

Crop and Contingency Planning for Rainfed Regions of India

- a compendium by AICRPDA



**All India Coordinated Research Project for Dryland Agriculture
Central Research Institute for Dryland Agriculture**

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Preface

Rainfed Agriculture extends over 87.5 m.ha of net sown area in different agro-climatic zones of our country and contributes over 40 percent to our food basket. Rainfed agriculture in turn supports 40 percent of human and 60 percent of livestock populations. Majority of the Nutritious cereals (87.5%), pulses (87.5%), oilseeds (77%) and cotton (65.7%) are predominantly grown in this area. The productivity of these rainfed crops, however, often fluctuates due to vagaries of weather. In this context, the All India Coordinated Research Project for Dryland Agriculture (AICRPDA) with a network of 22 centres in different SAUs and supported by 8 Operational Research Projects (ORPs) has been making efforts to develop and upscale appropriate contingency crop planning strategies to achieve sustainable productivity of rainfed crops in different agro-climatic environments. The project has also generated appropriate strategies and agro-techniques for growing rainfed crops under normal and delayed onset, early withdrawal and extended monsoon conditions. The project has also come up with sustainable rainfed practices, which are being actively adopted by the small, medium and large rainfed farmers in different parts of the country.

I compliment Dr.YS. Ramakrishna, Director, CRIDA and the efforts made by the Project Coordinator Dr.G.Subba Reddy and his team of Scientists from AICRPDA across the network project in bringing out this publication entitled “Crop and Contingency Planning for Rainfed Regions of India”- a compendium by AICRPDA. I am confident that this publication will be of immense use for the development agencies, which are involved in transfer of technology for rainfed crops in the country besides its utility to the farming community for achieving higher and stabilized productivity from the rainfed areas of the country.


(A.K. Singh)

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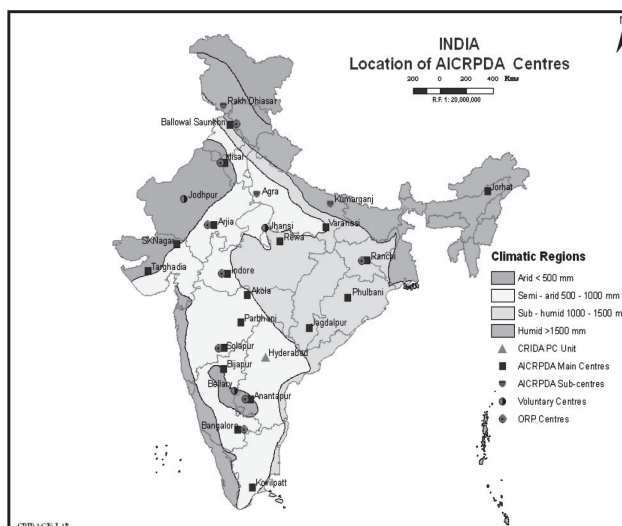
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Introduction

Rainfed agriculture occupies a prominent place in Indian economy and rural livelihoods. At present, about 60% of total net sown area is rainfed, contributing 40% of the total food production. It supports 40% of human and 60% of livestock population. Coarse cereals (87.5%), pulses (87.5%), oilseeds (77%), rice (48%) and cotton (65.7%) are predominantly grown under rainfed farming. Agriculture in rainfed areas continues to be a gamble and rainfed farmers face several uncertainties like aberrant weather, lack of timely inputs and credit leading to low and unstable productivity and profitability. The crop production in rainfed region has inherent risks because rain is undependable in time and amount. In this context, All India Coordinated Research Project for Dryland Agriculture (ICAR) under the aegis of Central Research Institute for Dryland Agriculture (CRIDA) is conducting site-specific research programs in arid, semiarid and sub-humid agro-ecologies through 25 network centers located across the country. These centers are located in dominant rainfed crop based production systems viz., Faizabad (NDUAT), Jagadaldpur (IGAU), Jorhat (AAU), Phulbani (OUAT), Ranchi (BAU), Varanasi (BHU) in Rice based Production System; Indore and Rewa (JNKVV) in Soybean based Production System; Anantapur (ANGRAU) and Rajkot (JAU) in Groundnut based Production System; Akola (PDKV), Kovilpatti (TNAU), Parbhani (MAU) in Cotton based Production System; Arjia (MPUAT), Ballawal - Saunkhri (PAU) and Rakh Dhiansar (SKUAST_J) in Maize based Production System, Bijapur (UAS_D), Bellary (CSWCRTI), Jhansi (IGFRI) and Solapur (MPKV) in Sorghum based Production System; Agra (Bichpuri College), Hisar (CCSHAU) and S.K.Nagar (SKDAU) in Pearl millet based Production System and Bangalore (UAS_B) in Finger millet based Production System

The principal source of water for rainfed crops is rain, a major portion of which is received during the south-west monsoon period. The monsoon period is beset with breaks of rain in almost all parts of the country. Sudden "bursts" of rain alternated with "breaks" is common in rainfed areas. Normally, there are at least four important aberrations in the rainfall behavior, viz., i) early commencement of the rains, or considerably delayed monsoon, ii) intermittent "breaks" during the cropping season, iii) variation in spatial and/or temporal aberrations, and iv) early cessation of rainfall or continued wet spells for longer period. These situations call for attention of agricultural scientists and planners to develop contingent measures to save the rainfed crops from varied monsoon aberrations. Further, there is a need to select crops and varieties matching the effective growing seasons in different agro climatic regions of the country. The high variability of rainfall (more precisely, the soil-water) is the single factor which influences the high fluctuations in the crop yields. Drought leads to moisture stress, which in turn effects crop production adversely. After considerable location specific research, the network centers under All India Coordinated Research Project for Dryland Agriculture (AICRPDA) developed strategies of crop and contingency crop planning matching different weather conditions for higher stable productivity and profitability.

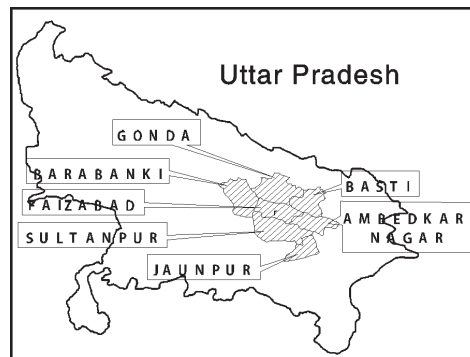
The contingent plans were presented based on crop based production systems in the following chapters.



1. Rainfed Rice based Production System

1.1. *Kharif* – Rabi Sub-humid Deep Inceptisols in Eastern Plain Zone of Uttar Pradesh

Recommendation Domain: Comprises Faizabad, Sultanpur, Gonda, Basti, Barabanki, Jaunpur, Ambedkarnagar districts of Uttar Pradesh.



Recommended crops and cultural calendar for a normal season

S.N.	Month	Crop/ intercropping system	Cultural operations	Remarks
1	January	i) Chickpea	Plant protection measures	-
		ii) Lentil	-	
		iii) Pigeonpea	Plant protection measures	
		iv) Linseed	-	
		v) Mustard	Plant protection measures	
		vi) Barley	-	
		vii) Barley + Mustard	-	
		viii) Lentil + Mustard	-	
2	February	i) Chickpea	Watching of all the crops from animals and birds	-
		ii) Lentil		
		iii) Pigeonpea		
		iv) Linseed		
		v) Mustard		
		vi) Barley		
		vii) Barley + Mustard		
		viii) Lentil + Mustard		
3	March	i) Chickpea	Harvesting of various crops	-
		ii) Lentil		
		iii) Pigeonpea		
		iv) Linseed		
		v) Mustard		
		vi) Barley		
		vii) Barley + Mustard		
		viii) Lentil + Mustard		
4	April	-	Deep ploughing in fallow fields once in 3 years	No crop will be in field during this month
5	May	-	Summer ploughing in fallow fields	No crop will be in field during this month

S.N.	Month	Crop/ intercropping system	Cultural operations	Remarks
6	June	i) Rice ii) Maize iii) Pearl millet iv) Pigeonpea v) Blackgram vi) Greengram vii) Sesame viii) Blackgram+ Pigeonpea ix) Maize+ Pigeonpea x) Sorghum+ Pigeonpea xi) Sesame + Pigeonpea	Land preparation for all the crops	As the monsoon starts in last week of June, preparation of land may be started after commencement of monsoon
7	July	i) Rice ii) Maize iii) Pearl millet iv) Pigeonpea v) Blackgram vi) Greengram vii) Sesame viii) Blackgram+ Pigeonpea ix) Maize+ Pigeonpea x) Sorghum+ Pigeonpea xi) Sesame + Pigeonpea	Sowing of all the crops as sole or in intercropping systems is recommended during this month and basal application of fertilizers may also be done at the time of sowing	-
8	August	i) Rice ii) Maize iii) Pearl millet iv) Pigeonpea v) Blackgram vi) Greengram vii) Sesame viii) Blackgram+ Pigeonpea ix) Maize+ Pigeonpea x) Sorghum+ Pigeonpea xi) Sesame + Pigeonpea	Weeding in all crops	-
9	September	i) Rice ii) Maize iii) Pearl millet iv) Pigeonpea v) Blackgram vi) Greengram vii) Sesame viii) Blackgram+ Pigeonpea ix) Maize+ Pigeonpea x) Sorghum+ Pigeonpea xi) Sesame + Pigeonpea	weeding in all the crops and cropping systems	-

