	171	53	-70	-99	-38

Legend	Description
	Excess (20% & above)
	Normal (-19% to 19%)
	Deficient (-20% to -59%)
	Scanty (-60% and above)

2.4 Withdrawal of Monsoon 2014

Withdrawal of the southwest monsoon 2014 is started on 23rd September 2014. Currently (on 7th September 2014) monsoon withdrew from Northwestern parts, Gujarat state, Uttar Pradesh, parts of Madhya Pradesh and Parts of Bihar (Fig. 6).



(Source:IMD)

Fig.6. Withdrawal of southwest monsoon 2014

3.0. Impact of Monsoon 2014

3.1. Water storage in reservoirs

The Central Water Commission (CWC) monitors the storage available in 84 major reservoirs across the country and a weekly report is issued. Information available from the latest report made on 25th September, 2014 indicates that the region wise storage available in these reservoirs is higher than the average storage available during last 10 years in all regions except for Southern region. Current storage available is almost equal to the last year's storage in Eastern and Western regions (Table 6).

Table. 6. Water storage levels in reservoirs monitored by CWC

Region	Total live storage available capacity (BCM)	% storage of capacity		
		Average storage during last 10 years	Storage during last year	Storage during current year
Northern	18.01	81	92	83
Eastern	18.83	77	83	82
Western	24.54	80	83	83
Central	42.3	66	89	84
Southern	51.37	80	83	72
All India	155.046	75	85	79

Analysis of storage information available at each reservoir across regions indicates that less water is available in few reservoirs compared to last 10 years average storage in different regions.

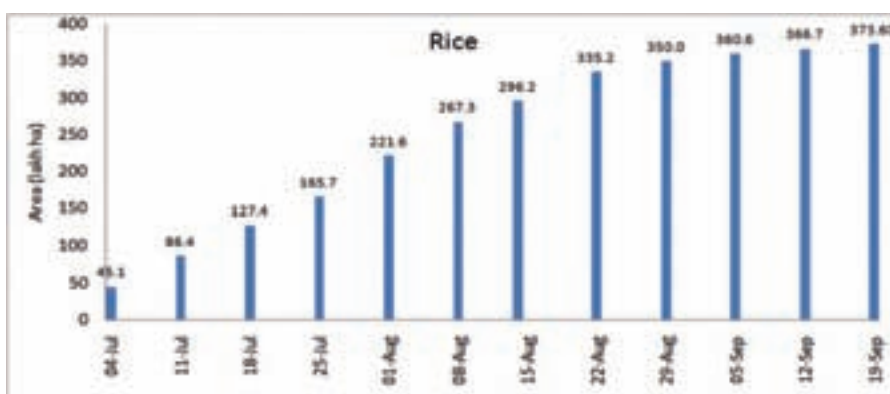
- Northern region - Pong dam in Himachal Pradesh (17% deficit)
- Eastern region - Kangsabti dam in West Bengal (14% deficit) Hirakud in Odisha (4% deficit)
- Western region - Shetrunj (28% deficit) and Bhadar (23% deficit), Dantiwada (18% deficit), Damanganga (4% deficit) and Panam dams (6% deficit) in Gujarat, Jayakwadi dam (16% deficit), Girna dam (10% deficit)
- Southern region - Lower Bhavani (28% deficit) and Vaigai dam (19% deficit) in Tamil Nadu

Among these reservoirs, only Jayakwadi and Vaigai reservoirs have culturable command area of more than 100,000 ha. Reservoirs of Sardar Sarovar in Gujarat, Indira Sagar in Madhya Pradesh, Nagarjuna Sagar in Andhra Pradesh, which have more than 500,000 ha of culturable command area, had 100% storage during this period.

3.2. Progress in *kharif* crops sown area

Progress in sowings of rainfed crops was badly hit due to deficit rainfall conditions. Delayed planting coupled with intermittent dry spells is likely to have an adverse impact on *kharif* production of millets (sorghum and pearl millet), pulses (pigeonpea and greengram) and oilseed crops (groundnut). In 2014, about 17 lakh ha area under coarse cereals, 2.2 lakh ha under pulses, about 7.5 lakh ha under oilseeds was unsown till 19th September 2014 which is likely to impact production.

Except that of rice, which showed a steady progress, sowing of other crops was delayed due to the delayed onset of monsoon during 2014 (Fig. 7). Significant jump in sowings for most crops occurred in the third week of July after receipt of rains. Coverage under rainfed crops was mostly hit and was lower than normal average area sown (Fig. 8). Area coverage was more than normal average area sown in case of rice, maize, soybean, blackgram and cotton. Farmers preferred to sow soybean and cotton with further delay in monsoon especially in Marathwada and Telangana regions. However, there is likely decline in production in view of the reduction in area and prolonged dry spells experienced by standing crop is anticipated in sorghum, pearl millet, greengram and groundnut crops. Although increase in acreage is higher under cotton and soybean, the early sown crops had to be re-sown in June to July and the standing crops experienced both early and mid-season dry spells. Also, a sizable area of both these crops was sown after mid-July. Hence, productivity decline is anticipated in these crops. The decline in area under sorghum and pearl millet is likely to adversely impact fodder availability.



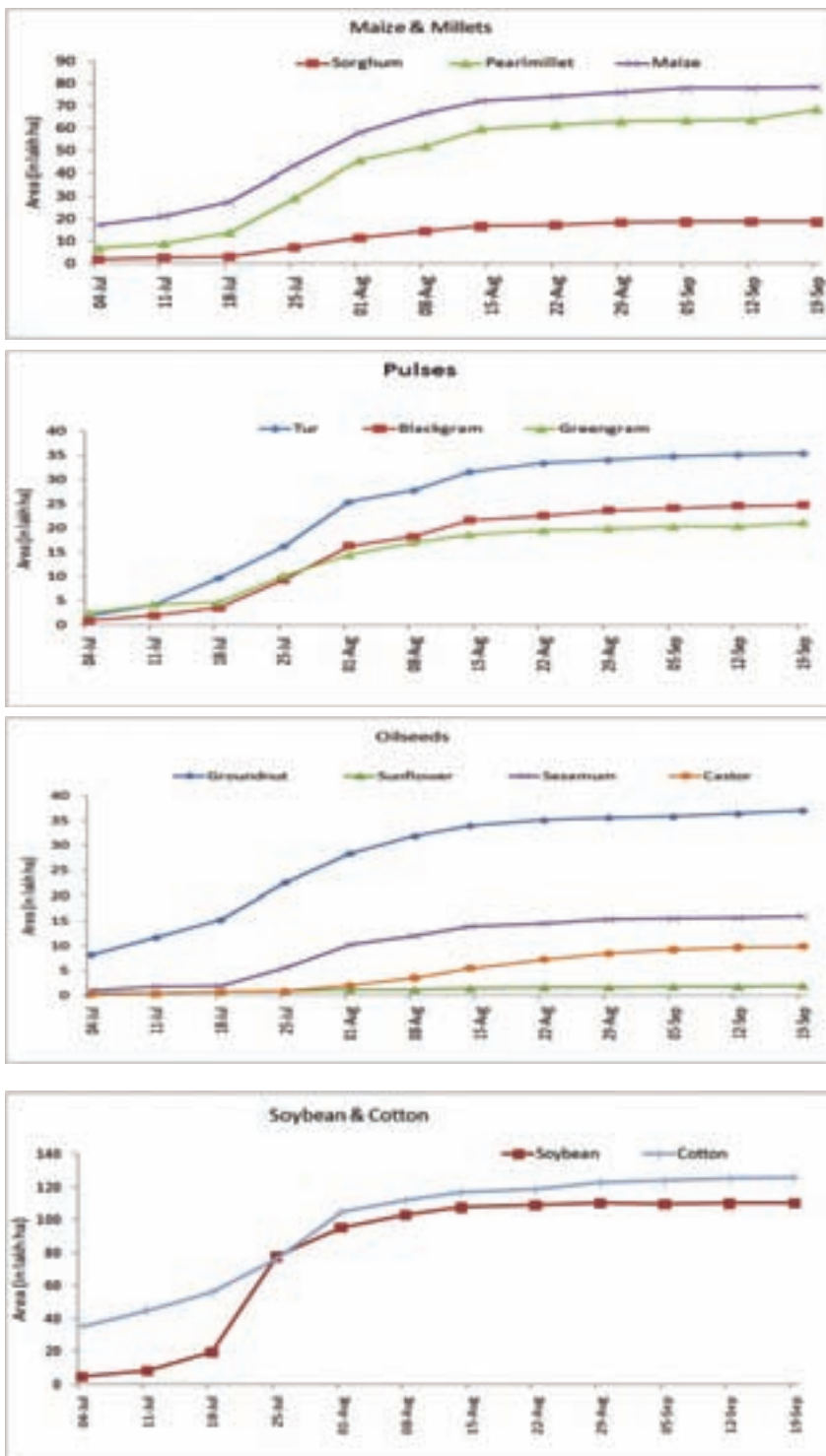


Fig. 7. Progress in sowings of different crops in 2014 monsoon season

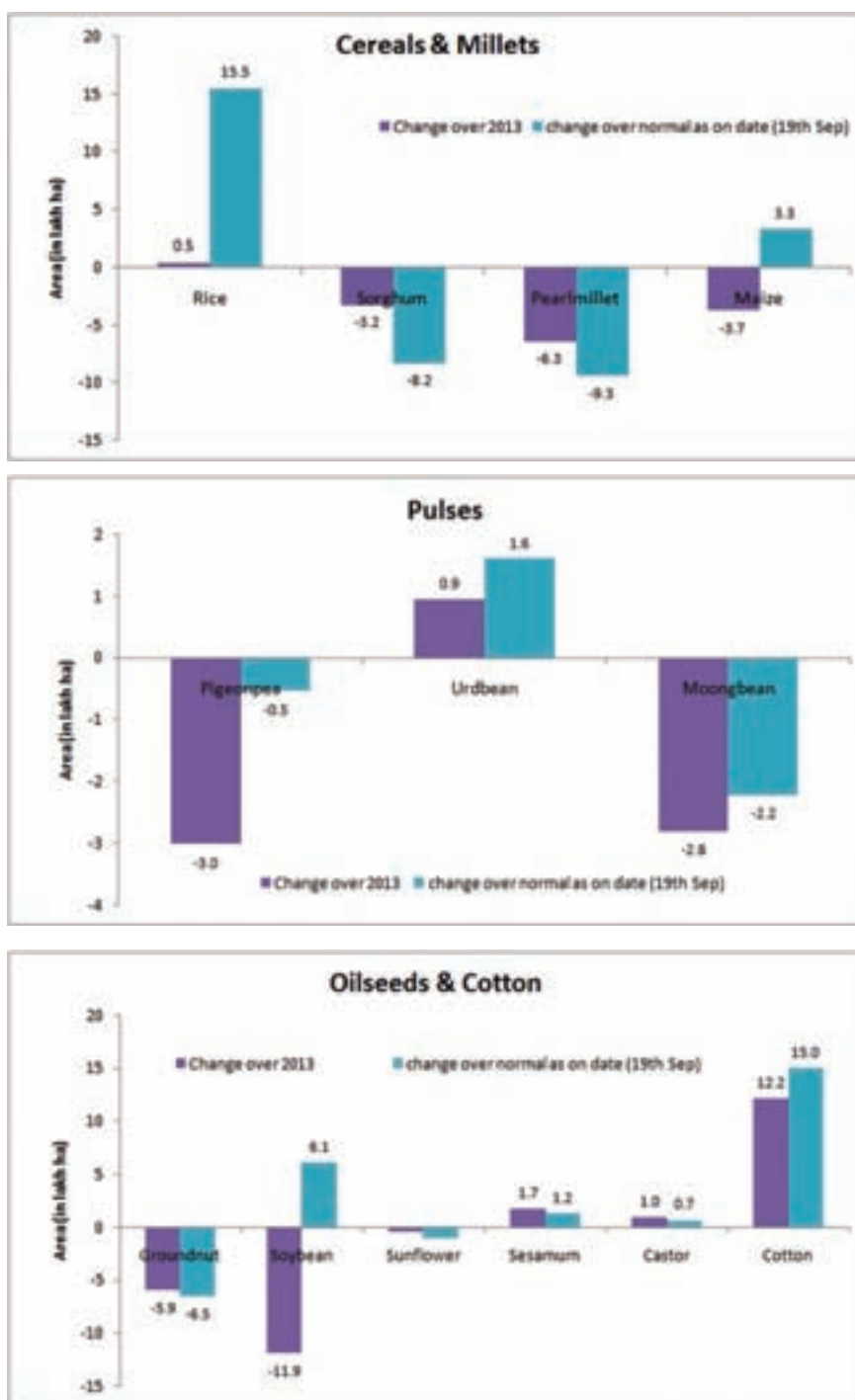


Fig. 8. Progress in crop sowings (lakh ha) compared to 2013 (previous year) and over normal kharif area a) cereals & millets b) pulses c) oilseeds & cotton

3.3 Prospects of groundwater recharge

The rainfall distribution coupled with total rainfall greatly influences the groundwater recharge during the monsoon period. Exact estimation of groundwater recharge would require considerable time and large quantities of data. On the other hand, qualitative estimation of groundwater recharge prospects was attempted by interpreting the rainfall received on a week to week basis for each district. For example, if scanty rainfall is received in more than 65% of weeks or deficit rainfall is received in more than 80% of weeks on a cumulative basis, the recharge possibility is considered to be extremely low. Criteria followed for categorizing groundwater recharge prospects are given in Table 7.

Table. 7. Categorization of groundwater recharge

Percent of deficit* rainfall weeks	Percent scanty* rainfall weeks	Groundwater recharge prospects
80	65	Extremely low
70	50	Very Low
50	30	Low
30	10	Medium
10	0	Normal

*deficit rainfall = - 20 to - 59% of normal rainfall; scanty = - 60% & above

Rainfall data furnished by IMD (www.imd.gov.in) during the current monsoon was utilized for the analysis purpose. Based on weekly rainfall analysis, the groundwater recharge due to monsoon rainfall appears to be extremely low to very low in about 197 districts (30% of total districts). About 57% of total districts have low to extremely low prospects for groundwater recharge. About 37 districts (52% of UP districts) out of this 7 districts are in Uttar Pradesh. Among the states of Punjab and Telangana, 75% (15 districts) and 80% (8 districts) of districts, respectively, have extremely low to very low prospects for groundwater recharge. States of Rajasthan Karnataka, Maharashtra and Andhra Pradesh had extremely low to very low ground water recharge prospects in about 6% (2 districts), 20% (6 districts), 25% (9 districts) and 15% (2 districts), respectively. States of Bihar, Jharkhand and Chhattisgarh had extremely low to very low groundwater recharge prospects in about 29% (11 districts), 29% (7 districts), and 11% (2 districts), respectively.

Prospects of groundwater recharge in rabi cropped areas

Districts with significant area during *rabi* season for different crops were identified. These districts cover 80% of *rabi* area under each crop. The crops considered for the study included wheat, chickpea, rice, sorghum, rapeseed & mustard, maize and groundnut. Out of 421 districts indentified to be dominant for *rabi* cropping, 112 districts had extremely low to very low groundwater recharge prospects. Among these 112 districts, 32 districts fall in Uttar Pradesh, 11 districts each in Haryana and Punjab, 9 districts each in Bihar and Maharashtra, 7 districts in Telangana and others are spread across Karnataka, Madhya Pradesh and Tamil Nadu. Another 133 districts had low prospects for groundwater recharge during the current monsoon and are spread in Uttar Pradesh (19 districts), Madhya Pradesh (121 districts), Gujarat (18 districts), Rajasthan (16 districts), Maharashtra (12 districts), Andhra Pradesh (7 districts). About 198 districts had the possibility of medium to normal groundwater recharge prospects.

The prospects of groundwater recharge for different crops in *rabi* cropping areas is given below:

a. Rice growing areas

Rice is grown during *rabi* season in about 109 districts in the country distributed in Andhra Pradesh, Assam, Bihar, Jharkhand, Karnataka, Kerala, Odisha, Telangana, Uttarakhand and West Bengal. Area under different sources of irrigation available in these districts, was categorized into canal irrigated, well irrigated and areas dependent on residual moisture. In the present analysis, states of Andhra Pradesh, Bihar, Jharkhand, Telangana were considered due to availability of irrigation source-wise data sets. Among these 4 states about 11 districts are dependent on canal irrigation system and are located in Andhra Pradesh (7) and Bihar (4). About 17 districts are dependent on well irrigation and are located in Bihar (9), Telangana (7), Andhra Pradesh (1). Among these 17 districts, the groundwater recharge prospects are extremely low to very low in 7 districts and are located in Bihar (2 districts) and Telangana (5 districts). Attempts to grow rice during *rabi* season in these districts would deplete the scarce groundwater and lead to non availability as the season progresses. Hence, growing of rice during *rabi* season is to be dissuaded in these districts. The districts include Purnea and Kathiwar in Bihar; Nizamabad, Medak, Warangal, Karimnagar and Nalgonda in Telangana. Saran in Bihar and Ranchi in Jharkhand, which grow rice in *rabi* season with residual moisture and/or with well irrigation could also suffer due to extremely low prospects of groundwater recharge during the current season (Table 8).