S.N.	Month	Crop/ intercropping system	Cultural operations	Remarks
10	October	i) Rice ii) Maize iii) Pearl millet iv) Pigeonpea v) Blackgram vi) Greengram vii) Sesame viii) Blackgram+ Pigeonpea ix) Maize+ Pigeonpea x) Sorghum+ Pigeonpea xi) Sesame + Pigeonpea xii) Chickpea xiii) Lentil xiv) Linseed xv) Mustard xvi) Barley xvii) Barley + Mustard xviii) Lentil + Mustard	Harvesting of <i>kharif</i> crops (except pigeonpea) Land preparation and sowing of <i>rabi</i> crops	
11	November	i) Chickpea ii) Lentil iii) Pigeonpea iv) Linseed v) Mustard vi) Barley vii) Barley + Mustard viii) Lentil + Mustard	Weeding in all crops (except pigeonpea) and thinning in Mustard	
12	December	i) Chickpea ii) Lentil iii) Pigeonpea iv) Linseed v) Mustard vi) Barley vii) Barley + Mustard viii) Lentil + Mustard	Plant protection measures in chickpea and mustard	-

Recommended *kharif* Contingency plans for delayed monsoon

Month	Fortnight	Crop/ Intercropping systems	Cultural operations including mid season corrections	Remarks
1. June	I Fortnight	-	Summer ploughing	
	II Fortnight	Rice (NDR-97)	Dry sowing	
2. July	I Fortnight	Rice (NDR-97) Maize (Naveen) Pigeonpea (Bahar) Maize+ Pigeonpea	Dry sowing	
	II Fortnight	Rice (NDR-97) Pigeonpea (Bahar)	Dry sowing	
3. August	I Fortnight	Pearl millet (BJ-560)		

Month	Fortnight	Crop/ Intercropping systems	Cultural operations including mid season corrections	Remarks
4. September	II Fortnight	(BJ-104 Hybrid) Pearlmillet (BJ-560) (BJ-104 Hybrid) Blackgram (T-9) Greengram (Jyoti, Jagriti)	Sowing	If rains occurs
	I Fortnight	Maize Sorghum Pearlmillet	Sowing and Harvesting for fodder	
	II Fortnight	Maize Sorghum Pearlmillet	Harvesting for fodder	
	I Fortnight	Rice Sorghum Maize Pearlmillet	Harvesting of various crops	
5. October	II Fortnight	-	Land preparation for <i>rabi</i> crops	

Recommended *rabi* Contingency plans for absence or delay rains or failed *kharif*

Month	Fortnight	Crop/ Inter cropping system	Cultural operations	Remarks
October	I Fortnight	Chickpea Lentil Linseed	Land preparation for sowing	In case <i>kharif</i> crop fails
	II Fortnight	Barley Mustard	Land preparation for sowing	In case of delayed monsoon rains
November	I Fortnight	Chickpea Lentil Linseed Barley Mustard	Weeding	
	II Fortnight	Chickpea Lentil Linseed Barley Mustard	Plant protection measures	
December	I Fortnight	Chickpea Lentil Linseed Barley Mustard	Harvesting of crops for fodder	If winter rains are occurring and soil does not have sufficient moisture for the survival of crops
	II Fortnight	Chickpea Lentil Linseed Barley Mustard	Harvesting of crops for fodder	If winter rains are occurring and soil does not have sufficient moisture for the survival of crops then crops should be harvested for fodder
January	I Fortnight	Chickpea Lentil Linseed	Harvesting of crops for fodder	If rains are not occurring, crops should be harvested for fodder

Month	Fortnight	Crop/ Inter cropping system	Cultural operations	Remarks
	II Fortnight	Barley Mustard Chickpea Lentil Linseed Barley Mustard	Harvesting of crops for fodder	If moisture is not available in the soil and there are no winter rains, then crop should be harvested for fodder purpose

Crops and varieties

Crop	Varieties/ Hybrids	Yield Potential (t/ha)	Duration from Seed to seed (Days)	Reaction to Diseases and Pests	Remarks
Rice	NDR – 118	4.5-5.0	85-90	Resistant to blast and leaf spot	Suitable for direct seeding in upland rainfed
	NDR-97	5.0-5.5		Resistant to blast, leaf blight, rot and brown spot	Suitable for direct Seed seeding in upland rainfed
Maize	Baranideep	4.5-5.0	95-100	Blast resistant	Suitable for upland Rainfed rice
	Naveen	3.5-4.0	80-85	–	Suitable for sequence and intercropping system
	Jaunpuri	2.0-2.5	70-75	–	Suitable for sequence and intercropping system
Pigeonpea	T-21	1.6-2.0	160-170	Susceptible to wilt and pod borer	Suitable for intercropping system
	Narendra Arhar-1	2.5-3.0	250-260	Wilt resistant/ tolerant	Suitable for monocropping system
	Bahar		260-270	–	Suitable for monocropping system
Sorghum	PKV-400	3.0-3.5	105-110	–	–
	Varsha	2.5-3.0	125-130	–	–
	UP Chari-1	40.0-50.0	60	–	Only for forage
Pearlmillet	Manupur	1.5-1.8	100-110	–	–
	WCC-75	3.0-3.5	80-90	–	–
	Rajkot	30.0-35.0	60	–	Only for forage
Blackgram	Narendra Urd-1	1.2-1.5	80-85	Resistant to mosaic	Suitable for <i>kharif</i> season
	T-9	1.0-1.2	85-90	Susceptible to mosaic	Suitable for <i>kharif</i> season
	Pant Urd-35	1.2-1.5	80-85		
Greengram	Narendra	1.2-1.5	65-70	Tolerant to yellow mosaic	Suitable for late sowing in <i>Kharif</i> and <i>Zaid</i>
	Moong-1				
	Pant Moong-	1 0.8-1.0	70-75	Tolerant to yellow mosaic in <i>Kharif</i> and <i>Zaid</i>	Suitable for late sowing
	Pant Moong-54	1.2-1.5	65-70	Resistant to yellow Mosaic	–
Sesame	T-4	0.6-0.7	90-100	Susceptible to stem rot	Suitable for Sequence and Intercropping
	T-12	0.5-0.6	85-90	Susceptible to Stem rot	Suitable for sequence and intercropping
Lobiya	T-2	1.4-1.6	130-135	–	–
	T-5259				

Crop	Varieties/ Hybrids	Yield Potential (t/ha)	Duration from Seed to seed (Days)	Reaction to Diseases and Pests	Remarks
Groundnut	Chitra (MA-10)	2.5-3.0	125-130	–	–
	Kausal(G-201)	2.0-2.2	115-120	–	–
Safflower	N-62-8	2.5-2.8	160-165	Susceptible to <i>Alternaria</i> blight and <i>Rhizoctonia</i>	Suitable for sequence and intercropping
	IC-11842	2.0-2.5	155-160	Susceptible to <i>Alternaria</i> blight and <i>Rhizoctonia</i>	Suitable for sequence and intercropping
Chickpea	Radhey	2.5-3.0	150-155	Susceptible to wilt	Suitable for late sowing in rainfed condition
	K-850		145-150	Susceptible to wilt	–
	Avrodhi		150-155	Resistant for wilt	–
	T-3	2.0-2.4	160-165	–	Suitable for moisture retentive soils
Pea	Rachana	2.0-2.5	130-135	Resistant to powdery mildew	–
	Aparna	2.5-3.0	125-130	–	Dwarf variety
	Malviya Pea-2	2.0-2.5		–	–
Lentil	Plant L-639	1.8-2.0	135-140	Resistant to rust	For sequence and intercropping
	Narendra Masoor	2.0-2.5	120-125	Resistant to rust and root	For rainfed and irrigation
	Priya (DPL-15)	2.0-2.2	135-140	–	–
Mustard	Varuna	2.0-2.5	125-130	–	For rainfed and irrigation
	Narendra Rai-1	2.0-2.5	120-125	–	For saline and alkali soils
	Vaibhav	1.5-2.0	125-130	–	For rainfed conditions
Linseed	Sweta	1.0-1.5	130-135	–	Only for rainfed
	Garima	1.6-2.0	125-130	–	For rainfed and irrigated
	Shubhra	1.3-1.5	130-135	–	For rainfed and irrigated
Wheat	Atal	2.0-2.5	130-135	–	–
	C-306	2.0-2.5	140-145	–	–
	Mahar (K-8027)	3.0-3.5		Resistant to smut and blight disease	For eastern Uttar Pradesh
Barley	Narendra Jau-1	3.5-4.0	110-115	–	For saline alkaline soils
	Narendra Jau-4	3.5-4.0	110-115	Resistant to rust and strip disease	For rainfed
	Lakhan	3.5-4.0	110-115	Slightly resistant to strip disease	For rainfed

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Rice/ wheat/ barley	100	30	Thick sown
Chickpea	80	45	10
Blackgram/ greengram	15	30	—
Maize	15	60	20
Safflower	15	45	10-15
Mustard	5	45	10-15
Pearlmillet	5	45	10-15
Lentil	30		

Nutrient management

Crop	Nutrients (kg/ha)					Mode of application	Remarks
	N	P ₂ O ₅	K ₂ O	S	Zinc		
Upland rice	80	*	*	—	—	During <i>kharif</i> place 1/2 N as basal in seed furrows and remaining 1/2 top dress when surface is moist (30 to 40 days after seeding). In <i>rabi</i> place fertilizer 10 – 15 cm deep in Safflower 40 * * the seed furrows	Apply P ₂ O ₅ and K ₂ O on soil test basis to these crops
Barley	60	*	*	—	—		
Wheat	60	*	*				
Chickpea	0	40	*				
Sesame	40	*	*				
Mustard	40	*	*				
Linseed	40	20					
Linseed	30	-	-	-	-		-
Lentil	-	30	-	15	-		-
Mustard	60	-	-	40	-		-
Sorghum	60	40	30		—	50% N at sowing and 50% at 40 days after sowing	—
Chickpea	—	60	—	—	25		

* In upland rice use of Agromin (chelated micronutrients) 0.16% solution spray when crop is about 45 days old helps in increasing yield.