Table 8. Prospects of groundwater recharge for rice crop

State	District	Irrigation system (well / residual moisture)	Groundwater recharge prospects
Bihar	Purnea	Well	Extremely Low
	Katihar	Well	Very Low
	Araria	well	Low
Jharkhand	Ranchi	Residual moisture	Extremely Low
Telangana	Karimnagar, Medak	Well	Extremely Low
	Nalgonda, Nizamabad, Warangal	Well	Very Low
	Khammam, Mahabubnagar	Well	Low

b. Wheat growing areas

About 170 districts are identified to be growing wheat crop are located in Uttar Pradesh (62 districts), Madhya Pradesh (32 districts), 16 districts each in Punjab, Haryana and Rajasthan, Bihar (13 districts) and others in states of Gujarat, Himachal Pradesh, Jammu & Kashmir. Among these 170 districts, canal irrigation is dominant in 45 districts (in the states of Punjab, Haryana, Rajasthan and Uttar Pradesh). Wheat is grown under well irrigated systems (95 districts) is dominant in the states of Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar and Gujarat. Other systems present include canals and wells, residual moisture, residual moisture and well irrigation etc. Among the districts with canal irrigation facility for wheat crop, 25 districts out of 45 districts had extremely low to very low groundwater recharge prospects. However, considering the storage available in the reservoirs which support these districts, there may not be any deficiency in availability of canal irrigation and normal area could be sown during *rabi* crop. About 95 districts, where groundwater plays a dominant role in wheat cultivation, 29 districts spread in Uttar Pradesh (23 districts), Bihar (4 districts), one district each in Madhya Pradesh and Rajasthan had extremely low to very low groundwater recharge prospects during the current monsoon, which could impact the wheat production. About 33 districts of 95 districts, located in Uttar Pradesh (13 districts) and Madhya Pradesh (10 districts), Gujarat (4 districts), 3 districts each in Maharashtra and Rajasthan had low prospects for groundwater recharge. It is anticipated that much of this area under wheat in these districts could shift to chickpea from wheat crop (Table 9).

Table 9. Prospects of groundwater recharge for wheat crop

State	District	Irrigation system (well / residual moisture)	Groundwater recharge prospects
Bihar	Buxar, Saran	Well	Extremely Low
	Aurangabad, Bhojpur	Well	Very Low
Gujarat	Banaskantha, Kheda, Mehsana, Sabarkanta	Well	Low
Himachal Pradesh	Kangra	Residual moisture	Extremely Low
Madhya Pradesh	Chhatarpur	Well	Extremely Low
	Bhind, Damoh, Dewas, Dhar, Indore, Khargone (West Nimar), Ratlam, Sehore, Shajapur, Ujjain	Well	Low
Maharashtra	Ahmednagar, Nasik, Solapur	Well	Low
Rajasthan	Alwar	Well	Extremely Low
	Chittorgarh, Jaipur, Nagaur	Well	Low
Uttar Pradesh	Bulandshahar, Etah, Farrukhabad, Firozabad, Ghaziabad, Gonda, Hardoi, Kanpur (Dehat), Kushi Nagar, Meerut, Pilibhit, Rampur,	Well	Extremely Low
	Agra, Azamgarh, Ballia, Bareilly, Deoria, Fatehpur, Muzaffarnagar, Sant Kabir Nagar, Shahjahanpur, Sultanpur, Unnao	Well	Very Low
	Aligarh, Balrampur, Faizabad, Ghazipur, Gorakhpur, Hamirpur, Jaunpur, Kannauj, Lalitpur, Mau, Moradabad, Saharanpur, Siddharth Nagar	Well	Low

c. Rapeseed and Mustard growing areas

Above 80% rapeseed & mustard is cultivated in 70 districts spread in Rajasthan, Madhya Pradesh, Haryana, West Bengal, Uttar Pradesh etc. Among these 70 districts, well and canal irrigation systems are dominant in 45 districts and 11 districts, respectively. In about 9 districts, residual moisture plays a dominant role. Among 11 districts with canal irrigation system spread in Haryana, Rajasthan and Uttar Pradesh, the cropped area may not reduce as the storage in reservoirs which support the canal systems is sufficient. Among 45 districts, where well irrigation is dominant, spread in Rajasthan (25 districts), West Bengal (8 districts), Madhya Pradesh (5 districts), Gujarat (3 districts), one district each in Madhya Pradesh (Chhatarpur district), Rajasthan (Alwar district) had extremely low prospects for ground water recharge which may result in reduction in cropped area. About 19 districts, spread in Rajasthan (11 districts), Madhya Pradesh (2 districts), Gujarat (3 districts), have low prospects for groundwater recharge, which may impact the cropped area and production. Among the districts (9 in number) which depend on residual moisture for crop production, 5 districts had low prospects for groundwater recharge. However, with rains at the end of September/ October, area under the crop may be normal (Table 10).

Table 10. Prospects of groundwater recharge for rapeseed-mustard crop

State	District	Irrigation system (well / residual moisture)	Groundwater recharge prospects
Assam	Dhemaji	Residual moisture	Extremely Low
Bihar	Champan (West)	Residual moisture	Low
Gujarat	Banaskantha, Mehsana, Patan	Well	Low
Haryana	Mewat	Residual moisture	Low
Jammu & Kashmir	Anantnag	Well	Low
Madhya Pradesh	Dindori, Gwalior	Residual moisture	Low
	Chhatarpur	Well	Extremely Low
	Mandsaur, Neemuch	Well	Low
Rajasthan	Alwar	Well	Extremely Low
	Ajmer, Barmer, Chittorgarh, Dholpur, Jaipur, Jalore, Jodhpur, Nagaur, Pali, Sirohi, Tonk	Well	Low
Uttar Pradesh	Balrampur	Residual moisture	Low
	Agra, Aligarh	Well	Very Low
West Bengal	Dinajpur (Uttar)	Well	Very Low
	Murshidabad	Well	Low

d. Rabi Sorghum growing areas

About 35 districts are found to be growing sorghum in *rabi* season and are spread in Maharashtra (19 districts), Karnataka (11 districts), Madhya Pradesh and Telangana (2 districts each), and Andhra Pradesh (1 district). *Rabi* sorghum is grown under residual moisture conditions in about 32 districts. The quantum and distribution of rainfall would influence the moisture availability in the root zone for its use during *rabi* season. Among 32 districts, where sorghum is grown under residual moisture conditions, 11 districts, spread in Maharashtra (7 districts), Karnataka (3 districts) and Telangana (1 district) had extremely low to very low prospects for recharge, which may impact on the cropped area and productivity. These districts include Bidar, Gulbarga and Raichur in Karnataka, Beed, Hingoli, Jalna, Latur, Nanded, Parbhani and Yeotmal in Maharashtra and Adilabad in Telangana (Table 11).

Table 11. Prospects of groundwater recharge for rabi sorghum crop

State	District	Irrigation system (well / residual moisture)	Groundwater recharge prospects
Karnataka	Bidar, Gulbarga, Raichur	Residual moisture	Very Low
Madhya Pradesh	Barwani, Khargone (West Nimar)	Residual moisture	Low
Maharashtra	Hingoli, Jalna, Nanded, Parbhani	Residual moisture	Extremely Low
	Beed, Latur, Yeotmal	Residual moisture	Very Low
	Ahmednagar, Akola, Aurangabad, Buldhana, Nandurbar, Osmanabad, Pune, Solapur	Residual moisture	Low
Telangana	Jalgaon	Well	Low
	Adilabad	Residual moisture	Extremely Low
	Mahabubnagar	Residual moisture	Low

e. Chickpea growing areas

About 80 districts are identified to be growing chickpea during *rabi* season and are spread in Madhya Pradesh (26 districts), Maharashtra (18 districts), Rajasthan (11 districts), Karnataka (8 districts), Uttar Pradesh (7 districts), Andhra Pradesh

(4 districts), Chhattisgarh (3 districts) and one district each in Telangana, Gujarat and Haryana. Among these 80 districts, in 39 districts, the crop is grown under residual moisture conditions and in another 16 districts, it is grown under both residual moisture and well irrigated conditions. The crop is grown under well irrigated conditions in 7 districts. Among 55 districts, where residual moisture content and well irrigation plays an important role 17 districts, spread in Andhra Pradesh (3 districts), Karnataka (3 districts), Madhya Pradesh (3 districts), Maharashtra (6 districts), Telangana and Rajasthan (1 district) each Uttar Pradesh (3 districts), had extremely low to very low recharge prospects, which may impact cropped area and production. 10 districts of Madhya Pradesh, 9 districts of Maharashtra, 4 districts of Rajasthan had low recharge prospects which may reduce the cropped area. 32 districts had medium to normal recharge prospects (Table 12).

Table 12. Prospects of groundwater recharge for chickpea crop

State	District	Irrigation system (well / residual moisture)	Groundwater recharge prospects
Andhra Pradesh	Anantapur, Cuddapah	Residual moisture	Extremely Low
	Prakasam	Residual moisture	Low
Karnataka	Bidar, Gulbarga, Raichur	Residual moisture	Very Low
Madhya Pradesh	Satna	Residual moisture	Very Low
	Mandsaur, Ratlam, Seoni	Residual moisture	Low
	Shajapur, Ujjain	Well	Low
Maharashtra	Parbhani	Residual moisture	Extremely Low
	Latur, Washim	Residual moisture	Very Low
	Akola, Buldhana, Osmanabad	Residual moisture	Low
	Jalgaon	Well	Low
Rajasthan	Tonk	Residual moisture	Low
	Jaisalmer	Well	Very Low
	Ajmer	Well	Low
Telangana	Medak	Residual moisture	Extremely Low
Uttar Pradesh	Jalaun, Mahoba	Residual moisture	Extremely Low
	Fatehpur	Residual moisture	Very Low
	Banda, Hamirpur, Jhansi	Residual moisture	Low

4.0 Compensatory *Rabi* Production Plan

Loss in production during *kharif* needs to be compensated with a suitable *rabi* production plan (practices and technologies) both in districts that experienced deficit rainfall and also the districts which received normal rainfall along with deployment of necessary inputs such as better management practices including seed, fertilizer, implements, credit and other production incentives. Additional interventions to be adopted for higher productivity and production in the *rabi* season include:

- Varieties suitable for early sowing under residual moisture conditions in Central India should be encouraged in wheat: HD 2987 (Pusa Bahar), HD 4672 (Malwa Ratna), HI1500 (Amrita), HI-1531 (Harshita), HI-7483 (Meghdoot), HI-8627, HW 2004 (Amar), JWS-17 (Swapnil)
- Adoption of early maturing wheat varieties of 100 - 110 days duration for zero tillage planting in eastern and north eastern states in problem soils (acidic soils) is recommended
- Basal application of ZnSO_4 , FeSO_4 , MnSO_4 @ 25kg/ha based on soil test values, and CuSO_4 and borax @ 10kg/ha and Ammonium molybdate @ 1kg/ha. In case of basal application is not possible in deficient soils, apply 0.5% micronutrients (ZnSO_4 , FeSO_4 , MnSO_4) along with 0.25% unslaked lime solution; 0.2% (CuSO_4 / borax) along with 0.25% unslaked lime solution; 0.05 – 0.1% Ammonium molybdate along with 0.05% unslaked lime solution. The micronutrients are to be applied 2-3 times at 10 - 15 days interval.
- Rapeseed- mustard responds to basal application of 20 - 40 kg sulphur as gypsum; zinc as Zinc Sulphate (25 kg/hectare) and Boron as borax (10 kg/hectare) in all types of deficient soils.
- In calcareous alkaline soils, basal application of 50 kg FeSO_4 per hectare is recommended to alleviate iron deficiency based on soil test values.
- Relay cropping of wheat by broadcasting in standing cotton at the time of last irrigation to cotton can improve wheat productivity in the cotton - wheat system in Punjab compared to delayed planting conditions

- To make best use of residual soil moisture, wheat can be planted with minimum tillage by using zero till drill or happy seeder which also eliminates paddy straw burning. Zero till drilling saves time (up to 10 days), cultivation cost (Rs 2000-3000/ha), diesel and energy and gives 5-10% higher yield. Importantly, it saves first irrigation water and permits effective weed control (*Phalaris minor*) in north-west India.
- Furrow-irrigated raised bed (FIRB) system in wheat saves water (25-40%), inputs (25% of seed and nitrogen fertilizer), promotes higher water productivity and energy efficiency (up to 25%). FIRB planted wheat increases resilience as the crop is less affected due to unseasonal rains in February/March associated with hailstorm due to vigorous plant growth and root system.
- Precision seeding and fertilizer application with roto till drill provides rotary tillage of top 10 cm with simultaneous placement of seed and fertilizer at desired depth can boost wheat productivity in Haryana
- Bionoculation of seed with biofertilizers (*Bacillus spp.*, *Azotobacter*, *Azospirillum*, PSB, VAM, *Rhizobium* etc.) can promote plant growth and increase in yield of wheat, pulses and oilseed crops by about 15%.
- Seed treatment with fungicides (@ 2 to 3 g/kg seed) prevents seed borne diseases, promotes better germination and crop stand leading to higher productivity in all *rabi* crops.
- Adoption of micro-sprinkler /sprinkler/drip irrigation systems in wheat, maize, oilseed crops and vegetable crops results in water saving upto 50% and yield improvement on an average by about 25% in all *rabi* production zones wherever suitable quality water is available for irrigation through micro irrigation system (MIS).
- Special emphasis should be given for enhancing productivity of *rabi* pulses viz. chickpea, lentil and field pea in the North-eastern states. Measures recommended include adoption of high yielding varieties, seed priming in chickpea, and seed treatment with fungicides @ 3 g/kgseed, bactericides @ 1g /kgseed, and bio-inoculants (*Rhizobium* @ 200 g/10 kg seed, *Trichoderma* @ 6g/kg seed), efficient weed control and if available irrigation at flowering/pod filling stage.
- Special emphasis may be given to production technology of *rabi* pulses (chickpea, blackgram, greengram and lentil) in rice fallows for achieving higher land productivity per unit area. The additional interventions include higher seed rate

(20 to 25% in lentil), seed priming in chickpea (soaking of seed for 4 to 5 hours in water, application of micronutrients in deficient soils, seed treatment with bioinoculants (PSB /VAM @200 g culture/10 kg seed) or soil application of PSB (5 kg/ha and VAM @10 kg/ha) in all *rabi* pulses. Foliar application of 2% urea/DAP @ flowering and pod formation stage in lentil and chickpea, monitoring and efficient management of pod borer in chickpea, thrips and powdery mildew in blackgram, greengram.

- In Central India, to achieve higher productivity in bold seeded chickpea (*kabuli*), a presowing irrigation may be given wherever possible. Additional interventions include seed priming with molybdenum @1 g/kg seed in chickpea cultivated after soybean.
- Effective integrated weed management through hoeing, hand weeding coupled with herbicide application (pre and postemergence) can boost crop yield in pulses and other *rabi* crops.
- Seed production of *rabi* fodder crops (lucerne, berseem and oats) may be encouraged along with adoption of better management practices.
- Special emphasis should be laid on adoption of pest and disease resistant/tolerant cultivars in *rabi* crops for higher productivity such as:
 - Wheat: Yellow rust tolerant varieties such as GW322, PBW502, DBW17, Raj 4037, PBW550, GW366, DBW621/50, HD2733, HD2864/2824, HUW510, NW2036, K0307
 - Blackgram: YMV resistant and short duration varieties for spring/summer season in UP and Bihar (WBU-109, Uttara, Azad Urd-1, Pant U 31) and for *rabi* / spring season in Odisha (IPU-7-3, BGG-04-008, LU-391, IPU-2-43, KU-301, TU-94-2)
 - Greengram: YMV resistant varieties for UP/ Bihar (HUM-16, Pant M5, IPM 2-3, Samrat); for Odisha (IPM 2-14, COGG 912, OUM 11-5, TARM-1)

4.1. Early *Rabi* Production Plan

In unsown areas and in areas where crop performance is severely affected due to moisture stress (midseason and terminal drought), early *rabi* cropping assumes importance for compensating the loss in production. Early *rabi* plan for different agro-climatic zones covering various states is given in the Table 13.

Table. 13. Suggested crops and cultivars for early *rabi* situation

State	Agro-climatic zone & Districts	Suggested crops and cultivars for early <i>rabi</i> situation
Maharashtra	Western Vidarbha Zone, Maharashtra (Akola, Buldana, Washim, Amaravati and Yeotmal)	Sorghum for grain & fodder : CSH- 9 & 14, CSH- 15R, CSH-19R, AKSV- 13R, SPV- 504, CSV- 14R, CSV- 18R, SPV- 1359, Maldandi 35-1, Ringni Groundnut : TAG- 24 Safflower : AKAS- 207, Bhima, Nari- 6, PKV Pink AKAS 311, Nari- NH-1 Pigeonpea : C- 11, ICPL- 87119 Sesamum : N- 8 Chickpea : BDN- 9-3, Vijay, Vishal, Jaki 9218, Phule G- 5, ICCV- 2, PKV Kabuli 2 &4, Gulak- 1, D- 8 Sunflower : PKVSH- 27, KBSH- 1 & 44, DRSH-1, PKVSF- 9, Modern, TAS- 82
	Central Maharashtra Plateau Zone (Parbhani, Aurangabad, Nasik, Nanded)	Safflower : PBNS 12, PBNS 40 Chickpea : Vijay, Aakash/ BDNG 797 Rabi sorghum : SPV-1411, 1595 Sunflower : KBSH- 1 & 44
	Scarcity zone (Solapur, Ahmednagar, Western part of Beed, Osmanabad, Eastern part of Pune, Sangli, Dhule, Nandurbar)	Sunflower : Bhanu, SS-56 Sorghum for fodder : Phule Amruta, Ruchira Safflower : SSF 708, 748, 733 and Bhima
Andhra Pradesh	Scarce rainfall zone (Kurnool, Anantapur)	Rainfed Red soils Foxtail millet : Surya Nandi, SiA 3085, 3156, Horsegram PDM 1, VZM 1, PHG9,6 Cowpea : C152, Co 702, Co 4,5, GC3, Greengram : (LGG 407, LGG 450, LGG 460, MGG 295): Fodder sorghum : SSG 59-3,988, PC 23,106, Fodder Pearl millet : Jaint Pearl millet, APFB2, Raj Pearl millet Chari 2 Black soils : Pigeonpea : LRG 41, 38, PRG 100.158, Sorghum : CSH 9,13,14, CSV 12,13,PSV 15,19, Sunflower : NDSH 1, KBSH 1, KBSH 44, DRSH 1 Chickpea : JG 11, NS 1, JAKI 9218
Punjab	Kandi region (Nawanshahr, Hoshiarpur, Gurdaspur and Roopnagar)	Pearl millet (FBC 16) Fodder Toria (TL-17)

State	Agro-climatic zone & Districts	Suggested crops and cultivars for early <i>rabi</i> situation
Karnataka	Central, eastern and southern dry zone (Tumkur, Bangalore (Rural and Urban), Kolar, Chitradurga, Mysore, Ramanagara, Chikkaballapur)	<p>Fingermillet: Transplanted finger millet GPU-48, G.P.U-45 and GPU-26 or in place of finger millet, sowing of cowpea (KBC-2),</p> <p>Sunflower: Modern, KBSH-1, KBSH-41, KBSH-42, KBSH-44 KBSH-55 and KBSH-56</p> <p>Cowpea: IT-38956-1, KBC-1, K.M-5 and TVX-944</p> <p>Field bean: HA-1 and HA-4</p> <p>Horsegram: KBH-1 and PHG-9</p> <p>Niger: No71 and K.B.N-1</p> <p>Rabi Sorghum: M-15-1 (Muguthi) and C.S.H-10</p> <p>Foxtail millet: RS-118, K-221-1, PS-4, SIA-326),</p> <p>Little millet: CO-2, PRC-3, OLM-203</p> <p>Kodomillet : PSC-1, JNK-364, RBK155, GPUK-3</p> <p>Sesame : TMV-3, GT-1</p> <p>Fodder Maize : South African Tall</p> <p>Fodder Sorghum: SSV-74</p> <p>Fodder Pearlmillet: Giant pearlmillet</p> <p>Other fodder crops: For late <i>kharij</i>, short duration finger millet (GPU-48), horsegram (PHG- 9), cowpea (IT-38956-1, KBC-2) field bean (HA-3, HA-4)</p>
	Northern dryzone (Bijapur, Bagalkot, Gadag, Koppal, Bellay, part of Dharwad, Belgaum, Raichur and Davangere)	<p>Sunflower : DSFH-3, KBSH-1, KBSH-53</p> <p>Rabi sorghum: M35-1, BJV 44, 5-4-1)</p> <p>Chickpea : A-1, JG 11, Jaki</p> <p>Safflower : A-1</p>
Assam	North Bank Plain zone (Darrang, Sonitpur, North Lakhimpur and Dhemaji)	<p>Rice: Sowing of sprouted seed of cultivar <i>Luit</i> (90 days duration)</p> <p>Blackgram: T-9, T 27, Pant U 19, T 122 , Saonia mah</p> <p>Greengram: SG-1, SG 21-5</p> <p>Sesame : ST 1683, Kaliabor local</p> <p>Cauliflower : Early Kunwari, Pusa Ketki, Pusa Deepali</p> <p>Radish : Pusa Himani, Pusa Chetki, Pusa Desi</p> <p>Other crops/grasses: Setaria, Guinea, Dinanath, Congo Signal</p>

State	Agro-climatic zone & Districts	Suggested crops and cultivars for early <i>rabi</i> situation
Chhattisgarh	Basthar Plateau zone (Bastar, Bijapur, Kondagaon, Narayanpur, Dantewada, Kanker)	Niger : JA-10, Greengram : Hum-1 Blackgram : PU-30, TPU-4, PU-31 Horsegram : BK-1, AK-20
Tamil nadu	Southern zone (Toothukudi, Tirunelveli, Virudhanagar and Madurai)	Sorghum : K8, K11 Blackgram : VBN 5&6, CO,6 Greengram : VBN 3 CO,8, CO,7
Jammu & Kashmir	Low altitude sub-tropical zone (Jammu, Kathua and parts of Udhampur)	Toria : RSPT-1 Toria (RSPT-1) + Gobhi sarson (DGS-1, GSL-1, GSL-2)
Gujarat	Northern Gujarat zone (Banaskantha, Sabarkantha, Palampur, Surendranagar)	Castor : GCH -5, GCH - 7
Uttar Pradesh	Eastern plain zone (Faizabad, Sultanpur, Gonda, Basti, Barabanki, Jaunpur, Ambedkar Nagar).	Toria : T9 Pigeonpea : Bahar with high plant population Maize : Pragati Pearlmillet : BJ for fodder
		Mustard : Bio-902 Pusa Jaikisan, T-59 (Varuna), Pusa Bold, Rohini, RH-30
Madya Pradesh	Malwa zone	Chickpea Ujjain 24, Ujjain 21, JG218, JG412, JG11, JG130, JG63, JG 16, JGG1, JG315, JG322 Vishal, Vijay ; Kabuli : JGK1, JGK2

4.2. Normal *Rabi* Production Plan

To enhance production of *rabi* crops, suggested practices / technologies include: optimum sowing time, location specific high yielding cultivars, seed treatment and improved agronomic, soil and water management practices (Table. 14), Resource conservation technologies recommended include planting methods for increasing the efficiency of applied water and nutrients for increased production and profitability

Table. 14. Suggested measures for normal *rabi* situation

State	Crop	Suggested measures for <i>rabi</i> crops
Uttar Pradesh (Central zone)	Mustard	Sowing time: First fortnight of October Varieties: Bio-902, Rohini, Urvashi, NRCDR-HB-10, Varuna, RS 30 Seed treatment: Thiram, Tricoderma & Agrosen GN @ 3 g/kg seed Seed rate: 5-6 kg/ha Spacing: 45 x 15 cm Fertilizer dose: 60:40:25:25 kg/ha NPKS as basal Interculture: One interculture at 20-25 DAS
	Chickpea	Sowing time: First fortnight of October Varieties: BG-256, C-235, C-214, K-850, Avrodhi, RGS-44 Seed treatment: Bavistin +Thiram (1:1) @ 3 g/kg seed and <i>Rhizobium</i> culture Seed rate: 80 kg/ha Spacing: 30 x 15 cm Fertilizer dose: 20: 40 kg/ha NP as basal Interculture: One interculture at 30-35 DAS Weed management: Pre- emergence application of pendimethalin 0.75 kg/ha
	Barley	Sowing time : Second fortnight of October Varieties: RS-6, Ratna, DL-70, PL-172 Seed treatment: Thiram, Tricoderma & Agrosen GN @ 3 g/kg seed Seed rate: 80-85 kg/ha Spacing: 22 x 10 cm Fertilizer dose: 60:40 kg/ha NP as basal Interculture: One interculture at 25-30 DAS
Uttar Pradesh (Eastern plain zone)	Lentil	Sowing time: Up to second fortnight of October Varieties: Narendra Masoor - 1, Pusa Vaibhav, PantL- 406, IPL - 81, K - 75, Pant L - 5, PantL - 639, DPL - 62, HUL - 57 Seed treatment: Thiram or Carbendanzim @ 3g/ kg seed and <i>Rhizobium</i> culture @ 200 g/ 10 kg seed. Seed rate: Small seeded: 40-50 kg /ha; Bold seeded: 70-80 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 20:60:20 kg NPK/ha as basal Weed management: Spray Pendimethalin @ 0.5-0.75 kg /ha as pre-emergence at 0-3 DAS, or two hand weeding at 20 and 45 DAS

State	Crop	Suggested measures for <i>rabi</i> crops
	Chickpea	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: Gujrat Chana-4, Pusa-256, KWR-108, Adhar, WCG-2, J.G.- 16, K- 850, Radhey, Avarodhi, Type-3, Type-6</p> <p>Seed treatment: Thiram or Carbendanzim @ 3g/ kg seed and Rhizobium culture @ 200 g/ 10 kg seed</p> <p>Seed rate: 80 kg/ha</p> <p>Spacing: 30 x 15 cm</p> <p>Fertilizer dose: 20:60:20 kg NPK/ha</p> <p>Weed management: Spray Pendimethalin @ 0.75-1.0 kg /ha or Oxyfluorfen @ 200 g /ha as pre-emergence at 0-3 DAS, or two hand weedings at 20 and 45 DAS</p>
	Mustard	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: Narendra Ageti Rai-4, Kanti (RK-9807), Narendra Rai-1, Narendra Swarna Rai-8, Varuna, Vaibhav, Ragini, Maya, Pusa Bold, Urvashi, Kranti</p> <p>Seed treatment: 1.5g Metoloxyl or 2.5g Thiram/kg seed</p> <p>Seed rate: 4-5 kg/ha</p> <p>Spacing: 45 cm x 15 cm</p> <p>Fertilizer dose: 60: 40: 30 kg NPK/ ha as basal</p> <p>Weed managment: Spray Pendimethalin (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 to 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS</p>
	Barley	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: Narendra Jau-1, Narendra Jau-3, Azad (K-125), K-141, Haritma (K-560), Lakhan, (K-226)</p> <p>Seed treatment: Thiram or Carbendanzim @ 3g/ kg seed.</p> <p>Seed rate: 100 kg/ ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertiliser dose: 60:40:30 NPK kg/ha as basal</p> <p>Weed management: To control broad- leaved weeds, spray 2,4-D @ 500 g/ha at 30 -35 DAS in 500 l water. Isoproturon @ 0.75 to 1.0 kg/ ha in 500 L water at 30- 35 DAS</p>
	Linseed	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: Sweta, Garima, Shubhra, Laxmi-27, Padmini, Sharda, Nilam, Mau Azad-1, Type-397, Shekhar</p> <p>Seed treatment: 1.5g Metalzyl or 2.5g Thiram/kg seed</p> <p>Seed rate: 25 kg/ha</p> <p>Spacing: 30 x 10 cm</p>

State	Crop	Suggested measures for <i>rabi</i> crops
		Fertilizer dose: 40:20:20 kg NPK/ ha as basal Weed management: Spray Pendimethalin (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 - 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS
Uttar Pradesh (Eastern Plain and Vindhyan Zone)	Chickpea	Sowing time: Second fortnight of October to first fortnight of November Varieties: Avarodhi, Pusa -256, T-6, KWR-108 Seed treatment: 2g Thiram /kg seed and <i>Rhizobium</i> culture @ 200g/ 10 kg seed Seed rate: 80 kg/ha Spacing: 45 x 10 cm Fertilizer dose: NPK: 20:40:20 kg/ha as basal Weed management: Pre-emergence application of pendimethalin @ 0.5 - 0.75 kg /ha or oxyfluorfen @ 200 g /ha, or mechanical weeding by weeder at 20 to 25 DAS
	Barley	Sowing time: Second fortnight of October to first fortnight of November Varieties: K-125, K-141, K-560, K-226, K-603 Seed treatment: 2.5 g Thiram /kg seed Seed rate: 100 kg/ha Fertilizer dose: 40:20:20 NPK kg/ha as basal Weed management: Mechanical weeding by dryland weeder at 45 DAS. To control broad- leaved weeds, spray 2,4-D @ 500 g/ha at 30 -35 DAS in 500 L water. Isoproturon @ 0.75 to 1.0 kg/ ha in 500 L water at 30- 35 DAS
	Lentil	Sowing time: Second fortnight of October to first fortnight of November Varieties: Pant L 406, 639, Narendra masoor -1, HUL-57, K-75, L-4076, KLS-218 Seed rate: 30 kg/ha Spacing: 30 cm x 10 cm Fertilizer dose: 20:40:20 kg/ha of NPK as basal Weed management: Mechanical weeding by dryland weeder at 20-25 DAS or Spray Pendimethalin @ 0.5 - 0.75 kg /ha (Pre emergence)