Suitable cropping systems**Sequence cropping**

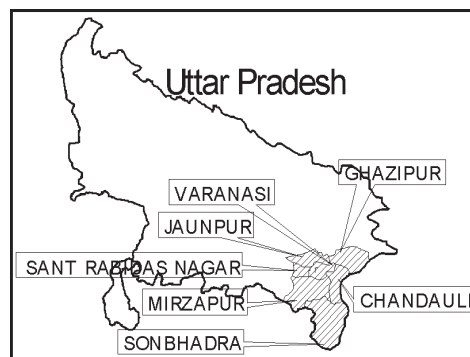
- Rice – chickpea/ lentil
- Pearl millet – chickpea/ mustard
- Sesame – chickpea/ mustard
- Blackgram – barley/ mustard (if barley or mustard are taken after blackgram in *kharif* 20 kg N/ha can be saved in *rabi*)
- For fodder:
- Maize + cowpea – oats
- Pearl millet + cowpea – oats

Intercropping

- Maize (Tipekhiya) in pigeonpea (Narendra Arhar –1) crop in 1: 1 row ratio
- Chickpea + mustard (4:1)/ (3:1)
- Pigeonpea + groundnut/ blackgram (1:3)
- Sorghum + greengram (2:2)

1.2. *Kharif-Rabi* Sub-humid Deep Inceptisols in Vindhya Zone of Uttar Pradesh

Recommendation domain: Comprises the districts of Uttar Pradesh of Varanasi, Chandauli, Sant Rabidas Nagar, Jaunpur, Ghazipur, Mirzapur and Sonbhadra districts and Vindhyachal commissionaires.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January to February	Standing crops / cropping system	Weed control measures, foliar application of N, prophylactic plant protection measures, supplemental irrigation in case of moisture stress	Standing winter crops
March to April	Standing crops/ cropping system	Harvesting of crops	
May	Threshed crops / plots	Threshing, conservation tillage associating mould board plough	Till the land with summer rains
June to mid July	Rice (NDR-97/118, Vandana, Govind) Maize (Ganga safed 2, Kanchan Jaunpuri, Ganga 5) Blackgram (T9) Sesame (T4,t12,T13, GT1) Pigeonpea (Bahar / NA1) Okra (Parbhani kranti, Arkanamika) Intercropping – Rice + Pigeonpea, Pigeonpea + Okra / sesame / black (combining listed varieties)	Summer tillage , conservation tillage, seeding, in-situ conservation measures, seed bed preparation, seed treatment, weed management treatments. Surface water management	Rice + Pigeonpea associated with ridge-furrow plantation
Mid July to mid August	Green gram (Jyoti, Janpriya, Jagriti, Janchetna) Blackgram(T9) Pigeonpea (Narendra Arhar 1) T21) Fodder (Maize + cowpea) Intercropping green gram / fodder component with pigeonpea (of recommended varieties)	Weed control in standing crops, seeding contingent operations relative to water stagnation / drought	Construction of diversion ditches in case of intended rains
Mid august to end of August	Fodder, Pearl millet (Nirmal 40, Pusa 23)	Conservation measures, seeding	
September	Toria (2 nd fortnight of September)	Plant protection measures in standing crop, harvesting of early maturing pulses /	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		oilseeds, tillage for conservation of stored / residual moisture	
October	Chickpea (T6,Arrodhi, Pusa 256), Lentil (Malviya Vishwanath, Pant L406), Mustard (Varuna , Sanjukta, Kranti, Linseed (Garima, Laxmi, T397), safflower (HUS 305), Barley (Lakhan, K125, Jyoti), Vegetable tomato, Spices Coriander, methi, Intercropping vegetable spices, artn either Pulses or oilseeds Chickpea + mustard (4:1), Barley + mustard (6:1)	Threshing of <i>kharif</i> crops seed bed preparation, seeding	Come up irrigation with harvested water Supplemented irrigation
December	Wheat (C306, HUW533), Mustard K802 (Sanjukta, Kranti), fodder (Oat + Mustard) Intercropping of mustard / Linseed with wheat / barley (of recommended varieties)	Weed control measures stirring interrow space for minimizing moisture loss	Wheat should be taken in plots with adequate residual moisture
December	-	Supplemental irrigation, weed control, plant protection measure foliar application of urea.	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	-	Conservation tillage for <i>in situ</i> moisture conservation weed control, reducing runoff and timely sowing of summer / <i>kharif</i> crops	
	II Fortnight	Recommended crops (varieties) and intercropping of anticipated normal season be practiced	Conservation tillage, seed bed preparation seeding.	
July	I Fortnight	Recommended crops (varieties) and cropping system	Same as recommended for the normal season	
	II Fortnight	Short duration pulses, like green gram, Blackgram, pigeonpea	Same as recommended for normal season	
August	I Fortnight	Pearlmillet (recommended varieties), pearlmillet + cowpea fodder (Crop substitution if normal rice fails)	Recommended practices like weed control, moisture conservation and plant protection measures	
	II Fortnight	Pearlmillet (grain) and fodder with cowpea	Same as recommended above	
September	I Fortnight	Under the situation normal rice faces moisture stress due to	Intercultural operation, weed control, life saving irrigation by	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
September	II Fortnight	late season drought	harvested water	
		Rice faces moisture stress during reproductive stage	Same as recommended for rice under stress during reproductive phase	
	I Fortnight	If monsoon is delayed upto 10 th of July, upland rice should not be taken and normal sown rice faces moisture stress due to drought. Rice, already sown, is not likely to succeed, may be harvested for fodder to conserve moisture for succeeding rabi crops	One life saving irrigation (5 cm) from harvested water	
	II Fortnight	Toria (recommended variety)	Preparatory tillage, seeding weed control, thinning and plant protection measures	
October	I fortnight	In case of failure of kharif rice, early sowing of chickpea, mustard, lentil etc.	Conservation tillage, seeding weed control, plant protection measures	
	II Fortnight	-	-	

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	If rains are delayed or kharif fails – early sowing of chickpea, mustard, lentil, linseed etc. (recommended varieties)	Conservation tillage, seeding, weed control, moisture conservation and plant protection	
	II Fortnight	If monsoon is allsorts and harvested water becomes available barley, chickpea and mustard (recommended varieties)	Pre-sowing or come up irrigation, preparatory tillage, seeding weed control	
November	I Fortnight	If rains delayed by October, wheat , barley chickpea and mustard intercropping chickpea + mustard	Preparatory tillage, seeding and moisture conservation, weed control	
	II Fortnight	-	-	
December	I Fortnight	Mustard fodder if winter rains occur	Broadcasting	
	II Fortnight	-	-	
January	I Fortnight	-	-	
	II Fortnight	-	-	

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to & stress condition disease and pest	Remarks
Rice	NDR-97	3.0	70	96	–	Suitable for sequence cropping -do-
	NDR-118	2.7	71	95	–	

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to & stress condition disease and pest	Remarks
Maize	Govind	2.5	70	100	–	Resistant to bacterial Suitable for leaf blight & blast sequence cropping
	Vandana	2.5	65	93	– –	
	Cauvery Akashi					
	Ganga safed-2	2.8-3.0	100-105	60-65	–	Suitable for sequence and intercropping
	Kanchan	2.5-3.0	45-45	75-80		
Pearlmillet	Jaunpuri Ganga-5	2.0-2.5	40-45	70-75		
	Pusa-23	1.7-2.3	45-50	80-85	–	Suitable for sequence and intercropping
Blackgram	Pusa-322	2.5-3.0	40-45	75-80		
	T-9	1.7	44	82		Susceptible to suitable for mosaic sequence and intercropping
Greengram	Pant U-19	1.5-1.6	45	85		Resistant to mosaic -do- yellow mosaic virus
	Pant U-35	1.2-1.5	45			
	T-44	1.0-1.1	43	66		Susceptible to suitable for yellow mosaic virus sequence and intercropping
	Pant Moong-1	1.0-1.2	45	65-70		Resistant to yellow mosaic virus
	Narendra Moong-1	1.2-1.5	52	70-75		
Sesame	T-13	0.7	64	92		Susceptible suitable for to stem rot sequence and intercropping
	T-4	0.6	60	90		
	T-12	0.5	64			
Pigeonpea	Bahar	2.5-3.0	200-210	260-270		Resistant to wilt Suitable for pure and intercropping
	Narendra arhar		200-220			Suitable for pure and intercropping
	T-21	1.2-1.3	99	176		Susceptible to Suitable for wilt & pod borer sequence and intercropping
Wheat	Malviya –533	2.8-3.0	72	135	– –	
	C 306	2.6-2.7	87	142		
	K 8027	2.8-3.0	78	140	Resistant to smut & blight	–
Barley	DL 3	3.5-3.6	71	127	Affected by	–
	K 125	3.2-3.3	72	128	helminthosporium	
	Ratna		71	129	-do-	
Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease and pest	Remarks
Chickpea	T-3	3.3	97	154	Severe wilt	–
	T-6	3.0-3.1	90	153	infestation	
	BG 1	3.4-3.5	97	155	-do-	
	BG 2		99	156	-do-	
	Type -1					

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease and pest	Remarks
Lentil	Pant L-406	1.6-2.0	90	135	Resistant to wilt	Small seed
	Pant – 639	1.6-1.8			-do-	–
	L-4076	1.4-1.6	85		-do-	Bold seed
	K-75		75	125	-do-	–
Safflower	N 62-8	2.6-2.7	116	162	Susceptible to <i>Alternariabligh Rhizoctonia</i>	–
	K-65	1.4-1.5	120	180-190	–	–
	Malaviya Kusum 3	0	110	160	–	–
	Local	2.6-2.7	117	160	–	–
	IC-11842	2.5	119	162	–	–
Rapeseed mustard	T-59 (varuna)	1.9	65	110	Susceptible to aphids	–
	Vardhan	1.8-2.0	60		Susceptible to aphids	–
	Kranti	1.6-1.0			-do-	–
	Sanjukta	1.5-1.8	55	95	-do-	–
Linseed	T-397	1.8	95	130	–	–
	Neelam	1.5-1.6	105	135	Susceptible	
	Garima Mukta	1.5-1.6	105	135	to aphids	

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Rice/ wheat/ barley	100	30	Thick sown
Chickpea	80	45	10
Blackgram/ greengram	15	30	—
Safflower	15	45	10-15
Maize	15	60	20
Rapeseed mustard/ pearl millet	5	45	10-15
Sesame	5		
Lentil	30		
Linseed	25		

Nutrient management

Crop	Nutrients (kg/ha)		
	N	P ₂ O ₅	K ₂ O
Upland rice	80	40	30
Barley	80	40	30
Wheat	80	40	30
Chickpea	20	40	20
Sesame	40	*	*
Rapeseed Mustard	40	*	*
Safflower	40	*	*
Linseed	40	20	*
Lentil	20	40	20

- During *kharif* place 1/2 N basal in seed furrows and remaining 1/2 top dress when surface is moist (30 to 40 days after seeding). In *rabi* place fertilizer 10-15cm deep in the seed furrows. Apply P_2O_5 and K_2O based on soil test basis to these crops.
- In upland rice use of Agromin (chelated micronutrients) 0.16% solution spray when crop is about 45 days old helps in increasing yield.
- On availability of organic source of fertilizer, its conjunctive use along with chemical fertilizers in proportion of 50:50 has confirmed its utility in sustaining the productivity of component crops in the proven system due to improved soil health.

Suitable cropping systems

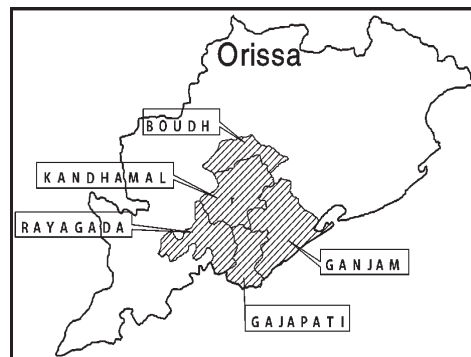
Water availability period (days)	Double cropping system Inceptisols and related soils	Intercropping system
200-230	Rice – chickpea Rice – lentil Rice – mustard Maize – lentil	Chickpea + mustard (4:1) Maize + blackgram (1:1) Pigeonpea + blackgram (1:1) Pigeonpea + sesame (1:1) Pigeonpea + groundnut (1:2) Barley + mustard (6:1)
180-200	Pearlmillet – chickpea Greengram – mustard Greengram – barley Blackgram – mustard Blackgram – barley Alfisols and related soils	Pearlmillet + pigeonpea (2:1) Chickpea + mustard (4:1) Chickpea + barley (2-3:1) Chickpea + linseed (2-3:1)
150 and above	Sesame – chickpea Blackgram – chickpea Blackgram – mustard Maize – mustard	Pigeonpea + blackgram Pigeonpea + groundnut (1:1)
Less than 150	Niger – mustard	Maize + blackgram (1:3) Maize + okra (1:1)

Sequence cropping

- Rice-lentil/ rapeseed mustard/ chickpea
- Pearlmillet - lentil/ rapeseed mustard/ chickpea
- Sesame-lentil / rapeseed mustard/ chickpea
- Blackgram –barely/ rapeseed mustard (if barley or mustard are taken after blackgram in *kharif* (20 kg N/ha can be saved in *rabi*)
- For fodder: Maize + cowpea – oats, pearlmillet + cowpea – oats
- Blackgram (T.9)/ sesame in pigeonpea (Bahar NA-1) as base crop (30+90 cm)
- Blackgram + pigeonpea (1:2)
- Sesame + pigeonpea (3:4)
- Barley + rapeseed mustard (8:1)
- Lentil + rapeseed mustard (4:1)
- Okra + pigeonpea
- Tomato + linseed

1.3 *Kharif-Rabi* Oxisols in Eastern Ghat Zone of Orissa

Recommendation domain: Comprises Kandhamal, Boudh, Rayagada, Gajapati and Asoka districts of Orissa