State	Crop	Suggested measures for <i>rabi</i> crops
	Mustard	<p>Sowing time: Second fortnight of October to first fortnight of November</p> <p>Varieties: Varuna, Sanjukta, Vaibhav</p> <p>Seed rate: 5 kg/ha</p> <p>Spacing: 45 x 20 cm</p> <p>Fertilizer dose: 40:20:20:20 kg/ha NPKS as basal</p> <p>Weed management: Mechanical weeding by dryland weeder at 20-25 DAS or spray Pendimethalin (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 to 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS</p>
	Toria	<p>Sowing time: Second fortnight of October to first fortnight of November</p> <p>Varieties: T-9, Bhavani, PT303, Narendra Ageti rai</p> <p>Seed treatment: 2g Thiram / kg seed or 30g Mancozeb /kg seed</p> <p>Seed rate: 4 kg/ha</p> <p>Spacing: 30 x 10-15 cm</p> <p>Fertilizer dose: 40-30-30 kg NPK. Half N and total PK as basal and half N as top dressing at 30-35 DAS</p> <p>Weed management: Mechanical weeding by dryland weeder or spray Pendimethaline (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 to 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS</p>
	Linseed	<p>Sowing time: Second fortnight of October to first fortnight of November</p> <p>Varieties: Garima, Sweta, Shekhar</p> <p>Seed treatment: Thiram @ 2 g/kg seed</p> <p>Seed rate: 25 kg/ha</p> <p>Spacing: 30 cm x 10 cm</p> <p>Fertilizer dose: 40:20:20:20 kg/ha NPKS as basal</p> <p>Weed management: Mechanical weeding by dryland weeder or spray Pendimethaline (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 - 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
Maharashtra (Western Vidarbha zone)	Safflower	<p>Sowing time: Up to first fortnight of October</p> <p>Varieties: AKS-207, Bhima, NARI-6, NARI Hybrid, NH-1</p> <p>Seed treatment: Thiram or Captan@ 3g/kg seed. Tricoderma 4 g/kg seed</p> <p>Seed rate: 10-12 kg/ha and 7.5 kg/ha for hybrids</p> <p>Fertilizer dose: 25:25:00 NPK kg/ha</p> <p>Interculture: Two hoeings at 15-20 DAS and 40 DAS</p> <p>Weed management: One hand weeding at 20-25 DAS or pre-emergence pendimethalin @ 0.75 - 1.0 kg /ha or one hand weeding at 20-25 DAS, or two hoeings at 15-20 days interval after sowing</p>
	Chickpea	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: Jaki-9218, Saki-9516, Green Chafa, ICCV-10, PKV Harita, PKV Kabuli-2</p> <p>Seed treatment: Thiram or Captan 3g/kg seed, Trichoderma 4g/kg seed and <i>Rhizobium</i> culture + PSB@ 25g/ kg seed</p> <p>Seed rate: 80-90 kg/ha (bold seeded), 60-75 kg/ha (medium sized seeded)</p> <p>Spacing: 30 x 10 cm (bold seeded); 45 x 7.5 cm (medium sized seeded)</p> <p>Fertilizer dose: 20:40:00 NPK kg/ha as basal</p> <p>Interculture: Two hoeings at 15-20 DAS and 40 DAS</p> <p>Weed management: One hand weeding at 30 DAS or spray of Pendimethaline @ 1 kg a.i./ha as pre-emergence</p> <p>Pre-emergence application of pendimethalin @ 0.75-1.0 kg /ha within 2-3 days of sowing or one hand weeding at 20-25 DAS.</p>
Maharashtra (Scarcity zone)	<i>Rabi</i> Sorghum	<p>Sowing time: Up to first fortnight of October</p> <p>Varieties: For shallow soils: Phule Mauli, Anuradha, Selection 3</p> <p>Medium deep soil: Phule Mauli, Phule Suchitra, M 35-1 and for deep and very deep soils : Phule Yashodha, Phule Vasudha, Parbhani Moti</p> <p>Seed treatment: 25 g Azotobactor + 25 g PSB/ kg seed</p> <p>Seed rate: 10 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertilizer dose: 50:25:25 kg/ha NPK as basal</p> <p>Interculture: Three hoeings i.e. at 3 weeks, 5 weeks and 8 weeks after sowing</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Chickpea	<p>Sowing time: First week of October</p> <p>Varieties: Vijay, Digvijay</p> <p>Seed treatment: 2 g Thiram + 2 g Carbendazim/kg seed or 5 g Trichoderma/ kg seed followed by <i>Rhizobium</i> culture @ 25 g/ kg seed</p> <p>Seed rate: 65-70 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 25:50 kg N and P₂O₅/ha as basal</p> <p>Interculture: Two hoeings i.e. 3 weeks and 4 weeks after sowing</p>
Andhra Pradesh	Chickpea	<p>Sowing time: First fortnight of October to first fortnight of November</p> <p>Varieties: JG-11, KAK-2 JAKI 9218 Vihar, LBeG 7, JG-130, ICCV-2</p> <p>Seed treatment: Captan or Thiram @ 2.5 g/kg seed and <i>Trichoderma viridi</i> @ 4-5 g/kg seed</p> <p>Seed rate: 70-80 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 20:50 NP kg/ha</p> <p>Weed management : Pre-emergence application of Pendimethalin @ 0.5 - 0.75 kg /ha within 2-3 days of sowing or one hand weeding at 20-25 DAS</p>
	Coriander	<p>Sowing time: October to November</p> <p>Varieties: Sadhana (CS-4), Sindhu (CS-2),Sudha (LCC-128) and Swathi (CS-6)</p> <p>Seed treatment: <i>Azospirillum</i> @ 1.5 kg/ha</p> <p>Seed rate :15 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 30 : 40 : 20 NPK kg/ha as basal application</p>
	Rabi maize	<p>Sowing time: Last week of October to second week of November</p> <p>Varieties: Kaveri 2288, 50, CP818, NMH 731 & 666</p> <p>Seed treatment: Bavistin + Captan (1:1 ratio) @ 2 g/kg seed; Apron 35 SD @ 4 g/kg seed</p> <p>Seed rate: 20 kg/ha</p> <p>Spacing: 60 x 20 cm or 75 x 20 cm</p> <p>Fertilizer dose: 90:45 (N & P) kg/ha for rainfed condition; 120:60 (N&P) kg/ha for irrigated condition. N in 3 splits i.e. 1/4 as basal, 1/2 at 30 DAS, 1/4th at pre-flowering. In Zn deficient soils, apply 50 kg ZnSO₄/ha. If Zn deficiency symptoms are observed in plants, spray 0.2% ZnSO₄ solution 2-3 times at weekly intervals</p>

State	Crop	Suggested measures for <i>rabi</i> crops
		<p>Interculture: One intercultivation at 30-35 DAS followed by ridging/ earthing up</p> <p>Weed management: Pre-emergence application of Atrazine @ 0.75 - 1.0 kg/ha mixed in 500 - 600 l of water or 2,4-D @ 500 g/ha at 20-25 DAS</p>
Rajasthan (Southern zone)	Wheat	<p>Sowing time: Up to first fortnight of November</p> <p>Varieties/Hybrids: HI-1531, HI-1500, HI-8627, Raj-3777, HI-8498</p> <p>Seed treatment: Chlorpyriphos 20 EC @ 600ml for 100 kg seed. Thiram or Mencozeb @ 3 g/kg seed + Azotobactor culture+ PSB culture</p> <p>Seed rate: 125-150 kg/ha Spacing: 20-23 cm interrow</p> <p>Interculture: One hoeing at 30 DAS</p> <p>Weed management: Application of Metsufuron @ 4 g/ha in 500 l of water at 30-35 DAS or spray 500 g/ha 2,4-D Ester salt or 750 g Amine salt at 30-35 DAS or hand weeding after 30 DAS</p>
	Barley	<p>Sowing time: Up to first fortnight of November</p> <p>Varieties: RD-2052, RD 2552, RD-2508</p> <p>Seed treatment: Chlorpyriphos 20 EC @ 600ml/100 kg seed. Thiram or Mencozeb @ 3 g/kg seed + Azotobactor culture+ PSB culture</p> <p>Seed rate: 100 kg/ha</p> <p>Spacing: Inter-row -22.5cm</p> <p>Fertilizer dose: 30:20:30 kg NPK kg/ha as basal. 20 kg N at 30 DAS and 20 kg N at flag leaf stage with irrigation.</p> <p>Weed management: Spray 500 g/ha 2, 4-D Ester salt or 750 g Amine salt at 30-35 DAS</p>
	Chickpea	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: D-Yellow, ICCV-10, RSG-888, Pratap Chana-1</p> <p>Seed treatment: Thiram or Mencozeb @ 3 g/kg seed + Azotobactor culture+ PSB culture+ 800 ml. Chlorpyriphos 20 EC @ for 100 kg seed. Trichoderma for fungal control.</p> <p>Seed rate: 80-100 kg/ha</p> <p>Spacing: 30 x 15 cm</p> <p>Fertilizer dose: 10:30 NP kg/ha as basal</p> <p>Weed management: Pre-emergence application of pendimethalin 0.5 - 0.75 kg/ha at 0-3 DAS or hoeing and weeding after 30 DAS as required</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Mustard	<p>Sowing time: Up to first fortnight of October</p> <p>Varieties: Bio 902, Laxmi, Varuna, Vasundhara, Arawali</p> <p>Seed treatment: Mencozeb @ 2.5 g/kg seed</p> <p>Seed rate: 4-5 kg/ha</p> <p>Spacing: 30 x 15 cm</p> <p>Fertiliser dose: 30:50:40 kg NPK kg/ha. Full dose of P and half dose of N as basal and half dose of N at grand growth stage.</p> <p>Weed management: Pre-emergence application of Pendimethalin 0.5 - 0.75 kg/ha at 0-3 DAS or hoeing and weeding after 25-30 DAS as required</p>
	Taramira	<p>Sowing time: Up to first fortnight of October</p> <p>Varieties: RTM-314, T-27, RTm-202</p> <p>Seed treatment: Mancozeb @ 2.5 g/kg seed</p> <p>Seed rate: 4-5 kg/ha</p> <p>Spacing: 30x 10 cm</p> <p>Fertiliser dose: 30:40 NP kg/ha. Full dose of P and half dose of N as basal and half dose of N at grand growth stage.</p> <p>Weed management: One weeding at 30 DAS</p>
Assam (North bank plain zone)	Boro rice	<p>Sowing time: December</p> <p>Varieties: Boro 1, Boro 2, Bishnu prasad, Jyoti prasad, Joymoti, Cauvery</p> <p>Seed treatment: Mancozeb@2.5g/1 of water under wet method Captan @ 2.5g/kg of seed under dry method.</p> <p>Seed rate: Pre germinated seeds to be sown 650-1000g per bed For transplanting 1ha of main field 40-45 kg of seeds is required</p> <p>Maintain water upto 7 cm depth.</p> <p>Fertilizer dose: 40:20:20 kg/ha NPK</p> <p>Weed mangment: Application of Butachlor @1.0 kg/ha or Pretilachlor 0.75 kg/ha as pre-emergence or weeding with rotary paddy weeder at 40 days after transplanting (DAT) or two hand weedings at 20 and 40 DAT</p>
	Toria	<p>Sowing time: First fortnight of October to first fortnight of November</p> <p>Varieties: M-27, TS-38, TS-36, TS-29</p> <p>Seed treatment: Apron 35WS@ 6g/kg of seed</p> <p>Seed rate:10 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 40:35:15 kg/ha NPK</p> <p>Weed management: One hand weeding at 20 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Mustard	<p>Sowing time: Second fortnight of October to first fortnight of November</p> <p>Varieties: TM-2, TM-4, Varuna</p> <p>Seed rate: 4-5 kg/ha Spacing : 30 - 45 x 15 cm</p> <p>Fertilizer dose: 40:35:15 kg/ha NPK</p> <p>Weeding: Spray Pendimethalin 0.5-0.75 kg/ha as pre-emergence or one hand weeding at 25-30 DAS</p>
	Potato	<p>Sowing time: First fortnight of October to first fortnight of November</p> <p>Varieties: Kufri Jyoti, Kufri Megha, Kufri Sinduri</p> <p>Seed treatment: Mancozeb @ 5g/lit for 10 minutes and dried in shade for 48 hours</p> <p>Seed rate: 25 q/ha Spacing: 50 cm x 15 cm</p> <p>Fertilizer dose: For Ranifed: 60:50:50 kg/ha NPK</p> <p>Interculture: Earthing up at stolon and tuber formation</p> <p>Weed management: Pre-emergence application of Metribuzin @ 500-700 g/ha at within 3-4 DAP or early post-emergence application of Metribuzin @ 500 g/ha at 15-20 DAP or one or two hand weedings as required</p>
	Pea	<p>Sowing time: First fortnight of October to first fortnight of November</p> <p>Varieties: T-163, Boneville, HUP-2 and <i>Rhizobium culture</i></p> <p>Seed treatment: Bavistin @ 2g/kg of seed</p> <p>Seed rate: T-163: 50kg/ha; Boneville: 60 kg/ha; HUP-2: 65 kg/ha</p> <p>Fertilizer dose: 10:46:0 kg/ha NPK as basal</p> <p>Weed management: Application of Pendimethalin 0.5- 0.75 kg/ha as pre-emergence (0-3 DAS) or application of Metribuzin @ 250 g/ha at 25-30 DAS</p>
Punjab (Kandi region)	Wheat	<p>Sowing time: Last week of October to first week of November</p> <p>Varieties: PBW 175, PBW 527, PBW 644</p> <p>Seed treatment: Dursban (Chlorpyrifos) 20 EC @ 12.5 ml/kg seed followed by Bavistan/ Deroal/Agrozim @ 2.5 g /kg seed or Raxil @ 1 g /kg seed</p> <p>Seed rate: 100 kg/ha</p> <p>Spacing: Interrow 22.5 cm</p> <p>Fertilizer dose: 40:40:30 kg/ha NPK as basal and 40 kg N /ha about 30-60 DAS with winter rain</p> <p>Interculture: One hoeing with kurpa 4-6 weeks after sowing</p> <p>Weed management : Spray of 2,4-D @ 500-750 g/ha in 500 L of water 30-35 DAS in sole wheat crop or post-emergence application of metsulfuron @ 4g/ha at 30 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Barley	<p>Sowing time: First fortnight to end of October</p> <p>Variety: PL 419</p> <p>Seed treatment: Vitavax and Thiram each @ 3g /kg seed</p> <p>Seed rate: 112.5 kg/ha</p> <p>Spacing: Inter-row 20 cm.</p> <p>Fertiliser dose: 40:30:15 kg/ha NPK as basal</p> <p>Interculture: One hoeing with kurpa 4-6 weeks after sowing</p> <p>Weed management: Spray 2,4-D @ 500 g/ha in 500 L of water 30 DAS in sole barley crop</p>
	Chickpea :	<p>Sowing time: Up to last week of October</p> <p>Varieties: PBG 1, PBG 5, C 235</p> <p>Seed treatment: Bavistin (1.5+1.5 g) @ 3.0 g or Hexacap or Captan @ 3g /kg seed and <i>Rhizobium</i> culture</p> <p>Seed rate: PBG 1:37.5- 45.0 kg/ha and PBG 5: 60.0 kg/ha</p> <p>Spacing: 30 x 15 cm</p> <p>Fertiliser dose: 15:20 kg/ha NP as basal</p> <p>Interculture: Two hoeings at 30 DAS and 60 DAS</p> <p>Weed management: One or two hand hoeing with kasola at 30 and 60 (48 and 49 SMW) DAS or if moisture is enough, go for Pre-plant application of trifluralin (Treflan 48 EC) 1.0 kg/ha or pre-emergence application of pendimethalin (Stomp 30 EC) @ 0.5-0.75 kg/ha.</p>
	Lentil	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: LL 699, LL 147, LL 931</p> <p>Seed treatment: Captan @ 2.0 g/ kg seed and <i>Rhizobium</i> culture</p> <p>Seed rate: 35 kg/ha</p> <p>Spacing: 22.5 cm x 10 cm</p> <p>Fertiliser dose: 12.5:20 kg/ha NP as basal</p> <p>Interculture: Two hoeings at 30 and 60 DAS.</p> <p>Weed management: pre-emergence application of Pendimethalin 30 EC @ 2.5 liters/ha</p>
	Toria	<p>Sowing time: First week of October</p> <p>Variety: TL 15</p> <p>Seed rate: 3.75 kg/ha</p> <p>Spacing : 30 x 15 cm</p> <p>Fertilizer dose: 50: 20 kg/ha NP</p> <p>Interculture: One hoeing with wheel hand hoe 3 weeks after sowing</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Raya	Sowing time: Second fortnight of October to first fortnight of November Varieties: RLM-619, PBR-97 Seed rate: 3.75 kg/ha Spacing: 30 x 15 cm Fertilizer dose: 37.5: 20 kg/ha NP as basal Interculture: Two hoeings at 3 and 6 weeks after sowing
	African Sarson	Sowing time: First fortnight of October Variety: PC-5 Seed rate: 3.75 kg/ha Spacing: 30 x 15 cm Fertilizer dose: 37.5: 20 kg/ha NP as basal Interculture: Two hoeings at 3 and 6 weeks after sowing
	Linseed	Sowing time: First fortnight of October Variety: LC-2023 Seed rate: 25 kg/ha Spacing: 23 x 10 cm Fertiliser dose: 37.5:20 kg/ha NP as basal Interculture: Two hoeings at 3 and 6 weeks after sowing
Karnataka (Central, eastern and souther dry zone)	<i>Rabi</i> Sorghum	Sowing time: First fortnight of October Varieties/Hybrids: M-35-1, Mooguthi, CSH-10 Seed treatment: 2g Sulphur/kg seed Seed rate: 7.5 kg/ha Fertilizer dose: 50:25 kg/ha NP as basal Interculture: Three to four at 10-15 days interval within 30 DAS Weed management: Application of Atrazin 0.5 kg/ha as pre-emergence @ 0-3 DAS
	Horsegram	Sowing time: Second fortnight of October Varieties: KBH-1, PHG-9 Seed rate: 25 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 25:50:25 kg/ha NPK as basal Interculture: Two interculture operations at 20 and 40 DAS