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Pigeonpea (Asha,laxmi)	Spraying of Endosulfan @ 2ml/litre against pod borer	
	Mustard (Parbati, Anuradha M-27)	Harvesting of rainfed <i>toria</i> varieties	
	Niger (Deomali IGP-76)	Removal of parasitic weed cuscuta plants from niger crop for getting cuscuta free seeds	
	Tuber crops (Yam, Elephant Foot yam and Colocasia)	Harvesting of yam, elephant foot yam and colocasia	
	Horsegram	Harvesting of horsegram	
	Turmeric & Ginger	Digging of turmeric and ginger	
	Chilli for spices	Harvesting of ripe chilli	
February	Pigeonpea (Asha,Laxmi)	Harvesting of long duration pigeonpea	
	Arrowroot,Tapioca & Yam	Harvesting of Arrowroot, Tapioca and Yam	
	Turmeric, Ginger & Chilli	Digging of turmeric and ginger and harvesting of ripe chilli	
March	Turmeric & Ginger	Treatment of turmeric and ginger rhizomes with 0.25% Indofil M-45 on or 0.5% Malathion for 30 minutes and drying under shade and storing in specially designed trenches (2 m x 1m x 30 cm pits). 5 cm of straw layer is laid at the bottom. Above straw layer, turmeric and ginger rhizomes are kept and above rhizome layers a layer of straw is put. Above straw, a layer of soil and cow-dung mixture is put so as to drawn excess water during rainfall. Land preparation of turmeric and ginger using off season rain.	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
April	Turmeric	Collection of sal leaf mulch. Collection of mother rhizome and primary rhizome or cut pieces of mother rhizome (20g) and planting at a depth of 7.5 – 10cm. Rhizome should be treated with 1g Bavistin +2ml Malathion per litre of water for 30 minutes. Then the treated rhizomes are dried under shade before planting. Application of 100% P ₂ O ₅ and 50% K ₂ O as basal dose. Application of leaf or straw mulch @ 15t/ha.	
May	-	Summer ploughing for <i>kharif</i> crops using off-season rain	
	Turmeric	Completion of planting	
	Ginger	Collection of 15-20g rhizome pieces. Treatment is done with 2g Indofil M-45 +2 ml Malathion per litre of water for 30 minutes. Bed method of planting is followed with bed width of 1m and height of 15-30 cm and channel of 40 cm in between beds. Application of 25t of FYM/ha and basal dose of 60 kg P ₂ O ₅ and 50 kg K ₂ O/ha. Straw or leaf mulch is covered up.	
	Runnerbean	Planting of runnerbean with spacing of 100 cmx50 cm basal fertilizer dose of 12.5:50:25kg N-P ₂ O ₅ -K ₂ O/ha and seed rate of 15 kg/ha	
June	Upland rice	Land preparation, application of FYM and fertilizer and sowing	
	Medium land rice	Nursery raising	
	Maize	Land preparation, application of FYM and fertilizer and sowing	
	Fingermillet	Land preparation, application of FYM and fertilizer and sowing	
	Sorghum	Land preparation, application of FYM and fertilizer and sowing	
	Pigeonpea	Land preparation, application of FYM and fertilizer and sowing	
	Cowpea	Land preparation, application of FYM and fertilizer and sowing	
	Intercropping systems like Rice +pigeonpea(5:2) Maize+pigeonpea(2:2) Maize+cowpea(2:2) Pigeonpea+radish(2:2) Pigeonpea+okra(2:2) Groundnut+pigeonpea (6:2) Yam + maize (1:2)	Land preparation, application of FYM and fertilizer and sowing	
	Groundnut	Land preparation, application of FYM and fertilizer and sowing	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	Tuber crops like Yam, elephant foot yam, arrowroot, colocassia	Land preparation, application of FYM and fertilizer and sowing	
	Turmeric & Ginger	First weeding, top dressing and mulching	
	Chilli	Nursery raising	
	Off-season vegetables: Tomato, cabbage and cauliflower	Nursery raising	
	Radish and Okra	Land preparation, FYM and fertilizer application and sowing	
	Upland rice	First hoeing, weeding and topdressing	
	Medium land rice (transplanted)	Land preparation, puddling and transplanting	
	Medium land rice (direct sown)	<i>Beushaning</i> , laddering and <i>khelua</i>	
	Maize	First hoeing, weeding top dressing and earthing up	
	Fingermillet (Direct sown)	First hoeing, weeding and topdressing	
	Fingermillet (transplanted)	Final land preparation, fertilizer application and transplanting	
	Sorghum	First hoeing, weeding, top dressing and earthing up	
	Pigeonpea & cowpea	First hoeing, weeding and light earthing up	
	Greengram & Blackgram	Final land preparation, application of FYM and fertilizer and sowing in last part of July	
	Groundnut	First hoeing, weeding and light earthing up	
	Sunflower & sesame	Final land preparation, FYM and fertilizer application and sowing	
	Tuber crops like Yam, elephant foot yam, arrowroot and colocassia	First hoeing, weeding topdressing and earthing up	
	Tuber crops like Yambean, sweet potato and cassava	Final land preparation, application of FYM and fertilizer and sowing/planting	
	Turmeric & Ginger	First weeding, topdressing and mulching (If the operation was not done in June)	
	Chilli	Final land preparation, FYM & fertilizer application and transplanting	
	Offseason vegetables like Tomato, cabbage and cauliflower	Final land preparation, FYM & fertilizer application and transplanting	
	Radish, okra and runnerbean	First hoeing, weeding, topdressing and earthing up. Staking in runnerbean	
	Intercropping systems like Rice +pigeonpea(5:2) Maize+pigeonpea(2:2) Maize+cowpea(2:2) Pigeonpea+radish(2:2)	First hoeing, weeding, topdressing in non-legume component crops and earthing up	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
August	Pigeonpea+okra(2:2)		
	Groundnut+pigeonpea(6:2)		
	Yam + maize (1:2)		
	Fruit trees	Planting of fruit trees like mango, custard apple, guava, citrus sapota, litchi, jackfruit etc and earthing up in pits prepared earlier.	
	Upland rice	Second weeding and top dressing	
	Medium land rice (direct sown)	First weeding and topdressing	
	Medium land rice (transplanted)	First weeding and top dressing	
	Maize	Second hoeing, weeding, topdressing and earthing up	
	Fingermillet (Direct sown)	Second weeding and top dressing	
	Fingermillet (Transplanted)	First weeding and topdressing	
	Sorghum	Second hoeing, weeding, top dressing and earthing up	
	Pigeonpea, cowpea	Second weeding and plant protection measures against aphids and leaf eating insects. Harvesting of fresh pods of cowpea	
	Greengram and blackgram	First hoeing, weeding and plant protection measures against aphids and leaf eating insects	
	Groundnut	Second weeding and spraying against leaf eating insects	
	Sunflower	First hoeing, weeding top dressing and earthing up	
	Sesame	First hoeing, weeding topdressing and light earthing up	
	Niger	Final land preparation, FYM and fertilizer application and sowing	
	Tuber crops like Yam, elephant foot yam, arrowroot and colocassia	Second hoeing, weeding, top dressing and earthing up	
	Tuber crops like yambean, sweet potato and cassava	First hoeing weeding, top dressing and earthing up	
	Turmeric & Ginger	Second weeding, top dressing and mulching	
	Chilli	First hoeing, weeding top dressing and earthing up	
	Off season vegetables like Tomato, cabbage and cauliflower	First hoeing, weeding, top dressing, earthing up and plant protection measures	
	Radish and runnerbean	Harvesting	
	Okra	Harvesting started	
	Intercropping systems like	Second weeding and plant protection measures	
	Rice +pigeonpea(5:2)	Second weeding, topdressing in maize &	
	Maize+pigeonpea(2:2)	earthing up	
	Maize+cowpea(2:2)	-do-	
	Pigeonpea+radish(2:2)	Harvesting of radish	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
September	Pigeonpea+okra(2:2)	Weeding and harvesting of okra	
	Groundnut+pigeonpea(6:2)	Second weeding & plant protection measures	
	Yam + maize (1:2)	Second weeding, topdressing and earthing up	
	Upland rice	Rogueing and harvesting	
	Medium land rice (direct sown)	Weeding and Plant protection measures	
	Medium land rice (transplanted)	Weeding and top dressing at panicle initiation stage and plant protection measures	
	Maize	Harvesting of green cobs (70-75 DAS) and ripe cobs (90-100 DAS)	
	Finger millet	Weeding and plant protection measures	
	Sorghum	Weeding and plant protection measures	
	Pigeonpea	Weeding and spraying against pod borer in short duration varieties and spraying against leaf eating insects in long duration varieties	
	Greengram & Blackgram	Weeding and spraying	
	Horsegram	Final land preparation and sowing	
	Groundnut	Removal of tall weeds	
	Sunflower	Second hoeing, weeding, top dressing, earthing up and plant protection measures	
	Sesame	Weeding and plant protection measures	
	Niger	First hoeing, weeding	
	Mustard (Toria group)	Final land preparation and sowing of rainfed mustard in 2 nd September	
	Tuber crops like yam, elephant foot yam, arrowroot, colocassia, yambean, sweet potato	Removal of tall weeds	
	Turmeric & Ginger	Removal of tall weeds and need based plant protection measures	
	Chilli	Weeding and need based plant protection measures	
	Off season vegetables like Tomato, cabbage, cauliflower and okra	Harvesting	
	Intercropping systems		
	Rice +pigeonpea(5:2)	Harvesting of rice, weeding in pigeonpea	
	Maize+pigeonpea(2:2)	Harvesting of maize cobs & weeding in pigeonpea	
	Maize+cowpea(2:2)	Harvesting of maize and cowpea	
	Pigeonpea+radish(2:2)	Weeding in pigeonpea and need based plant protection measures	
	Pigeonpea+okra(2:2)	Harvesting of okra & weeding in pigeonpea	
	Groundnut+pigeonpea(6:2)	Removal of tall weeds and need based plant protection measures	
	Yam + maize (1:2)	Harvesting of maize, weeding in yam	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	Medium land rice	Harvesting of early-medium rice varieties, plant protection measures in medium duration rice varieties against stem borer, gallmidge, gundhi bug, BLB and blast	
	Medium land rice (direct sown)	Plant protection measures in medium duration rice varieties against stem borer, gallmidge, gundhi bug, BLB and blast	
	Finger millet	Harvesting	
	Sorghum	Harvesting	
	Pigeonpea	Spraying against pod borer and leaf eating insects in medium and long duration pigeonpea varieties	
	Greengram and blackgram	Harvesting	
	Horsegram	Weeding	
	Groundnut	Harvesting	
	Sesame	Harvesting	
	Sunflower	Harvesting	
	Mustard (Toria group)	Hoeing, weeding and need based plant protection	
	Tuber crops like yam, elephant foot yam, arrowroot, colocassia and cassava	Removal of tall weeds	
	Yambean and sweet potato	Harvesting	
	Turmeric and Ginger	Removal of tall weeds & need based plant protection	
	Chilli	Need based plant protection measures	
	Intercropping systems		
	Rice +pigeonpea(5:2)	Spraying against leaf eating insects and pod borer in pigeonpea	
	Maize+pigeonpea(2:2)		
	Maize+cowpea(2:2)		
	Pigeonpea+radish(2:2)	Harvesting of groundnut and spraying against Pod borer and leaf eating insects in pigeonpea	
	Pigeonpea+okra(2:2)		
	Groundnut+pigeonpea(6:2)	Removal of tall weeds in yam	
	Yam + maize (1:2)		
November	Medium land rice	Harvesting	
	Pigeonpea	Spraying against pod borer	
	Horsegram	Removal of tall weeds	
	Mustard (toria group)	Need based plant protection	
	Niger	Removal of cuscute	
	Tuber crops: Yam, elephant foot yam, arrowroot, cassava and colocassia	-	
	Turmeric, Ginger & Chilli	-	
	Intercropping systems: Pigeonpea based intercropping systems	Need based plant protection measures	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
		(Gajendra), Arrowroot (Orissa Local) Turmeric (Sudarsan, Roma) Ginger (Vardhan, Nadia, Suprabha) Intercropping systems like- Pigeonpea + rice Pigeonpea+ maize Yam + maize Maize + cowpea Low land rice Intercropping system extra- Groundnut + pigeonpea (6:2) Rice + okra (4:2) Rice + radish (4:2) Medium land and low land rice Off season vegetables - (Tomato, cabbage, cauliflower)	Land preparation and direct sowing Nursery sowing Nursery sowing	
July	I Fortnight	Upland rice (Vandana, ZHU 11-26), Maize (Novjot), Pigeonpea (UPAS-120, Asha, Laxmi) Finger millet (Dibyasingha, Nilachal, Bhairabi, Subhra) Runnerbean (Udayagiri Local) Tuber crops like Yam (Orissa elite), Elephant foot yam (Gajendra), Arrowroot (Orissa Local) Turmeric (Sudarsan, Roma) Ginger (Vardhan, Nadia, Suprabha) Intercropping system extra- Groundnut + pigeonpea (6:2) Rice + okra (4:2) Rice + radish (4:2) Medium land and low land rice Off season vegetables - (Tomato, cabbage, cauliflower) Tubercrops- Yambean (cv. Rajendra Mishri Kanda-1), Sweet Potato (cv. Shankar & Gouri), Cassava (cv. Sree Jaya)	Even distribution of plants (<i>Khelua</i>) should be taken up immediately by using local tools. If plant population is more than 50% and weeding is not possible, weeds are uprooted by normal means	Resowing of rice is needed in medium and low land (direct sown rice), if plant population is less than 50%. Line sowing of pre-germinated seeds of rice (125 days duration) should be done. Nursery for comparatively shorter duration rice varieties may be done.
	II Fortnight	Greengram (cv. PDM-54, K-851) Blackgram (cv. Pant U-30, Sarala) Early pigeonpea (cv. UPAS-120) Tuber crops-Sweet potato, Yam bean Short duration vegetables like-	Land preparation FYM and fertilizer application and sowing	When upland rice is completely damaged the crop may be cut down for supplying straw to the cattle. Non-paddy crops

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
August		Radish (Pusa chetka) Okra (Parvati kranti) Cluster bean Cowpea (SEB -2 & SGL-1) (Direct sowing of short duration rice varieties like Vandana, Kalinga-III, Rudra, Sankar, ZHU 11-26 in medium and low lands.		such as finger millet, greengram, blackgram, cowpea, Sesame should be taken up.
	I Fortnight	Upland : Niger (Deomali, IGP-76) Sesame (Prachi, Uma, Usha) Greengram (PDM-54, K-851) Blackgram (Pant U-30, Sarala) Cowpea (SGL-1, SEB-2) Radish (Pusa Chetki) Medium & Low land : Direct sowing of extra early rice varieties in case the normal crop fails	Land preparation, FYM and fertilizer application and sowing	
	II Fortnight	Niger Sesame Cowpea Horsegram (Urmi, Local)	Land preparation, FYM & fertilizer application and sowing	In case of dryspell/drought situation-Hoeing and weeding is avoided in groundnut, weeds should be cut or uprooted not to interfere in pegging and pod formation. Uprooted weeds should be used as mulch between crop rows. In other crops hoeing and weeding is done for creation of a soil mulch and minimization of moisture loss from soil. Foliar spray of 2% urea in upland rice and ragi. -Thinning of excess plants in late sown crops -Use of green leaf mulch to reduce evaporation loss from soil. Spraying of planofix 10 PPM at 45 DAS and 20 PPM at flowering to prevent fruit drop in cotton.
September	I Fortnight	Horsegram (Urmi, Local) Torii (Parbati, Anuradha, M-27)	Land preparation and sowing Land preparation	Harvested rain water should be recycled for life saving irrigation.
	II Fortnight	Torii (Parbati, Anuradha, M-27)	Sowing	

Recommended *rabi* Contingency plans for absence or delayed rains or failed kharif

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Mustard Pigeonpea Chilli	Maize stover mulch in inter row space of mustard and pigeonpea crop. Rice straw mulch in inter row space of chilli crop	

Crops and varieties

Crop	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest & stress condition	Remarks
Upland rice	ZHU 11-26	3.0	57	82	Tolerant to leaf blast disease and moisture stress	Suitable for intercropping and sequence cropping systems in rainfed uplands
	Vandana	2.9	68	93	Tolerant to leaf blast, bacterial leaf blight and moisture stress	Suitable for sequence cropping system
	Pathara	2.9	82	109	Moderately tolerant to leaf blast and bacterial leaf blight	Care must be taken to sow the crop early at the onset of monsoon to escape the terminal drought situation
Blackgram	OBG-23	1.3	36	69	Moderately resistant to <i>Cercospora</i> leaf spot, powdery mildew and yellow mosaic virus	Suitable for sowing in last week of July in rainfed upland condition to synchronize harvesting with dry period
	OBG-15	1.2	37	67	-do-	-do-
	Pant U-30	1.1		72	-do-	-do-
	T-9	1.0		69	-do-	-do-
	Sarala	1.0	36	70	-do-	-do-
	LBG-645	1.1	47	87	Moderately resistant to <i>Cercospora</i> leaf spot and powdery mildew disease	-do-
Greengram	PDM-54	0.7	36	70	Tolerant to Yellow mosaic virus, moderately tolerant to powdery mildew and susceptible to <i>Cercospora</i> leaf spot disease during <i>Kharif</i> season	Suitable for sowing in last week of July in rainfed upland condition to overcome harvesting problem
	K-851	0.8	35	60-65		
Pigeonpea	R-60	1.0	140-145	180	Susceptible to pod borer	Suitable for mono and intercropping systems in rainfed uplands
	T-21	0.8	120-125	160	Susceptible to pod borer	Suitable for mono cropping in rainfed uplands
Finger millet	PR-717	2.5	70-75	100	Susceptible to neck blast	Suitable for mono cropping
	Sodangi-6	2.4				
	A 2-3-4	2.0	60-65	90	-do-	-do-

Crop	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest & stress condition	Remarks
Maize	Dibyasingha	1.8	55	85	–	Suitable for mono and intercropping
	Nilachal	2.5		110	–	Suitable for mono
	Bhairabi	3.0		105	–	cropping
	Navjot	3.9	45	95	Moderately	The varieties are suitable for accommodating cowpea (cv.SEB-2 and SGL-1) as intercrop and are also suitable for sequence cropping like maize-mustard
	DHM-103	4.2	47	100	resistant to leaf blight disease	
Cowpea	SEB-2	0.8	49	90	Susceptible to leaf eating caterpillar and pod borer	
	SGL-1	0.6	42	70	Susceptible to leaf eating caterpillar and pod borer	
Groundnut	Smruti (OG 52-1)	1.7	28	103	Moderately tolerant to leaf eating caterpillar and tikka disease	The variety is suitable for intercropping with maize and sequence cropping in cowpea -mustard system during <i>Kharif</i> . For seed purpose sowing should be done during last week of July to 1st week of August
	JL-24 (HN)	1.7	29	101	Moderately tolerant to tikka disease	
	TAG-26	1.5	26	104	Moderately tolerant to leaf eating caterpillar and	
	ICGS-11	1.5	29	103	tikka disease	
Castor	DCH-177	0.8	57	106	Tolerant to wilt disease	Suitable for monocropping in rainfed uplands
	DCH-30	0.5	61	104		
	Aruna	0.5	57	106		
Mustard	M-27	0.8	30	75	Moderately tolerant to pod borer	Suitable for sequence cropping in maize-mustard and upland rice (short duration)-mustard system
Horsegram	Urmi	0.8	53	94	Tolerant to moisture stress, moderately resistant to leaf spot, leaf eating caterpillar and pod borer	Suitable for rainfed uplands after harvest of early rice
Sesame	Usha	0.6	–	83	–	–
	Uma	0.6	–	83	–	–
Niger	Phulbani local	0.5	55-60	85	No serious disease or pest problem	Suitable for sequence cropping after cowpea
	Deomali(GA-10)	0.6	63	110		
	IGP-76	0.5	60	106		
Turmeric	Sudarsan	5.7	—	190	Resistant to leaf	Suitable for

Crop	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest and stress condition	Remarks
Ginger	Suguna	5.7			spot and leaf blotch disease	mono cropping in rainfed uplands and have high curcumin content 7-8%
	Subarna	5.6		200		
	Vardhan	4.3	—	200	Moderately resistant to soft rot and leaf-spot disease	Suitable for monocropping in rainfed uplands
	China	3.9	—		Resistant to soft rot and leaf spot disease	-do-
	Nadia	3.4	—		Moderately resistant to soft rot and leaf spot disease	-do-

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Upland rice	100	15-20	—
Medium land rice (Transplanted)	50-75	15-20	10-15
Maize	15	60	30
Fingermillet (Direct sown)	10	20	—
Fingermillet (Transplanted)	6	15-20	10
Pigeonpea (Early variety)	20	45	20

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Pigeonpea (Late variety)	15	60	30
Blackgram	25	30	10
Greengram	25	30	10
Horsegram	50	30	5-10
Cowpea	20	45	15
Niger	10	30	10
Sesame	7	30	10
Groundnut	105 (kernels) i.e. 150 (pods)	30	10-15
Mustard	8	30	8-10
Sunflower	10	45	30
Linseed	25	30	5
Turmeric	1700 (fresh rhizome)	30	20
Ginger	1000 (fresh rhizome)	25	20
Yam	925 (tuber pieces of 50-100g)	90	90
Cotton	2-3 (hybrids)	120	60

Nutrient management

Crop	Nutrients (kg/ha)			Mode of application			Remarks
	N	P ₂ O ₅	K ₂ O	Basal	First top dressing	Second top dressing	
Upland rice	30	20	20	All P ₂ O ₅ and 50% N at 21 K ₂ O, 25% N days after germination		25% N at panicle initiation stage	–
Local							
Improved	40	20	20		-do—do-		
High yielding	60	30	30	-do—do-			
Medium land rice	50	25	25	All P ₂ O ₅ and 50% N three K ₂ O, 25% N at weeks after at transplanting transplanting		25% N at panicle initiation stage	–
Local							
Improved	60	30	30		-do—do-		
High yielding	80	40	40	-do—do-			
Maize	80	40	40	All P ₂ O ₅ and 50% N at 21 K ₂ O, 25% N days after germination		25% N at 6-7 weeks after germination	–
Fingermillet	20	12	12			–	–
Pigeonpea (Early variety)	20	40	20	All N, P ₂ O ₅ and K ₂ O	–	–	–
Pigeonpea (Late variety)	20	60	20	All N, P ₂ O ₅ and K ₂ O	–	–	–
Blackgram	20	40	20	All N, P ₂ O ₅ and K ₂ O	–	–	–
Greengram	20	40	20	All N, P ₂ O ₅ and K ₂ O	–	–	–
Horsegram	10	25	0	All N and P ₂ O ₅	–	–	–
Cowpea	25	50	25	All N, P ₂ O ₅ and K ₂ O	–	–	–
Niger	40	20	20	All P ₂ O ₅ and K ₂ O, 50% N	50% N at 21 days after germination	–	–
Sesame	40	20	20	All P ₂ O ₅ and K ₂ O, 50% N	50% N at 21 days after germination	–	–
Groundnut	20	40	40	All N, P ₂ O ₅ and K ₂ O	–	–	Lime should be applied based on the pH value for correction of soil acidity
Mustard	30	15	15	All N, P ₂ O ₅ and K ₂ O	–	–	–
Linseed	30	20	15	All N, P ₂ O ₅	–	–	–