State	Crop	Suggested measures for <i>rabi</i> crops
Karnataka (Northern dry zone)	<i>Rabi</i> Sorghum	<p>Sowing time: First fortnight of October</p> <p>Varieties/Hybrid: M-35-1, Muguti (5-4-1), GRS-1, DSV-5, DSH -4, DSV-4, CSH-15R</p> <p>Seed rate: 6-7.5 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertilizer dose: 50:25 kg/ha NP as basal</p> <p>Weed management: One hoeing at 45 DAS and spray Atrazine 50% @ 1.0 kg a.i./ha as pre-emergence</p> <p>Weed management: Application of Atrazin 0.5 kg/ha as pre-emergence at 0-3 DAS</p>
	Chickpea	<p>Sowing time: First fortnight of October to second fortnight of November</p> <p>Varieties: ICCV-2, Annigeri-1, ICCV-10, JG -11</p> <p>Seed rate: 50 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 10:25 kg/ha NP as basal</p> <p>Interculture: One hoeing at 30 DAS</p> <p>Weed management: Pre-emergence application of Pendimethalin (Stomp 30 EC) @ 0.5-0.75 kg/ha or one hand weeding/hoeing at 25-30 DAS.</p>
	Safflower	<p>Sowing time: First fortnight of October to second fortnight of November</p> <p>Varieties: A-1</p> <p>Seed rate: 8-10 kg/ha</p> <p>Spacing: 60 x 30 cm</p> <p>Fertilizer dose: 50:25 kg/ha NP as basal</p>
	Horsegram	<p>Sowing period: October</p> <p>Varieties: BGM-1 & Local Var.</p> <p>Weed management: one hand weeding/hoeing at 25-30 DAS</p>
	Wheat (Rainfed)	<p>Sowing period: October</p> <p>Varieties: Kiran Bijga Yellow, DWR-2006</p> <p>Weed management: one hand weeding at 25-30 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
Haryana (South-western dry zone)	Chickpea	<p>Sowing time: Second week of October to first week of November</p> <p>Varieties: C-235, H-208. HC-1, HC-5</p> <p>Seed treatment : Bavistin @ 2.5 g/kg seed and <i>Rhizobium</i> culture</p> <p>For termite control: 800 ml Endosulphan or Monocrotophos dissolve in 2 litres of water and mix in 100 kg seed</p> <p>Seed rate: 70-75 kg/ha</p> <p>Spacing: 30 x 15 cm</p> <p>Fertilizer dose: 20:40 kg/ha NP as basal</p> <p>Interculture: One hoeing at 35-40 DAS</p>
	Mustard	<p>Sowing time: Second week of October to first week of November</p> <p>Varieties: RH-30, RH-819, RH-8812, RB 24,RB-50</p> <p>Seed treatment: <i>Azotobactor</i> culture @ 25g/kg seed</p> <p>Seed rate: 5-6 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertiliser dose: 40:20 kg/ha NP as basal</p> <p>Interculture: One interculture at 35-40 DAS with wheel hand hoe and kasola</p>
	Barley	<p>Sowing time: Third week of October to first fortnight of November</p> <p>Varieties: BH-393, BH-87</p> <p>Seed rate: 112.5 kg/ha</p> <p>Fertilizer dose: 40: 20 kg /ha NP as basal</p> <p>Interculture: One interculture at 35-40 DAS with wheel hand hoe and kasola</p>
Madhya Pradesh (Malwa zone)	Mustard	<p>Sowing time: Second week of October</p> <p>Varieties: T-9, JT-1, (Toria) JM-1, JM2, Push bold, Varuna, Type 151</p> <p>Seed treatment: Bavistin 2 g/kg of seed and <i>Rhizobium</i> culture+ PSM 5 g/kg of seed</p> <p>Seed rate: 5-6 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertilizer dose: 40 :40: 20 kg/ha NPK + sulphur 40 kg/ ha as basal</p> <p>Interculture: One intercultivation at 30 DAS</p> <p>Weed management: Spray Pendimethalin 0.5-0.75 kg/ha as pre-emergence at 0-3 DAS or one hand weeding/hoeing at 25-30 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Wheat	<p>Sowing time: First week of October to second week of November</p> <p>Varieties: Sujatha, C -306, HW 2004 (Amar), Swapnil, HI 1500 (Amrata), HI 1531 (Harshita), JW 3020, Lok-1, Malav Kranti (HI 8638), Malav Ratna (HD 4672), JW 17, JW3020, Narmada 4</p> <p>Seed treatment: Thiram 2 g/kg seed and <i>Azaotobacter</i> + PSM 5 g/kg of seed</p> <p>Seed rate: 100 kg/ha</p> <p>Spacing: 30 x 5 cm</p> <p>Fertilizer dose: 40:20:10 kg/ ha NPK as basal. 20 kg N/ha with winter rains</p> <p>Weed management: Application of Atlantis (Mesosulfuron+ Iodosulfuron) or Vesta (clodinafop+metsulfuron) @ 400 g/ha as POE at 25-30 DAS. Application of 2,4-D 0.5 kg/ha in 500 L of water at 30-35 DAS</p>
	Chickpea	<p>Sowing time: First fortnight of October</p> <p>Varieties: <i>Desi</i>: JG-16, JG-412, JG-322, JG-218, JG-11, RVG-201, JG-6, JAKI – 9218</p> <p><i>Kabuli</i>: RVKG-101, RVKG-102, JGK-1, JGK-3, KAK-2</p> <p>Seed treatment: Bavistin 1.5 g/kg seed and <i>Rhizobium</i> culture+ PSM 5 g/kg of seed</p> <p>Seed rate: 80 kg/ha (<i>Desi</i>), <i>Kabuli</i>: 100 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 20:40 kg/ha NP as basal</p> <p>Interculture: One hoeing at 20 DAS</p>
Tamil Nadu (Southern plateau and hills and East coast plains and hills regions)	Cotton	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: KC-2, KC-3 and hybrids</p> <p>Seed rate: 20 kg/ha, hybrids – 1.5 kg/ha</p> <p>Spacing : 45 x 30 cm</p> <p>Fertilizer dose: 20:20:40:10 kg/ha NPKS as basal. 20 kg/ha N at square formation. Foliar spray of 1% MgSO₄ at 50 and 80 DAS</p> <p>Foliar spray of 0.5% ZnSO₄ at 45 and 60 DAS</p> <p>Interculture: One intercultural operation with blade harrow at 60 DAS</p> <p>Weed management: Spray Pendimethalin @ 1.0 kg /ha or Oxyfluorfen 200 g/ha followed by one hand weeding at 25-30 DAS and one mechanical weeding with power weeder at 45 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	<i>Rabi</i> Sorghum	<p>Sowing time: First fortnight of October</p> <p>Varieties : K 8, APK 1, CSV 1, Co 26, CSH-16, COH-2</p> <p>Seed rate: 10 kg/ha</p> <p>Spacing : 45 x 15 cm</p> <p>Fertilizer dose: 20:20:10 kg/ha NPS as basal. 20 kg N/ha at 40 DAS.</p> <p>Interculture: Two hoeings at 20 and 40 DAS</p> <p>Weed management: Spray Atrazine @ 500 g/ha as pre-emergence application within 3 days or one intercultivation at 20-25 DAS</p>
	Maize	<p>Sowing time: Up to second week of October</p> <p>Varieties: CO H (M) 5, Co -1</p> <p>Seed rate:15 kg/ha</p> <p>Spacing: 45 x 15 for composites, 60 x 30 cm for hybrids</p> <p>Fertilizer dose: 20:20 kg/ha NP as basal. 20 kg N/ha as top dressing at 25-30 DAS</p> <p>Interculture: Two hoeings at 20 and 40 DAS</p> <p>Weed management: Application of Atrazine @ 500 g/ha at 3 DAS or 2,4-D @ 500 g/ha or one hand weeding at 25-30 DAS</p>
	Blackgram	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: Co 5, CO 6, VBN 6, VBN 7</p> <p>Seed rate: 20 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 12.5:25:12.5 kg/ha NPK/ha as basal</p> <p>Weed management: Pre-emergence application of Pendimethalin 0.50-0.75 kg/ha at 3 DAS + one hand weeding on 30 DAS</p>
	Greengram	<p>Sowing time: Up to second fortnight of October</p> <p>Varieties: CO 6, VBN 3, CO 7</p> <p>Seed rate: 20 kg/ha</p> <p>Spacing: 30 x 10 cm</p> <p>Fertilizer dose: 12.5 : 25 : 12.5 kg/ha NPK/ha as basal</p> <p>Weed management: Pre-emergence application of Pendimethalin 0.50-0.75 kg/ha at 3 DAS or one hand weeding on 30 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Sunflower	<p>Sowing time: Up to first week of October</p> <p>Varieties: Morden, CO 4,,CO SFV 5</p> <p>Seed rate: 7 kg/ha</p> <p>Spacing : 45 x 30 cm</p> <p>Fertiliser dose: 40:20:0 kg/ha NPK as basal</p> <p>Interculture: One hand weeding at 30 DAS</p> <p>Weed management : Pre-emergence application of Pendimethalin 0.75 kg/ha within 3 DAS or one hand weeding at 25 to 30 DAS</p>
	Pearl millet	<p>Sowing time: Third week of October to second week of November</p> <p>Varieties: ICMV 221, Co (Cu) 9, WCC – 75, Hybrids – ICH 301</p> <p>Seed rate: 6 kg/ha</p> <p>Spacing: 45 X 15 cm</p> <p>Fertilizer dose: 20:20 kg/ha NP as basal and 20 kg N at 40 DAS</p> <p>Interculture: One intercultivation at 20 DAS</p> <p>Weed management: Spray Atrazine @ 50 % WP 0.25 kg a.i./ha as pre-emergence/early post emergence</p> <p>Pre- emergence application of atrazine @ 500 g/ha at 3 DAS or one hand weeding at 30-35 DAS</p>
	Senna	<p>Sowing period: First week of October</p> <p>Variety: KKM Se 1</p> <p>Seed rate :25 kg/ha; Spacing : 45 x 30 cm</p> <p>Fertilizer dose: Basal application of 25:25:40 NPK/ha</p> <p>Weed management : One manual hoeing to control weeds and close the cracks at 25 DAS and second hand weeding at 75 DAS</p>
Odisha (Eastern Ghat Zone)	Mustard	<p>Sowing time: First fortnight of October</p> <p>Varieties : Parvati, Anuradha, M-27</p> <p>Seed rate: :10 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertilizer dose: 30:15: 15 kg/ha N:P:K</p> <p>Interculture: Two intercultural operations at 25 and 45 DAS</p> <p>Weed management: One hand weeding at 30 DAS or spray of Pendimethalin 0.5-0.75 kg/ha at 2-3 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
Jammu & Kashmir (Low altitude sub-tropical zone)	Chickpea	<p>Sowing time: Up to third week of October</p> <p>Varieties: PBG-1, K-468, C-235, Gaurav, SCS-3, GNG – 469</p> <p>Seed rate: 75-80 kg/ha</p> <p>Spacing: 30 x 15 cm</p> <p>Seed treatment: Captan or Thiram or Bavistin @ 3 g/kg seed and <i>Rhizobium</i> culture</p> <p>Fertilizer dose: 15:40 kg/ha NP as basal</p> <p>Interculture: Two hand weedings at 25 and 40 DAS</p> <p>Weed management: Pre-emergence application of pendimethalin @ 1.0 kg/ha just after sowing or two hand weedings at 25 & 40 DAS with khurpa or hand blade hoe</p>
	Lentil	<p>Sowing time: Last week of October to second week of November</p> <p>Varieties: L-9, L-12 & PL-406</p> <p>Seed rate: 40 kg/ha</p> <p>Spacing: 20 x 5 cm</p> <p>Seed treatment: Captan or Thiram or Bavistin @ 3 g/kg seed and <i>Rhizobium</i> culture</p> <p>Fertilizer dose: 15:40 kg/ha NP as basal</p> <p>Interculture: Two hand weedings at 25 and 40 DAS</p> <p>Weed management: Pre-emergence application of pendimethalin @ 1.0 kg/ha just after sowing or two hand weeding at 25 & 40 DAS with khurpa or hand blade hoe</p>
	Wheat	<p>Sowing time: Last week of October to last week of November</p> <p>Variety: PBW-396, PBW – 175, RSP – 81, Raj-3077, PBW-226</p> <p>Seed treatment: Chlorpyrifos 20 EC @ 4.5 ml/kg of seed followed by Bavistin @ 2 g/kg of seed</p> <p>Seed rate: 100 kg/ha</p> <p>Spacing: Inter row 25 cm</p> <p>Fertilizer dose: 60:30:20 kg/ha NPK. 2/3rd of N and full dose of P & K as basal dose as basal. 1/3rd N at 60 DAS with first winter rain. It should not be applied if boot stage has passed</p> <p>Interculture: One hoeing at 30 DAS</p> <p>Weed management: Application of Vesta (Clodinafop + Metsulfurom) RM @ 400 g/ha at 25-30 DAS. Or Tank mix application of Clodinafop @ 60 g + Sulfosulfuron @ 25 g ai/ha in 500 liter water at 25-30 DAS</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Gobi sarson	<p>Sowing time: First week of October to last week of November</p> <p>Varieties: GSL-1, GSL-2 & DGS-1</p> <p>Seed rate: 5 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertilizer dose: 50:30:15:20 kg/ha NPKS. 2/3rd of N, full dose of P, K & S as basal and 1/3rd N as top-dressing at 20-30 DAS with winter rains</p> <p>Interculture: One hoeing at 30 DAS</p> <p>Weed management: Pre-emergence application of Pendimethalin/ Isoproturon @ 0.75-1.0 kg/ha in 500-600 L of water. One hoeing must be done with wheel hand hoe within 30 DAS to control weeds and conserve moisture.</p>
	Mustard	<p>Sowing time: First week of October to last week of November</p> <p>Varieties: RLM-198, Pusa Bold (second fortnight of October); RSPR-01, RLM-514, RLM-519, Kranti, Pusa- Basant, Pusa-Bahar, RH-30, Varuna (first week of October to last week of November)</p> <p>Seed rate: 5 kg/ha</p> <p>Spacing: 45 x 15 cm</p> <p>Fertilizer dose: 60:30:15:20 NPKS kg/ha. Half of N and full dose of P, K and S as basal. Half of N at 20-30 DAS with winter rains.</p> <p>Interculture: One hoeing at 30 DAS</p> <p>Weed management: Pre-emergence application of Pendimethalin/ Isoproturon @ 0.75-1.0 kg/ha in 500-600 L of water. One hoeing must be done with wheel hand hoe within 30 DAS to control weeds and conserve moisture</p>
	Toria	<p>Sowing time: Up to first week of October</p> <p>Variety: RSPT-1</p> <p>Seed rate: 5 kg/ha</p> <p>Spacing : 30 x 15 cm</p> <p>Fertilizer dose: 15:18:10 kg/ha NPK as basal. 15 kg N/ha at 30 DAS.</p> <p>Interculture : One weeding / hoeing at 3 weeks after sowing</p>

State	Crop	Suggested measures for <i>rabi</i> crops
Madhya Pradesh (Keymore plateau and Satpura Hill zone)	Wheat	<p>Sowing time: Entire October</p> <p>Varieties/Hybrids: C 306, Sujata, JW-17, HI 1500, Amar, HW 2004, JW 3020</p> <p>Seed rate: 100 kg/ha</p> <p>Fertilizer dose: 40:40: 20 kg/ha NPK as basal</p> <p>Interculture: One interculture at 25-30 DAS</p> <p>Weed management: Application of Vesta (clodinafop + metsulfuron) RM @ 400 g/ ha at 25-30 DAS or Tank mix application of clodinafop @ 60 g + Sulfosulfuron @ 25 g/ha in 500 L of water at 25-30 DAS</p>
	Barley	<p>Sowing time: Entire October</p> <p>Varieties: JB -1, RD 2552, JB 58, RD 2503, K 603, K 560</p> <p>Seed rate: 110 kg/ha</p> <p>Fertilizer dose: 60:40:20 N:P:K kg/ha .½ N with full quantity of P & K applied at sowing. Remaining ½ N applied after 45 DAS (Rs. 1700/ha)</p> <p>Interculture : One interculture at 35-40 DAS with hand hoe</p>
	Chickpea	<p>Sowing time: First week of October</p> <p>Varieties: JG – 130, JG – 322, SHAKI, JG – 11, JG – 16, JG- 74, JG – 315, JG – 218, Vijay, Vishal</p> <p>Seed rate: 75 kg/ha</p> <p>Spacing: 45 x 10 cm</p> <p>Fertilizer dose: 20:40:0 kg/ha NPK as basal</p> <p>Interculture: One hoeing at 40-45 DAS</p> <p>Weed management: Pre-emergence application of Pendimethalin @ 1.0 kg/ha just after sowing or two hand weedings at 25 & 40 DAS.</p>
	Lentil	<p>Sowing time: First week of October</p> <p>Varieties: JL -1, JL-2, Ler 4076, IPL 81, JL -3</p> <p>Seed rate: 45-50 kg/ha</p> <p>Spacing : 25 x 10 cm</p> <p>Fertilizer dose: 20:30: 20: 20 kg/ha N P K S as basal</p> <p>Interculture: Pre-emergence application of Pendimethalin @ 0.5-0.75 kg/ha just after sowing or two hand weedings at 25 & 40 DAS.</p>

State	Crop	Suggested measures for <i>rabi</i> crops
	Mustard	Sowing time: First week of October Varieties: Pusa Bold, Varuna, Jaikisan, Kranti JM-1JM -2JM -3 Seed rate: 5 kg/ha Spacing: 45 x 15 cm Fertilizer dose: 30:30:20:20 kg/ha NPK as basal Interculture: On interculture at 30 DAS
	Linseed	Sowing time: First week of October Varieties: JLS -9, JLS - 23, JT - 27, JLT - 26, R- 552, T 397, J - 1 Seed rate: 20-25 kg/ha Fertilizer dose: 60:30:20 kg/ha NPS kg /ha as basal Interculture: One hoeing by wheel hoe at 30 DAS
Jharkhand	Chickpea	Sowing time: Third week of October to first week of November Varieties: Pant G 114, KPG-59, Jg - 14 Seed rate: 75-100 kg/ha Spacing: 30 x 15 cm Fertilizer dose: 20:40:20:10 kg/ha NPKS as basal Interculture: Two hoeings i.e. 30 DAS and 50 DAS
	Wheat	Sowing time: First week of November to second week of December Varieties: K 9107, K 307, Birsa Gehun- 2, Birsa Gehun- 3 Seed rate: 125-150 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 100:60:40 kg/ha NPK. All PK as basal and 25 % N as basal, 25 % at 21 DAS and 50 % at 45 DAS. Interculture: Two hoeings i.e. 30 DAS and 50 DAS
Maharashtra (Marathwada)	Chickpea	Sowing time: First fortnight of October Varieties: BDN -797 Seed rate: 50 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 25:50 kg/ha NP as basal Interculture: Two hoeings i.e. 3 weeks and 6 weeks after sowing