Crop	Nutrients (kg/ha)			Mode of application			Remarks
	N	P ₂ O ₅	K ₂ O	Basal	First top dressing	Second top dressing	
Sunflower	60	30	30	and K ₂ O All P ₂ O ₅ , K ₂ O and 50% N	50% N at 3-4 week stage	–	–
Turmeric	60	30	90	100% P ₂ O ₅ and 50% K ₂ O	50% N at 45 days after planting	50% N and 50% K ₂ O at 90 days after planting	15.5 and 5t/ha <i>Sal</i> twigs are applied as mulch after planting, at first topdressing and second top dressing respectively
Ginger	125	100	100	100% P ₂ O ₅ and 50% K ₂ O	50% N at 45 days after planting	50% N and 50% K ₂ O at 90 days after planting	15.5 and 5t/ha <i>Sal</i> twigs are applied as mulch after planting, at first topdressing and second top dressing respectively
Yam	80	60	80	All P ₂ O ₅	50% N and 50% K ₂ O at 30 days after planting	50% N and 50% K ₂ O at 60 days after planting	Nitrogen and Potash can be given in three equal splits at 30, 60 and 75 days after planting in sandy soils
Cotton (Hybrids)	120	60	60	All P ₂ O ₅ , 50% K ₂ O and 25% N	50% N at 21 days after germination	25% N, 50% K ₂ O at 45 days after germination	–

Suitable cropping systems

Non – arable wastelands

- Tree farming (*Sal*, *Teak*)
- Silvi-pastoral (*Shisham* / *Leucaena* / *gambar* + *Stylo/Cenchrus*/mixture)

Arable wastelands

- Agri-horticulture: Fruit crops (mango/ citrus/ sapota/ pomegranate/ custard apple/ aonla/ litchi/ jackfruit/ phalsa) + field crops (pulses/ oilseeds). Hybrid mango varieties viz. Pusa Amrapalli and Pusa Mallika are becoming increasingly popular in the zone.
- Alley cropping: *Leucaena* + turmeric/ ginger

Low fertility, unbunded uplands

- Sunhemp (green manure) – Niger (IGP 76, Phulbani local)

- Cowpea (SGL-1, SEB-2) – Niger (IGP-76, Phulbani local)

Uplands

Monocropping

- Turmeric (Sudarsan, Suguna, Subarna). Planting is done in 1.0 m width, 15-30 cm high beds. Channels of 30 cm width are left between the beds.
- Ginger (Suprabha, Nadia, Vardhan and China) planting is done in beds as in turmeric.

Sequence cropping

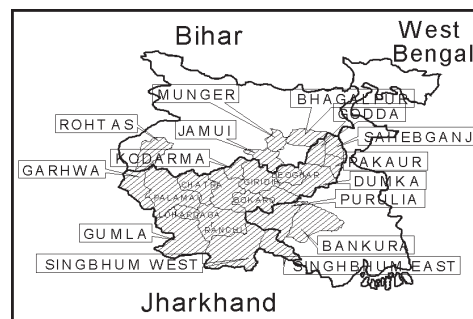
- Rice (ZHU 11-26/ Vandana/ Heera) – horsegram (Urmi/local) / toria (M-27, PT-303)
- Maize (Navjot) – toria (PT 303/M-27)
- Maize (Navjot) + cowpea (SGL-1, Arka Kamal)- toria (PT 303, M-27).

Relay cropping

- Rice (ZHU 11-26, Heera) + horsegram (Urmi, local).
- Rice (ZHU 11-26, Heera) + pigeonpea (UPAS 120)

1.4. *Kharif* Sub-Humid Alfisols in Central and North Eastern Plateau Zone of Jharkhand

Recommendation domain: Comprises the districts of Gumla, Hazaribagh and Entire plateau of Jharkhand state, parts of Rohtas, Gay, Jamui in Monghyr district, Banka sub-division of Bhagalpur district in Bhir and Purulia and Bankura districts of West Bengal.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Late sown wheat (C-306) Barley-(Ratna K-125, Jyoti, Ratu) Pigeonpea (BR-65)	Weeding, hoeing, top dressing & life saving irrigation harvesting	
February	Linseed- T 397 Lentil- PL406, BR-25 Chickpea- Pant G-114 BR-75 H-208 Pigeonpea-Birsa Arhar-1	Harvesting	
March	Late sown wheat (C-306) Safflower- A 300 Pigeonpea Luxmi Linseed, Lentil and Chickpea	Harvesting Harvesting Harvesting Harvesting Threshing	
April	Land fallow	Ploughing Blading Soil sample for total N Total organic Available K ₂ O Available P ₂ O	
May	Birsa Dhan-108 & Birsa vikas Dhan-109 & Vandana	Dry seeding	
June	Pigeonpea BR-65 Bahar Laxmi	Sowing	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	Birsa Arhar-1		
	Rice- Vandana		
	Birsa Vikash dhan-109		
	BirsaVikash dhan-110		
	Black gram-T9		
	Soybean- Brag		
	Birsa Soybean-1		
	Sesame- Kanke white		
	Ground nut- AK 12-24		
	B.G.-1	Sowing	
	B.G.-2		
	B.G.-3		
	Maize- Suwan composite		
	Birsa makka-1	Sowing	
	Soybean- CSH -5		
	CSH- 6	Sowing	
	Fingermillet- A-404		
	Birsa Marua-1		
	Birsa Marua-2	Sowing	
July	All crops	Weeding, hoeing, top dressing	
	Sowing of late sown rice.		
	Birsa vikas Dhan-109 Vandana	Sowing	
August	Horse gram-Mehu	Sowing	
	Birsa Kulthi-1	Weeding of rice	
September	Rice	Harvesting	
	Toria- BR-23	Sowing	
	Niger- Birsa Niger-1	Sowing	
	N-5		
	Horsegram- Madhu		
	Birsa Kulthi-1	Sowing	
	Chickpea- Pant G-114		
	H-208	Sowing	
	Mustard- Siwani, Varuna	Sowing	
October	Linseed – T-397	Sowing	
	Saflower- A-300	Sowing	
	Lentil- PL 406	Sowing	
	PL 639	Weeding of Niger, Horsegram, Chickpea, Harvesting of Groundnut, Soybean, Fingermillet, Sesame, Black gram	
November	Horsegram	Harvesting Kulthi	
December	Toria	Harvesting	
	Wheat	Sowing	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	-	-	-
	II Fortnight	-	Ploughing	Normal monsoon used to come on or after 15 th June of every year.
July	I Fortnight	Intercropping of Pigeonpea + rice, pigeonpea + Groundnut pigeonpea + marua. Sowing of drought tolerant varieties of rain fed upland rice (Vandana, Birsa Vikas Dhan-108, Birsa Vikas Dhan-110), drought tolerant varieties of maize (Birsa Vikas Makka 1 and Birsa Vikas Makka 2) and millet (marua-A 404, Birsa Marua II) Raising of rice seedling variety (IR -64, Birsa Dhan-202 and Birsamati)	Field Preparation	Due to delayed monsoon crop or variety can be grown in intercropping of pigeonpea-rice, pigeonpea-groundnut, Pigeonpea-marua
	II Fortnight	(I) Sowing of early maturing variety of rice and other crops. (II) Raising of rice seedling of short duration varieties (IR-64, BD-202 and Birsamati)	Ploughing and field preparation for sowing	Sowing is done as and when field is ready.
August	I Fortnight	—	Field preparation and puddling for transplanting of rice, weeding and hoeing.	Transplanting of rice is done.
	II Fortnight	Rice, Horsegram (Birsa Kulthi-1) Niger (Birsa Niger-1, N5)	Field preparation for sowing the kulthi and niger field preparation and puddling for transplanting	Sowing of Horsegram niger and transplanting of rice.
September	I Fortnight	Horsegram (Birsa Kulthi-1 and Madhu) and Niger (Birsa Niger-I, N5)	Field preparation weeding and hoeing	Sowing of niger and horsegram
	II Fortnight	Late sown varieties of niger (Birsa niger-I, N 5), Horsegram (Birsa Kulthi-I, Madhu) and toria (T9 and PT 303)	Field preparation for sowing	Sowing of niger, horse gram and toria
October	I Fortnight	-	-	-
	II Fortnight	-	-	-

Recommended *rabi* Contingency plans for absence or delayed rains or failed kharif

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Mustard (Pusa Bold, Varuna) Linseed (T397, Sweta) Chickpea (H-208 and Pant G-114) Lentil (PL-406, PL-639)	Field Preparation and sowing. Harvesting of upland rice, maize and marua	Sowing of early maturing variety of mustard, Linseed, and Lentil and Lentil
	II Fortnight	Pea (Arkel and Azad Pea I)	Field Preparation and sowing. Harvesting of upland rice maize and marua	Sowing of early maturing variety of mustard, Linseed, Chickpea Gram and Lentil
November	I Fortnight	Lentil (PL-406, PL-639) Linseed (T-937) Wheat (C-306, K-8027)	Field Preparation and sowing. Harvesting of transplanted rice.	Sowing of Lentil, Linseed, Wheat and harvesting of transplanted rice
	II Fortnight	Linseed (PL 406, PL 639) Lentil (T-397) Wheat (C 306, K 802)	Field Preparation and sowing. Harvesting of transplanted rice.	Sowing of Lentil, Linseed, Wheat and harvesting of transplanted rice
December	I Fortnight	Niger Horsegram	Harvesting of Niger and Horsegram	Harvesting of Niger and Horsegram
	II Fortnight	Toria	Harvesting of Toria	Harvesting of Toria
January	I Fortnight	-	-	-
	II Fortnight	-	-	-