State	Crop	Suggested measures for <i>rabi</i> crops
	Safflower	Sowing time: First fortnight of October Varieties: PBNS – 21, PBNS – 40 Seed rate: 12-15 kg/ha Spacing: 45 x 20 cm Fertilizer dose: 25:50 kg/ha NP as basal Interculture: Two hoeings i.e. 3 weeks and 6 weeks after sowing

(Source : Prasad *et al.*, 2012, 2014; Rajendra Prasad *et al.*, 2013; Srinivasa Rao *et al.*, 2013; Srinivasa Rao *et al.*, 2014; Umate *et al.*, 2011; Vittal *et al.*, 2003)

4.3. Fodder Production Plan

Animal production within the mixed farming systems is predominantly dependent on the efficiency of use of the available coarse crop residues and grazing resources. Availability of good quality fodder along with wholesome clean drinking water are the major constraints to animal production during drought. Drought's most severe effects on animal agriculture include low productivity, morbidity and in severe cases mortality as the availability of crop residues, feed and forage resources substantially get reduces and there may be altered plant populations with more toxic plants in grazing lands. Initially, animals try to be selective grazing on non- toxic plants, which in long run increases toxic plant dominance in grazing lands if drought prolongs. Animals are more likely to graze on toxic plants when good-quality forages are limited. Nitrates may get accumulate in forages or crops fertilized just before a drought and leads to toxicity in animals. Prussic acid tends to accumulate in green forages like sorghum during drought. Livestock become deficient in vitamins A, D, and E if they do not have green fodder for more than 30 days. Animals that lack sufficient protein, energy, minerals and vitamins cannot tolerate toxins. Prolonged drought leads to adverse impact on immunity and health of the animal in addition to loss in productivity. Feeding of available poor quality forage and limited energy, protein, essential minerals and vitamins intake adversely affects fertility also. Some parasite eggs tend to concentrate more in the lower part of the forage plants, thus poor growth of the plant due to drought conditions can increase the potential parasite load in grazing livestock. Selective culling and selling of unproductive and aged animals at the onset of a drought helps in getting a higher price than if sold later and it saves costs associated with feed and livestock management.

Under accelerated fodder development programme of Ministry of Agriculture, DAC, New Delhi the following fodder varieties seed material (Table 15) may be supplied to the farmers.

Table. 15. Proposed varieties for inclusion in the kit for fodder production

Types	Proposed Varieties for inclusion in the kit
Forage Varieties	Avika Pearl millet Chari, FBC-16, PCB-164, Narender Chari Pearl millet-2, Proagro No. 1 (multi-cut), JKBH-676 of pearl millet and Hara Sona, Pant Chari-4, Pant Chari-5, Pusa Chari Hybrid-106, Gujarat Fodder Sorghum-5, CSH-24 MF (low HCN), CSH20MF, Haryana Sorghum-513, Haryana Chari-308, CO(FS) 29 of sorghum
Dual purpose varieties/Hybrids with stay green at maturity	CSH-13, CSV-23, GJ-40, CSH-13 R, SSV-84, CSV-15, DSV-4, SPH- 837, Pratap Sorghum-1430, K-11 of sorghum and Sabara of little millet
Dual purpose varieties/hybrids of maize	Prakash, JH-3459, Pusa Early Hybrid Makka-3, DMH-2, Gujarat Makka-6 and forage variety like Pratap Makka Chari-6
Fodder varieties of Oat	Bundel Jai-851, 992, 991, 2001-03, 2004, Harita
Napier varieties	IGFRI-5, NB-21, NB-37, PBN-223, KKM-1, APBN-1, Suguna, Supria and Sumpurna and other grasses like dinanth grass, sudan grass and guinea grass.

In case of complete or major failure of grain crops in *kharif*, contingency strategies for ensuring fodder supplies include re-sowing with short to medium duration fodder varieties of millets, pulses or forage crops such as:

- Sorghum – varieties / hybrids CSV-17 and CSH 14 in red soils; CSH 16, CSH 18 and CSH 21 in black soils
- Pearl millet - short duration varieties like Rajko, JB, PSB-2, GHB-526, HHB-67, ICMH-356, Shraddha, GK-1004 or medium duration varieties like GHB-558, Proagro-9443 and for late assured rain fall areas in light to medium soils of Marathwada region varieties like AHB-251
- Finger millet - medium duration varieties like GPU 28, PR 202, HR 911 and Pusa Composite 612, MP 480 for second fortnight of July to first fortnight of August; short duration varieties: GPU 26, GPU 45, GPU 48 and Indaf 9 for late sown conditions from second fortnight of August to 20 September
- Maize – African tall, APFM 8, PEHM-3 and FH-3077 which produce some grain and fodder

- Intercropping of cowpea varieties Bundel Lobia-1, CO 5, CO (FC) 8, IFC 8401, UPC 8705, DFC 1 and UPC- 625 after 8 to 10 rows of finger millet
- *Rabi* fodder crops like berseem (Mescavi, Wardan, UPB 110), Lucerne (CO 1, LLC 3, RL 88) should be sown in arable lands and tank beds.
- Current fallows should be used for fodder production by sowing short duration varieties of sorghum or pearl millet or finger millet or maize or cowpea in *kharif* season and or berseem or lucerne in *rabi* season.
- In wastelands, grasses like *Cenchrus ciliaris*, *C. setigerus*, *Chloris gayana*, *Panicum maximum*, *Desmanthus virgatus*, *Stylosanthes scabra* can be taken up to increase forage production.
- In areas that receive north east monsoon rains, multi-cut fodder varieties of sorghum (CO 27, Pant Chari-5 (UPFS- 32), COFS- 29 or pearl millet (Co-8) or maize (African tall) and leguminous fodder crops (Lucerne, Berseem, Horse gram, Cowpea) are recommended for fodder production
- In areas that receive summer rains, fodder crops like cowpea and maize are recommended

Further, fodder block making units costing 40,000/rupees from CIAE, Bhopal may be procured and made available at each mandal which frequently affected with drought. Development of seed/germplasm banks and nurseries of fodder species in each state through Central Sector Scheme for Fodder and Grazing Land Management would further help in mitigating fodder scarcity in the country. In case of mid season drought, suitable fodder crops of short to long duration as may be sown in *kharif* under rainfed conditions. Mid season drought affects the growth of the fodder crop. Once rains are received in later part of the season the crop revives and immediate fertilization help in speedy recovery. If sufficient moisture is available, *rabi* crops like berseem (Wardan, UPB 110, etc. varieties), lucerne (CO 1, LLC 3, RL 88, etc.) can be grown during winter. In waste lands fodder varieties like Bundel Anjan 3, CO-1 (Neela Kalu Kattai), *Stylosanthes scabra* etc., can be sown for fodder production. As late season drought affects seed setting, normal short duration fodder crops may be sown. Avoid multicut fodder varieties under rainfed conditions. All the available fodder must be harvested before drying out to preserve nutritive quality. Depending on availability of moisture, *rabi* fodder crops especially low water requiring varieties of lucerne may be planted. Normal intensive fodder systems may be followed under irrigated conditions.

The following are some of the state specific compensatory fodder production measures to be followed to augment the availability of feed and fodder resources for optimum production from different categories of livestock (Table 16)

Table. 16. Suggested fodder production measures during *rabi*

State	Suggested fodder production measures in <i>rabi</i>
Maharashtra	<ul style="list-style-type: none"> Promote sowing and establishment of fodder species like <i>Cenchrus ciliaris</i>, <i>Stylo hamata</i>, <i>Stylo scabra</i> etc in inter row spaces in existing orchards Promotion of horse gram (CRHG-19;CRHG-4,CRHG 18 R) as contingent crop and harvesting it at vegetative stage as fodder in all crop failed areas Encourage progressive farmers to grow fodder crops of sorghum/pearl millet/maize (UP chari, MP chari, HC-136, HD-2, Gaint bajra, L-74, K-677, Ananad/African Tall, Kisan composite, Moti, Manjari, B1-7 on their own lands with input subsidy in case of some rains in the coming weeks Sowing of berseem varieties like Mescavi, Wardan, BB-2, BB- 3 and oat varieties like JHO-822, Kent, JHO-851, UPO-212 & UPO-94 till the second fortnight of October, where as lucerne varieties like Chetak, Sirsa-9, Anand-2 can be sown from September to October will boost fodder production Supply of quality seeds of COFS 29, Stylo and fodder slips of Marvel, Yaswant, Jaywant, Napier, guinea grass well before monsoon will strengthen feed and fodder base at village level .
Madhya Pradesh	<ul style="list-style-type: none"> Sowing of maize varieties like african tall and Sorghum single cut varieties like MP Chari, Pusa Chari –6, Jawahar Chari-6, irrigated- HC-136, Pusa Chari-23, UP Chari-2, Proagro Chari (SSG-988), HC-308; multi cut varieties like Jawahar Chari-69, Proagro Chari (SSG-988), Pant Chari-5 (UPFS- 32); dual purpose (grain and fodder) varieties like CSH 13 as <i>rabi</i> crop for fodder production Berseem varieties like Jawahar Berseem-1 (JB-1), JB-5, Bundel Berseem-2 (JHB-146), Mescavi; lucerne varieties like GAUL-1 (Anand-2), Anand Lucerne-3 (AL-3) and where ever irrigation source is there, RL-88 can be cultivated as <i>rabi</i> crop for fodder production Guar varieties like Bundel Guar- 1, 2 and 3, HG-75, HFG-119, FS-277 etc from mid October to early November and sometimes till late December can be cultivated Encourage growing oats varieties like JO-1,Bundel Jai-822, OS-6, UPO– 212, OL-125, Bundel Jai- 851 for fodder production in <i>rabi</i> Cowpea varieties like Crop- UPC – 287, Bundel Lobia-1 (IFC - 8401), UPC- 9202, UPC – 618, UPC- 625 can be grown in October and or late monsoon.

State	Suggested fodder production measures in <i>rabi</i>
Rajasthan	<ul style="list-style-type: none"> • Harvest the top fodder (Khejari, Neem, Subabul, Acasia, Pipol etc) and create fodder banks at village level • Establishment of silvi-pastoral system in CPRs with <i>Stylosanthus hamata</i> and <i>Cenchrus ciliaris</i>, Dinanath, Dhaman and Sewan grass etc., as grass with <i>Leucaena leucocephala</i>, Khejari, Neem, Subabul, Acasia, Pipol etc., as tree component • Sowing of improved varieties of pearl millet (Giant, Bajra, Raj Bajra Chari 2, AVKB 19), Guar (Bundel Guar 1, Bundel Guar 3, Guara 80, HFG 356), sorghum (Harasona 855, Safed Moti, GFS 4, CSH 20), lucerne (RL 88, Anand 2, Anand 1, Anand 3), Cowpea (UPC 5287, UPC 5286, UPC 618, UPC 622, CL367), oats (Bundel Jai 851, OL 125, UPO 212, UPO 94, Kent), guinea grass (PGG 14, PGG 616, PGG 101, Bundel G. grass 1), Dinanath grass in <i>rabi</i> season for fodder production • In winter, maize cultivation may be carried in areas with assured irrigated conditions with the varieties like PEHM 1, PEHM 2, Prakash, HM 2, Pratap Makka Hybrid 1, Mahi Kanchan, Mahi Dhawal, Navjot, GM-6 and GM-138, Aravali • Mothbean varieties like RMG-40, RMO-257, G-8 can also be cultivated for fodder purpose • Under irrigated conditions, pearl millet cultivars like RHB 121, RHB 127, HHB 67, GHB 558, ICMH 356, JBV-3, Raj-171, CZP-9802 for green fodder production
Karnataka	<ul style="list-style-type: none"> • Short duration Pearl millet (AVKB-19, Giant Bajra, CO 8 varieties) crop which is hardy and requires less moisture may be cultivated if there are small rains. Short duration dual (grain and fodder) varieties like GPU 26, GPU 45 and GPU 48 for late sown conditions from second fortnight of August to September can be cultivated for fodder production • Perennial sorghum (CSV -216R) cultivation may be cultivated canal command areas. Farmers growing this crop may be adequately compensated and green fodder after harvest may be transported to areas of deficit. Short duration varieties like CSH 14 and CSV 17 for crops in red soils, and CSH 16, CSH 18 and CSH 21 may be grown in black soils and in transitional belt in <i>rabi</i> season • Cowpea (Bundel Lobia -2, KBC 2, RBL-6, COFC 8) as fodder crop may also be cultivated and fed to cattle and buffaloes as protein source. If adequate moisture level is available, farmers may be advised for cultivating maize crop (African Tall & Pratap Makka varieties). • Sampoorana (DHN 6), CO-3, CO-4, APBN-1 etc., hybrid napier fodder varieties can be grown where ever assured irrigation facility exists.

State	Suggested fodder production measures in <i>rabi</i>
	<ul style="list-style-type: none"> Wherever feasible, cultivation of fodder grasses like <i>Bothriochloa intermedia</i>, <i>Cenchrus setigerus</i>, <i>Dichanthium annulatum</i>, <i>Pennisetum pedicellatum</i>, <i>Panicum maximum</i> and fodder legumes like <i>Arachis hagenbackii</i>, <i>Stylosanthes hamata</i>, <i>S. Scabra</i> may be promoted.
Gujarat	<ul style="list-style-type: none"> Sowing of sorghum (HC- 106, AS-16, SSG-988, Harasona 855, Safed Moti, Pant Chari-5, UPMCH-1101, CSH-13, GFS 4), lucerne (Chetak, GAUL-2, RL 88, Anand 2, Anand 1, LL 3, Anand 3), cowpea (Kohinoor, GFC-1/2/3/4, UPC 5287, UPC 5286), pearl millet (Giant Bajra, Raj Bajra Chari 2, AVKB 19), guar (T-8, Bundel Guar 1, Bundel Guar 3, Guara 80, HFG 356), oats (Bundel Jai 851, OL 125, UPO 212, UPO 94) in <i>rabi</i> season for fodder production Promote sowing and establishment of fodder species like <i>C. ciliaris</i>, <i>S. hamata</i>, <i>S. scabra</i> etc in inter row spaces in existing orchards Round the year forage production in irrigated areas with Napier- Pearl millet hybrid + cowpea / lucerne and maize + cowpea / oat or maize + cowpea may be promoted The silvipastoral systems involving <i>Acacia nilotica</i> + <i>Cenchrus setigerus</i> and <i>Leucaena leucacephala</i> + <i>Panicum maximum</i>/ <i>Dichanthium annulatum</i> can be developed in waste lands Wherever feasible, cultivation of fodder grasses like guinea grass (PGG 14, PGG 616, PGG 101), <i>dinanath grass</i> (Bundel 2, CO 1) <i>Cenchrus ciliaris</i>, <i>Chloris gayana</i>, <i>Dichanthium</i>, <i>Stylosanthes</i>, <i>Clitori</i> and legumes grasses like <i>Stylosanthes hamata</i>, <i>S. Scabra</i> may be promoted in grazing lands.
Chhattisgarh	<ul style="list-style-type: none"> Sowing of sorghum single cut varieties like MP Chari, Pusa Chari –6, Jawahar Chari-6, irrigated- HC-136, Pusa Chari-23, UP Chari-2, Proagro Chari (SSG-988), HC-308; multi cut varieties like Jawahar Chari-69, Proagro Chari (SSG-988), Pant Chari-5 (UPFS- 32); dual purpose (grain and fodder) varieties like CSH 13 as <i>rabi</i> crop for fodder production Berseem varieties like Jawahar Berseem-1 (JB-1), JB-5, Bundel Berseem-2 (JHB-146), Mescavi; lucerne varieties like GAUL-1 (Anand-2), Anand Lucerne-3 (AL-3) and where ever irrigation source is there, RL-88 can be cultivated as <i>rabi</i> crop for fodder production Guar varieties like Bundel Guar- 1, 2 and 3, HG-75, HFG-119, FS-277 etc from mid October to early November and sometimes till late December can be cultivated

State	Suggested fodder production measures in <i>rabi</i>
	<ul style="list-style-type: none"> • Encourage growing oats varieties like JO-1, Bundel Jai-822, OS-6, UPO-212, OL-125, Bundel Jai- 851 for fodder production in <i>rabi</i> • Cowpea varieties like Crop- UPC – 287, Bundel Lobia-1 (IFC - 8401), UPC- 9202, UPC – 618, UPC- 625 can be cultivated in October and or late monsoon • The silvipastoral systems involving <i>Acacia nilotica</i> + <i>Cenchrus setigerus</i> and <i>Leucaena leucacephala</i> + <i>Panicum maximum</i>/<i>Dichanthium annulatum</i> can be developed in waste lands • Wherever feasible, cultivation of fodder grasses like <i>guinea grass</i> (PGG 14, PGG 616, PGG 101), <i>dinanath grass</i> (Bundel 2, CO 1) <i>Cenchrus ciliaris</i>, <i>Chloris gayana</i>, <i>Dichanthium</i>, <i>Stylosanthes</i>, <i>Clitori</i> and legumes grasses like <i>Stylosanthes hamata</i>, <i>S. Scabra</i> may be promoted in grazing lands. • Irrigated fodder with the varieties like CO-3, CO-4, APBN-1 etc., may be promoted.
Southern Tamil Nadu	<ul style="list-style-type: none"> • Short duration Pearl millet (CO-8, TNSC-1) crop which is hardy and requires less moisture may be cultivated if there are small rains. Short duration sorghum varieties like CO-27, COFS-29, K-11 can be cultivated for fodder production in <i>rabi</i> season • Legume fodder crops like Rice bean-RBL-6, Lucerne-CO-1, Cowpea-CO-1/5, CO(FC)-8 may also be cultivated and fed to cattle and buffaloes as protein source. If adequate moisture level is available, farmers may be advised for cultivating maize crop (African Tall & DHM varieties) in winter • CO-1/2/3/4, KKM-1, APBN-1 etc., hybrid napier fodder varieties can be grown where ever assured irrigation facility exists. • Wherever feasible, cultivation of fodder grasses like hedge lucerne-<i>Desmanthus virgatus</i>; subabul CO-1 (P), FD 1423; Dinanath grass-COD-1; Guinea grass-CO-1/2; Anjan grass-CO-1; <i>Stylosanthes hamata</i>, <i>S. Scabra</i> may be promoted • Creation of tree fodder models with subabul, glyricidia, Agathi, prosopis etc. at village level.
Andhra Pradesh	<ul style="list-style-type: none"> • In all rice field bunds, para grass may be grown for green fodder production • If adequate moisture level is available, farmers may be advised for cultivating sorghum (Proagro Chari (SSG-988), APFB-2, Pant Chari-5 (UPFS- 32) and maize crop (African tall, APFM-8) for fodder production in <i>rabi</i> season

State	Suggested fodder production measures in <i>rabi</i>
	<ul style="list-style-type: none"> • Berseem varieties like Mescavi, Vardhan (S99-1), JB-1, JB-2, JB-3 and UPB-103; Cowpea varieties like Vardan or Mescavi for; lucerne varieties like T-9, Anand-2, S-244, CO-1, RLS-88 can be cultivated in <i>rabi</i> season for leguminous fodder production • In assured irrigation having areas, cultivation of perennial Napier varieties like APBN -1, Co-1, Co-2, Co-3, NB-21, BH-18, Guinea gross, Paragrass etc may be taken up • Top dressing of N in 2-3 split doses @ 20-25 kg N/ha in common property resources (CPRs) like temple lands, panchyat lands or private property resources (PPRs) like waste and degraded lands with the monsoon pattern for higher biomass production • Promote tree fodder (Neem, Subabul, Acasia, Pipal etc) in degraded lands.
Telangana State	<ul style="list-style-type: none"> • If adequate moisture is available, farmers may be advised for cultivating sorghum (PC-6, MP Chari, HC-136, Hara Sona, Proagro Chari (SSG-988), APFB-2, Pant Chari-5 (UPFS- 32), maize (African tall, Vijay, Jawahar Moti Composite, APFM-8, HGT-3), Pearl millet (Rajko, K599, T-55AP, L-72, L-74) and oats (Kent, UPO-94, OS-6, S-2688, OL-9, UPO-212, HFO-114, OS-7, JHO-822) for fodder production in <i>rabi</i> season • Berseem varieties like Mescavi, Vardhan (S99-1), JB-1, JB-2, JB-3 and UPB-103; cowpea varieties like Vardan or Mescavi for; lucerne varieties like T-9, Anand-2, S-244, CO-1, RLS-88 can be cultivated in <i>rabi</i> season for leguminous fodder production • In assured irrigation having areas, cultivation of perennial Napier varieties like APBN -1, Co-1, Co-2, Co-3, Co-4, NB-21, BH-18, guinea grass, Para grass etc may be taken up • Top dressing of N in 2-3 split doses @ 20-25 kg N/ha in common property resources (CPRs) like temple lands, panchyat lands or private property resources (PPRs) like waste and degraded lands with the monsoon pattern for higher biomass production • The grasses like buffalo grass (Molopo, S-3108, S-3106, CAZRI-75), Dinanth grass (IGFRI-43-1, IGFRI-4-22-1, Bundel-1), Rhodes grass (Callide Kotambore, Pioneer), Urochloa (Nixon) etc., and shrubs like Hedge Lucerne may be grown in waste lands for fodder production • Promote tree fodder (neem, subabul, Acacia, Pipal etc) in degraded land.

State	Suggested fodder production measures in <i>rabi</i>
Jharkhand	<ul style="list-style-type: none"> • The sufficiently available forest grass during rainy season would be harvested at its flowering period and preserved as hay or silage or may be turned into feed blocks. • Encouragement for cultivation of lucerne (RL-88), hybrid napier (BNH-10, Co-3), maize (African Tall, Pratap Makka Chari 6), sorghum (CSH-20MF (UPMCH- 1101), CSH-20-MF (UPMCH-1101), pearl millet (BAIF Pearl millet-1), berseem (Bundel Berseem-3) in <i>rabi</i> season • Wherever possible, other legumes like ricebean (RBL-6Bidhan-1&2), cowpea (UPC 5286, EC-4216) will be encouraged for leguminous fodder production • Fodder tree species like subabul, sesbania species, gliricidia, mulberry, Ficus species, shivan, jackfruit etc. would be planted on field bunds and grasslands. • Maximum rice field bunds will be planted with hybrid napier (NH-10) and guinea grass for green fodder production • In water logged areas, Coix (KCA-3, KCA-4, Bidhan Coix 1) and Paragrass may be cultivated • Wherever assured irrigation facilities are available, cultivate hybrid napier (Jawahar Pennisetum-12) and guinea grass (Hamil).
Western Uttar Pradesh	<ul style="list-style-type: none"> • Harvesting potato leaves as fodder in potato growing areas • If adequate moisture level is available, farmers may be advised for cultivating sorghum (MP Chari, UP Chari-1 (IS 4776), UP Chari-2, Pant Chari- 3, Proagro Chari (SSG-988), Harasona 855, Safed Moti (FSH-92079), UPFS- 32, CSH-13), Pearl millet (Raj Bajra Chari-2, CO-8, TNSC-1, FMH-3, AVKB-19) and maize (African tall, Pratap Makka Chari 6) for fodder production • Oats (Bundel Jai-822, Bundel Jai- 851, Bundel Jai 992 (JHO 99-2)Haryana Javi – 114, FOS-1/29, Kent, UPO-94) can be cultivated as forage crop in <i>rabi</i> season • Berseem (Bundel Berseem-2 (JHB-146), Bundel Berseem-3, JB-5, Pusa Giant, Warden, UPB-10) and lucerne (Chetak (S-244), Sirsa Type 9) may be promoted for cultivation of leguminous fodder crops in winter • If assured irrigation facilities are available, recommend for cultivation of hybrid napier (Hybrid Napier-3 (Swetika), NB-21)

State	Suggested fodder production measures in <i>rabi</i>
	<ul style="list-style-type: none"> • Silvo-pastoral systems with <i>Dichrostachys-Cenchrus/Chrysopogon</i>, <i>Leucaena-Cenchrus/Chrysopogon</i>, <i>Albizia lebbek-Cenchrus-Sehima</i>, <i>Albizia procera-Cenchrus</i>, <i>Acacia/Prosopis-Cenchrus-Chrysopogon</i>, <i>Albizia-Leucaena</i>, <i>Bauhinia</i> and <i>Leucaena</i>, <i>Hardwickia binata Cenchrus/Chrysopogon</i> and <i>Stylosanthes</i> may be developed in waste lands for enhancing fodder availability • Wherever feasible, cultivation of fodder grasses like <i>guinea grass (PGG 14, PGG 616, PGG 101)</i>, <i>dinanath grass (Bundel 2, CO 1)</i> <i>Cenchrus ciliaris</i>, <i>Chloris gayana</i>, <i>Dichanthium</i>, <i>Clitori</i> and legumes grasses like <i>Stylosanthes hamata</i>, <i>S. Scabra</i> may be promoted in grazing lands.
North -Eastern Region	<ul style="list-style-type: none"> • <i>Rabi</i> fodder with berseem (Pusa Giant, Wardan, Hisar Berseem-1 (HFB-600)), Cowpea (UPC-622, UPC – 618) and rice bean (Bidhan Rice Bean 2 (KRB 4)) may be promoted in suitable areas • Farmers may be advised for cultivating oats (OS-7, OL-9, Bundel Jai 991 (JHO 99-1), Bundel Jai 2004 (JHO 2000-4) and maize (African tall, Pratap Makka Chari 6) for fodder production in <i>rabi</i> season • Encourage cultivation of fodder grasses like napier, guinea (Hamil) and Coix (KCA-3, KCA-4, Bidhan Coix 1) in areas with assured irrigation • Promote cultivation of Azolla at back yard and in paddy fields • Grassland/grazing land can be improved with forage grasses (<i>Brachiaria decumbens</i>, <i>B. mutica</i>, <i>Paspalum notatum</i>), legumes (<i>Desmodium uncinatum</i>, <i>D. heterophyllum</i>), shrubs and trees (<i>Artocarpus heterophyllus</i>, <i>A. lakoocha</i>, <i>Ficus hookeri</i>, <i>F. nermoralis</i>, <i>Parkia roxburghii</i>, <i>Morus alba</i>) for better fodder availability for the livestock • Promote growing of hybrid napier alone or maize + cowpea - maize -sorghum- oats or guinea (Hamil) alone for fodder production in assured irrigation areas.

(Kumar et al., 2012; Pandey and Roy 2011, DAC 2011)



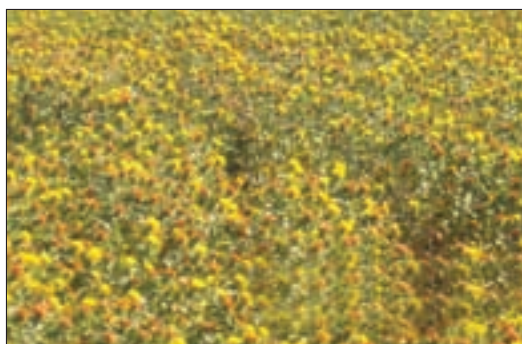
Blackgram (Azad Urd)



Rabi sorghum - Phule Vasudha



Rabi sorghum – BJY- 44



Safflower-Phule Kusuma



Berseem (Mescavi)



Furrow-irrigated raised bed (FIRB)
system in wheat



Timely weeding with cycle hoe



Sprinkler irrigation in chickpea

5. Conclusions

The delayed onset of monsoon and deficit rainfall conditions during *kharif* 2014 affected progress in crop sowings and performance of standing crops. Further, deficit rainfall also led to poor prospects of groundwater recharge and less storage in some reservoirs. This may affect normal *kharif* output. To compensate the anticipated loss in *kharif*, enhancing production and productivity prospects from *rabi* crops assumes importance. This calls for a two pronged approach of promoting early *rabi* cropping in unsown areas and adoption of additional interventions in normal *rabi* cropping situations. The detailed location-specific *rabi* production plans are suggested in this bulletin.

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Annexure –I**i. Rainfall categorization during June month (number of districts)**

State	Excess	Normal	Deficit	Scanty	Total
A & N Islands	1	2			3
Andhra Pradesh			4	9	13
Arunachal Pradesh	2	3	5	6	16
Assam	8	8	11		27
Bihar	7	13	12	6	38
Chhattisgarh	1	2	10	5	18
Delhi			5	4	9
Diu & Daman				2	2
Goa			2		2
Gujarat		1	2	23	26
Haryana	1	7	5	8	21
Himachal Pradesh		3	5	4	12
Jammu & Kashmir	1	1	1	19	22
Jharkhand	3	6	13	2	24
Karnataka	1	2	19	8	30
Kerala		9	5		14
Madhya Pradesh	6	10	13	21	50
Maharashtra			15	20	35
Manipur	1	1	1	6	9
Meghalaya	3	1	1	2	7
Mizoram	1		2	6	9
Nagaland			1	10	11
Odisha			8	22	30
Pondicherry				4	4
Punjab	2	1	3	14	20
Rajasthan	3	4	11	15	33
Sikkim	3		1		4
Tamil Nadu	2	3	7	20	32
Tripura	2	1	1		4
Uttar Pradesh	3	14	27	27	71
Uttarakhand			6	7	13
West Bengal	2	9	6	2	19
Telangana		1	2	7	10
Total districts	53	102	204	279	638

ii. Rainfall categorization during July month (number of districts)

State	Excess	Normal	Deficit	Scanty	Total
A & N Islands		2	1		3
Andhra Pradesh	1	6	6		13
Arunachal Pradesh	2	3	5	6	16
Assam	5	6	13	3	27
Bihar	8	3	21	6	38
Chhattisgarh	6	9	3		18
Delhi			6	3	9
Diu & Daman	2				2
Goa		2			2
Gujarat	3	8	15		26
Haryana		2	7	12	21
Himachal Pradesh	1	4	4	3	12
Jammu & Kashmir		6	9	7	22
Jharkhand	5	8	10	1	24
Karnataka	5	14	11		30
Kerala		8	6		14
Madhya Pradesh	7	20	22	1	50
Maharashtra	6	15	11	3	35
Manipur	1			8	9
Meghalaya	1	1	1	4	7
Mizoram		1	1	7	9
Nagaland	1	1	1	8	11
Odisha	23	7			30
Pondicherry	2			2	4
Punjab		3	9	8	20
Rajasthan	2	15	14	2	33
Sikkim	1	1	2		4
Tamil Nadu	3	12	8	9	32
Tripura		1	3		4
Uttar Pradesh	2	14	38	17	71
Uttarakhand	4	6	3		13
West Bengal	1	10	7	1	19
Telangana			10		10
Total districts	92	188	247	111	638

iii. Rainfall categorization during August month (number of districts)

State	Excess	Normal	Deficit	Scanty	Total
A & N Islands		2	1		3
Andhra Pradesh	1	5	6	1	13
Arunachal Pradesh	8	1	3	4	16
Assam	12	9	6		27
Bihar	17	13	7	1	38
Chhattisgarh	3	9	5	1	18
Delhi			2	7	9
Diu & Daman		2			2
Goa	1	1			2
Gujarat	3	5	17	1	26
Haryana			1	20	21
Himachal Pradesh		4	5	3	12
Jammu & Kashmir	4	6	6	6	22
Jharkhand	3	14	6	1	24
Karnataka	21	6	3		30
Kerala	13	1			14
Madhya Pradesh	3	11	24	12	50
Maharashtra	5	10	15	5	35
Manipur	1		1	7	9
Meghalaya	2	3		2	7
Mizoram			3	6	9
Nagaland		3		8	11
Odisha	10	16	4		30
Pondicherry		1	1	2	4
Punjab		2	1	17	20
Rajasthan	13	6	12	2	33
Sikkim	2	2			4
Tamil Nadu	21	10	1		32
Tripura	1	2	1		4
Uttar Pradesh		7	18	46	71
Uttarakhand		2	9	2	13
West Bengal	7	10	2		19
Telangana			8	2	10
Total districts	151	163	168	156	638

iv. Rainfall categorization during September month (number of districts)

State	Excess	Normal	Deficit	Scanty	Total
A & N Islands	3				3
Andhra Pradesh	6	4	3		13
Arunachal Pradesh		1	7	8	16
Assam	1	6	13	7	27
Bihar	1	8	24	5	38
Chhattisgarh	6	8	4		18
Delhi	3	4		2	9
Diu & Daman	2				2
Goa	2				2
Gujarat	23	3			26
Haryana	5	6	10		21
Himachal Pradesh		5	6	1	12
Jammu & Kashmir	17		1	4	22
Jharkhand	1	6	15	2	24
Karnataka	15	6	1	8	30
Kerala	14				14
Madhya Pradesh	19	17	14		50
Maharashtra	26	8	1		35
Manipur	1		1	7	9
Meghalaya			4	3	7
Mizoram	2	1		6	9
Nagaland		1	1	9	11
Odisha	20	9	1		30
Pondicherry		2		2	4
Punjab	13	4	3		20
Rajasthan	27	5	1		33
Sikkim		1	2	1	4
Tamil Nadu	5	4	6	17	32
Tripura	2		2		4
Uttar Pradesh	2	13	33	23	71
Uttarakhand		1	7	5	13
West Bengal		3	15	1	19
Telangana	8	2			10
Total districts	224	128	175	111	638

Annexure-II**Domain Districts for normal Rabi situation**

Crop	Number of districts	State / District (s)
Rice	207	<p>Andhra Pradesh: West Godavari, East Godavari, Krishna, Guntur, Nellore, Srikakulam, Prakasam, Kurnool, Vizianagaram, Visakhapatnam</p> <p>Assam: Nagaon, Barpeta, Sonitpur, Lakhimpur, Karbi-Anglong, Kamrup, Cachar, Kokrajhar, Sibsagar, Golaghat, Dhubri, Baksa, Jorhat, Udalguri, Goalpara</p> <p>Bihar: Champaran(East), Madhubani, Champaran(West), Aurangabad, Rohtas, Muzafarpur, Bhabhua (Kaimur), Araria, Purnea, Siwan, Katihar, Gaya, Supaul, Bhojpur, Banka, Nalanda, Darbhanga, Patna, Saran, Kishanganj</p> <p>Chattisgarh: Raipur, Durg, Bilaspur, Rajnandgaon, Mahasamund, Janjgir, Sarguja, Raigadh, Bastar, Jashpur, Kanker, Dhamtari, Dantewara, Korba, Kawardha</p> <p>Gujarat: Ahmedabad, Kheda, Anand</p> <p>Haryana: Karnal, Kaithal, Kurukshetra, Jind, Sonipet, Fatehabad</p> <p>Jharkhand: Ranchi, West Singhbhum, Gumla, Giridish, East Singhbhum.</p> <p>Karnataka: Raichur, Shimoga, Mysore, Bellary, Davanagere, Gulbarga, Mandya</p> <p>Kerala: Palakkad</p> <p>Madhya Pradesh: Balaghat, Rewa, Mandla, Seoni, Shahdol, Anuppur, Katni, Satna</p> <p>Maharashtra: Gondia, Bhandara, Gadchiroli, Thane, Chandrapur, Raigad, Kolhapur</p> <p>Odisha: Baragarh, Ganjam, Mayurbhanj, Kalahandi, Bolangir, Sundargarh, Balasore (Baleshwar), Nabarangpur, Nayagarh, Bhadrak, Sonepur, Keonjhar, Cuttack, Sambalpur, Kendrapara, Puri, Dhenkanal, Jajpur, Koraput, Jagatsingpur, Malkangiri, Angul, Nuapada, Khurda, Deogarh, Boudh, Gajapati, Rayagada</p> <p>Punjab: Sangrur, Firozpur, Ludhiana, Patiala, Gurdaspur, Amritsar, Moga, Jalandhar, Kapurthala, Muktsar, Bathinda, Faridkot, Fatehgarh Sahib</p> <p>Tamil Nadu: Thiruvarur, Thanjavur, Nagapattinam, Villupuram, Ramanathapuram, Cuddalore, Thiruvannamalai, Pudukkottai, Kancheepuram, Thirunelveli, Sivagangai</p>

Crop	Number of districts	State / District (s)
		<p>Telangana: Nalgonda, Karimnagar, Warangal, Nizamabad, Mahabubnagar, Khammam, Medak</p> <p>Tripura: West Tripura</p> <p>Uttar Pradesh: Shahjahanpur, Azamgarh, Kheri, Siddharth Nagar, Barabanki, Bareilly, Maharajganj, Pilibhit, Bahraich, Gorakhpur, Sitapur, Ghazipur, Allahabad, Hardoi, Jaunpur, Rampur, Sultanpur, Moradabad, Deoria, Kushi Nagar, Ambedkar Nagar, Gonda, Rae-Bareilly, Amethi, Basti, Balrampur, Ballia, Chandauli, Pratapgarh, Sant Kabir Nagar, Faizabad, Mau</p> <p>Uttarakhand: Udham Singh Nagar</p> <p>West Bengal: Midnapore (West), Burdwan, Midnapore (East), 24-Paraganas (South), Murshidabad, Bankura, Birbhum, Hooghly, Purulia, Cooch Behar, Dinajpur (Uttar), 24-Paraganas (North), Nadia, Jalpaiguri, Dinajpur (Dakshin), Malda, Howrah</p>
Wheat	170	<p>Bihar: Rohtas, Champaran(East), Siwan, Muzafarpur, Saran, Madhubani, Champaran(West), Gopalganj, Bhojpur, Darbhanga, Aurangabad, Buxar, Nalanda</p> <p>Gujarat: Ahmedabad, Junagadh, Sabarkanta, Rajkot, Banaskantha, Kheda, Mehsana</p> <p>Haryana: Sirsa, Hissar, Jind, Fatehabad, Kaithal, Karnal, Bhiwani, Sonipet, Kurukshetra, Rohtak, Jhajjar, Palwal, Ambala, Panipet, Yamunanagar, Mewat</p> <p>Himachal Pradesh: Kangra</p> <p>Jammu & Kashmir: Jammu</p> <p>Karnataka: Bijapur</p> <p>Madhya Pradesh: Hoshangabad, Vidisha, Sehore, Raisen, Sagar, Dhar, Shivpuri, Rewa, Chhatarpur, Satna, Harda, Dewas, Ujjain, Datia, Ashoknagar, Seoni, Chhindwara, Tikamgarh, Betul, Gwalior, Jabalpur, Rajgarh, Morena, Indore, Guna, Shajapur, Bhind, Khandwa(East Nimar), Damoh, Ratlam, Khargone(West Nimar), Bhopal</p> <p>Maharashtra: Ahmednagar, Solapur, Nasik</p> <p>Punjab: Firozpur, Sangrur, Ludhiana, Bathinda, Patiala, Gurdaspur, Muktsar, Amritsar, Moga, Mansa, Jalandhar, Hoshiarpur, Faridkot, Kapurthala, Fatehgarh Sahib, Shahid Bhagat Singh Nagar</p> <p>Rajasthan: Ganganagar, Hanumangarh, Alwar, Bharatpur, Jaipur, Bundi, Baran, Kota, Sikar, Dausa, Chittorgarh, Banswara, Bikaner, Jhunjhunu, Karauli, Nagaur</p>

Crop	Number of districts	State / District (s)
		<p>Uttar Pradesh: Hardoi, Budaun, Shahjahanpur, Unnao, Azamgarh, Aligarh, Sitapur, Allahabad, Bareilly, Moradabad, Jaunpur, Kheri, Bulandshahar, Gorakhpur, Mathura, Rae-Bareilly, Ghazipur, Etah, Siddharth Nagar, Fatehpur, Barabanki, Bahraich, Gonda, Pilibhit, Mainpuri, Deoria, Maharajganj, Sultanpur, Pratapgarh, Jalaun, Banda, Rampur, Ballia, Agra, Jhansi, Muzaffarnagar, Saharanpur, Lalitpur, Kushi Nagar, Kanpur (Dehat), Ambedkar Nagar, Basti, Bijnor, Faizabad, Kanpur City, Auraiya, Firozabad, Chandauli, Mirzapur, Jyotiba Phulenagar, Hamirpur, Mau, Etawah, Sant Kabir Nagar, Lucknow, Balrampur, Meerut, Amethi, Hathras, Ghaziabad, Kannauj, Farrukhabad</p> <p>Uttarakhand: Udham Singh Nagar,</p> <p>West Bengal: Murshidabad</p>
Chickpea	80	<p>Andhra Pradesh: Kurnool, Prakasam, Anantapur, Kadapa</p> <p>Chhattisgarh: Durg, Kawardha, Rajnandgaon</p> <p>Gujarat: Dahod</p> <p>Haryana: Bhiwani</p> <p>Karnataka: Gulbarga, Bidar, Bijapur, Raichur, Mysore, Bagalkot, Belgaum, Dharwad</p> <p>Madhya Pradesh: Vidisha, Ujjain, Sagar, Shajapur, Raisen, Damoh, Ashoknagar, Dewas, Narsinghpur, Sehore, Rajgarh, Chhatarpur, Dhar, Panna, Satna, Guna, Indore, Ratlam, Jabalpur, Rewa, Shivpuri, Seoni, Mandsaur, Chhindwara, Betul, Bhopal</p> <p>Maharashtra: Ahmednagar, Amravati, Osmanabad, Nagpur, Buldhana, Latur, Akola, Washim, Beed, Pune, Jalgaon, Parbhani, Nanded, Solapur, Nasik, Aurangabad, Hingoli, Sangli</p> <p>Rajasthan: Churu, Hanumangarh, Bikaner, Ganganagar, Jhunjhunu, Jaisalmer, Sikar, Jaipur, Ajmer, Jhalawar, Tonk</p> <p>Telangana: Medak</p> <p>Uttar Pradesh: Banda, Hamirpur, Mahoba, Chitrakut, Fatehpur, Jhansi, Jalaun</p>
Pigeonpea	66	<p>Andhra Pradesh: Prakasam, Kurnool, Anantapur, Guntur, Kadapa</p> <p>Chhattisgarh: Sarguja</p> <p>Gujarat: Vadodara, Bharuch, Panchmahal, Narmada, Sabarkanta, Tapi, Dahod, Surat</p> <p>Karnataka: Gulbarga, Bijapur, Bidar, Tumkur, Raichur</p> <p>Madhya Pradesh: Narsinghpur, Raisen, Rewa, Damoh, Satna, Betul, Chhindwara, Sidhi, Khargone(West Nimar), Sagar, Jabalpur, Seoni, Chhatarpur</p>

Crop	Number of districts	State / District (s)
		<p>Maharashtra: Yavatmal, Amravati, Latur, Osmanabad, Buldhana, Wardha, Parbhani, Nanded, Nagpur, Beed, Akola, Washim, Aurangabad, Jalna, Chandrapur, Hingoli, Solapur, Nandurbar, Jalgaon</p> <p>Telangana: Mahabubnagar, Adilabad, Nalgonda, Ranga Reddy, Medak, Warangal, Khammam</p> <p>Uttar Pradesh: Fatehpur, Banda, Allahabad, Hamirpur, Chitrakut, Mirzapur, Aligarh, Bulandshahar</p>
Pearlmillet	38	<p>Gujarat: Banaskantha, Kheda, Mehsana, Anand, Patan</p> <p>Haryana: Bhiwani, Mahendragarh</p> <p>Karnataka: Bijapur, Koppal</p> <p>Madhya Pradesh: Morena</p> <p>Maharashtra: Nasik, Ahmednagar, Beed, Dhule, Aurangabad</p> <p>Rajasthan: Barmer, Jodhpur, Nagaur, Churu, Jalore, Jaipur, Sikar, Jhunjhunu, Alwar, Bikaner, Jaisalmer, Dausa, Karauli, Bharatpur, Ajmer, Pali, Dholpur, Sawai Madhopur, Hanumangarh, Tonk</p> <p>Uttar Pradesh: Budaun, Agra, Aligarh</p>
Sorghum	42	<p>Andhra Pradesh: Kurnool</p> <p>Karnataka: Gulbarga, Bijapur, Belgaum, Bagalkot, Raichur, Bidar, Gadag, Koppal, Bellary, Dharwad, Haveri</p> <p>Madhya Pradesh: Khargone (West Nimar), Barwani, Betul</p> <p>Maharashtra: Solapur, Ahmednagar, Pune, Osmanabad, Sangli, Parbhani, Beed, Satara, Latur, Aurangabad, Nanded, Jalgaon, Jalna, Yavatmal, Buldhana, Hingoli, Nandurbar, Akola, Amravati.</p> <p>Rajasthan: Ajmer, Pali, Tonk, Bharatpur, Jodhpur, Nagaur</p> <p>Telangana: Mahabubnagar, Adilabad</p>
Maize	119	<p>Andhra Pradesh: Guntur, West Godavari, Kurnool, Krishna</p> <p>Assam: Karbi-Anglong</p> <p>Bihar: Begusarai, Khagaria, Bhagalpur, Samastipur, Purnea, Katihar, Vaishali, Saran, Madhepura, Saharsa, Araria, Siwan, Champaran(East), Muzafarpur, Gopalganj, Banka, Champaran(West)</p> <p>Chhattisgarh: Sarguja</p> <p>Gujarat: Panchmahal, Dahod, Vadodara, Sabarkanta, Junagadh, Kheda</p> <p>Himachal Pradesh: Kangra, Mandi, Hamirpur, Una, Chamba, Bilaspur, Solan, Sirmaur</p>

Crop	Number of districts	State / District (s)
		<p>Jammu & Kashmir: Udhampur, Rajouri, Doda, Baramulla, Kupwara, Poonch</p> <p>Karnataka: Davanagere, Belgaum, Haveri, Bellary, Chitradurga, Bagalkot, Shimoga, Bijapur, Hassan, Dharwad, Gadag, Chamarajanagar, Chikballapur, Koppal, Mysore</p> <p>Madhya Pradesh: Chhindwara, Jhabua, Dhar, Ratlam, Rajgarh, Betul, Shajapur, Mandsaur, Barwani, Neemuch, Shivpuri, Khargone (West Nimar)</p> <p>Maharashtra: Nasik, Aurangabad, Jalgaon, Buldhana, Jalna, Ahmednagar, Dhule, Solapur, Nandurbar, Sangli</p> <p>Odisha: Nabarangpur</p> <p>Punjab: Hoshiarpur, Rupnagar</p> <p>Rajasthan: Bhilwara, Udaipur, Chittorgarh, Banswara, Dungarpur, Rajsamand, Bundi, Jhalawar, Ajmer, Sirohi, Pali</p> <p>Tamil Nadu: Perambalur, Dindigul, Salem, Tiruppur</p> <p>Telangana: Mahabubnagar, Medak, Karimnagar, Nizamabad, Warangal, Khammam, Rangareddy</p> <p>Uttar Pradesh: Bahraich, Gonda, Bulandshahar, Jaunpur, Hardoi, Kannauj, Lalitpur, Mainpuri, Farrukhabad, Etah, Unnao, Aligarh</p> <p>West Bengal: Darjeeling, Dinajpur (Uttar)</p>
Groundnut	43	<p>Andhra Pradesh: Anantapur, Kurnool, Chittoor, Kadapa, Vizianagaram, Srikakulam</p> <p>Gujarat: Junagadh, Jamnagar, Rajkot, Amreli, Bhavnagar, Kutch, Porbandar, Sabarkantha, Banaskantha, Vadodara</p> <p>Karnataka: Chitradurga, Tumkur, Bijapur, Bellary, Gadag, Belgaum, Gulbarga, Raichur, Koppal, Dharwad, Chikballapur</p> <p>Madhya Pradesh: Shivpuri</p> <p>Maharashtra: Kolhapur, Satara, Pune, Nasik, Sangli</p> <p>Rajasthan: Bikaner, Jaipur, Jodhpur, Sikar</p> <p>Tamil Nadu: Thiruvannamalai, Vellore, Villupuram, Namakkal</p> <p>Telangana: Mahabubnagar, Warangal</p>
Sunflower	16	<p>Karnataka: Raichur, Bijapur, Gulbarga, Koppal, Bellary, Bagalkot, Gadag, Chitradurga, Belgaum, Chamarajanagar, Davanagere, Hassan</p> <p>Maharashtra: Osmanabad, Latur, Solapur, Amaravati</p>

Crop	Number of districts	State / District (s)
Rapeseed & Mustard	70	<p>Assam: Lakhimpur, Kokrajhar, Karbi-Anglong, Dhemaji</p> <p>Bihar: Champaran (West)</p> <p>Gujarat: Banaskantha, Patan, Mehsana</p> <p>Haryana: Bhiwani, Mahendragarh, Rewari, Hissar, Sirsa, Jhajjar, Mewat</p> <p>Jammu & Kashmir: Anantnag</p> <p>Madhya Pradesh: Bhind, Morena, Sheopur Kalan, Gwalior, Shivpuri, Mandsaur, Tikamgarh, Neemuch, Chhatarpur, Dindori</p> <p>Rajasthan: Alwar, Ganganagar, Bharatpur, Tonk, Sawai Madhopur, Jaipur, Baran, Hanumangarh, Jhunjhunu, Jalore, Jodhpur, Karauli, Dausa, Kota, Sikar, Dholpur, Bundi, Nagaur, Jaisalmer, Chittorgarh, Bikaner, Jhalawar, Pali, Bhilwara, Barmer, Churu, Sirohi, Ajmer</p> <p>Uttar Pradesh: Agra, Mathura, Kheri, Budaun, Kanpur (Dehat), Aligarh, Sitapur, Balrampur</p> <p>West Bengal: Murshidabad, Nadia, Dinajpur (Uttar), 24-Paraganas (North), Malda, Birbhum, Burdwan, Dinajpur (Dakshin)</p>

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