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed	Reaction to & stress condition disease and pest	Remarks
Rice	Brown gora	1.5-2.0	60-65	90-95	Moderately resistant to blast	Suitable for monocropping, intercropping and sequence cropping
	Bandana	2.0-2.5	55-60	80-90	-do-	Suitable for mono and sequence cropping
	Kalinga-III	2.0-2.5	60-65	85-90	—	Fine grain quality
	B.D.101	2.0-2.5	55-60	85-90	Moderately resistant to blast	Suitable for mono as well as sequence cropping
Fingermillet	A-404	Dir.2.5-3.0 Tran.3.0-3.5	75-80	115-120	Moderately resistant to blast	Suitable for monocropping, drought tolerant
	Birsa Marua-1	1.6-2.0	50-55	90-95	Susceptible to blast and blight	Suitable for mono and intercropping
	PR-202	Dir.2.0-2.5 Tran.2.5-3.0	65-70	110-115	Moderately resistant to blast	Suitable for monocropping
	Birsa Marua-2	Dir.1.8-2.2 Tran.2.4-2.8	65-70	100-105	Moderately resistant to blast and blight	Suitable for moisture stress condition
Sorghum	CSH-5	3.5-4.0	53-55	95-100	Moderately to resistant to insect pest	Drought resistant
	CSH-6	4.0-4.5	53-55	95-100		
Gundli	Birsa	1.0-1.2	35-37	55-60	Nothing in	Suitable for waste land

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed	Reaction to & stress condition disease and pest	Remarks
	Ghundi-1				particular	and early and first crop to be grown
Maize	Swan comp.-1	5.0-5.5	Days to flower 55-58	105-110	Tolerant to foliar disease	Tall plant, medium maturity
	Birsa Makka -1	3.5-4.0	Days of flower 47-52	80-85	Highly resistant to turicum leaf blight	Early maturing
Mesta	AS-7	1.0-1.2	—	125-130	—	Can withstand weed competition
	CPEL	0.8-1.0	—	115-120	—	Suitable for poor
	DPLL	0.8-1.0	—	115-120	—	type of upland condition, can withstand weed competition
Jute (seed)	JRO-632	0.3-0.4	—	135-140	—	—
	JRC-212	0.4-0.5	—	140-145	—	—
Groundnut	AK 12-24	1.5-1.7	25-30	100-105	Highly resistant to tikka disease	Early maturing, small pods
	BG-3	2.2-2.4	30-35	110-115	Moderately resistant to tikka	—
	GG-2	2.0-2.2	25-30	100-105	-do-	Small seed
	JL-24	1.8-2.0	25-30	100-105	Moderately tolerant to tikka	Medium sized seed
	Birsa bold	2.5-3.0	30-35	125-130	Resistant to tikka disease	Highly bold seed (export quality)
Niger	Birsa niger 1	0.6-0.7	62-67	100-105	Resistant to disease and pest	Drought resistant
	N5	0.5-0.6	60-65	95-100	-do-	Highly drought resistant
Sesame	Kanke white	0.4-0.5	40-45	100-105	Moderate resistant to disease and pest	Susceptible to water logging
	Krishna	0.3-0.4	35-40	90-100	—	-do-
Greengram	Sunayna	0.7-0.8	35-40	55-60	Tolerant to <i>Cercospora</i> leaf spot	Capable to being grown as a summer crop
	K 851	0.6-0.7	35-40	60-65	—	—
Blackgram	T9	1.0-1.2	38	75-80	Susceptible to leaf post	Suitable for mixed cropping with marua (1:1)
	Birsa urad-1	1.0-1.2	—	80	Resistant to yellow mosaic virus and powdery mildew	-do-
	Pant U-19	2.0-1.2	36	75-80	Resistant to yellow mosaic virus	Erect type
Horsegram	Madhu	1.0-1.2	50-55	100-110	—	Highly drought resistant
	Birsa kulthi-1	1.0-1.2	45-50	90-95	Resistant to macro-phomina disease	—
Soybean	Punjab-1	2.0-2.2	35-38	105-107	Moderately resistant to yellow mosaic virus	Vigorous plant growth
	Birsa soya-1	2.2-2.5	38-40	110-115	Moderately resistant to Cater pillar and yellow mosaic virus	Black seeded
Linseed	T-397	0.7-0.8	65-67	125-130	Susceptible to rust	Drought and rainfed

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed	Reaction to & stress condition disease and pest	Remarks
	Sweta	0.7-0.8	60-65	125-130	–	condition Suitable for irrigated condition
	Shubhra	0.7-0.8	60-65	125-130	–	
Toria	BR-23	0.3-0.4	35-40	70-75	Immune to white rust	Escapes aphid attack
	Assam selection	0.3-0.4	35-40	70-75	-do-	-do-
	PT-303	0.4-0.5	30-35	65-70	Moderately resistant to aphids	–
Safflower	A-1	1.0-1.2	120-125	160-165	–	Drought resistant
	A-300	1.0-1.2	110-115	155-160	–	Highly drought resistant
Chickpea	BR-77	0.8-0.9	65-70	135-140	–	Suitable for normal sowing
	H-208	1.0-1.2	70-75	140-150	–	Suitable for late sowing
	Pant G.114	1.2-1.6	–	140-145	–	Normal and late sowing
Rai	BR-40	0.4-0.6	55-60	110-120	Susceptible to white rust	Drought resistant
	Baruna	0.4-0.6	–	110-120	–	–
	Pusa bold	0.6-0.7	–	115-120	–	–
Lentil	Pant 209	1.2-1.5	65-72	115-120	–	Drought resistant
	BR-25	1.6-1.8	70-75	120-125	–	
	Pant 406	1.8-2.0	75-80	130-140	–	
Barley	BR-31	1.5-1.7	–	105-110	<i>Helminthosporium</i> in traces	Drought resistant
	BR-32	1.5-1.7	–	110-115		
Wheat	C-306	1.0-1.2	55-60	115-120	Tolerant to rust	

Dir. Direct planting; Tran : Transplanting

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Upland rice Medium land rice	100 40-50	20-25 15	Lines 15
Low land rice	40-50	15	15
Fingermillet direct sown Fingermillet (transplanted) Maize	10 6 16	20 15-20 60	Lines 10 30
Sorghum Minor millets	10 6-8	45 25	20 5
Pigeonpea, Soybean, Greengram	18 60 20	60 45 30	30 5 10

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Blackgram	20	30	10
Horsegram	20	30	10
Groundnut (Shelled)	80-85	30	10
Groundnut bold varieties (shelled)	100-110	30	15

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Sesame	8	30	15
Niger	6	30	15
Rapeseed Mustard	10	30	5
Linseed	20	30	10
Safflower	15	40	10
Chickpea	75	30	20
Lentil	30	25	8
Barley	100	25	Lines
Wheat	60	23	Lines

Nutrient management

Crop	Nutrients (kg/ha)			Mode of application		
	N	P ₂ O ₅	K ₂ O	Basal	1st top dressing	2nd top dressing
Rice						
Local	30	20	20	All P ₂ O ₅ , K ₂ O and 50% N	50% N at 21 days after sowing	–
Improved	40	20	20	All P ₂ O ₅ , K ₂ O and 50% N	50% N at 21 days after sowing	–
High yielding	60	30	20	All P ₂ O ₅ , K ₂ O and 50% N	25% N at 21 days after sowing	25% N at 35 days after sowing
Rice - Medium land						
Local	40	30	20	All P ₂ O ₅ , K ₂ O and 50% N	50% N at 21 days after sowing	–
High yielding	80	40	40	All P ₂ O ₅ , K ₂ O and 50% N	25% N at 25 days after transplanting	25% N at 50 days after transplanting
Maize	100	60	40	All P ₂ O ₅ , K ₂ O and 50% N	25% N at 21 days after sowing	25% N at tasseling
Sorghum	80	40		All P ₂ O ₅ , K ₂ O and 50% N	25% N at 21 days after sowing	25% N at 50 days after sowing
Finger millet (direct sown or transplanted)	40	30	20	All P ₂ O ₅ , K ₂ O and 50% N	50% N at 25 days after sowing	–
Minor millets	20	20	20	All P ₂ O ₅ , K ₂ O and 50% N	50% N at panicle initiation	–
Pigeonpea	20	40	20	All N, P ₂ O ₅ , K ₂ O	–	–
Soybean	20	40	20	All N, P ₂ O ₅ , K ₂ O	–	–

Crop	Nutrients (kg/ha)			Mode of application		
	N	P ₂ O ₅	K ₂ O	Basal	1st top dressing	2nd top dressing
Greengram	20	40	20	All N, P ₂ O ₅ , K ₂ O	–	–
Blackgram	20	40	20	All N, P ₂ O ₅ , K ₂ O	–	–
Horsegram	20	40	20	All N, P ₂ O ₅ , K ₂ O	–	–
Groundnut	20	40	20	All N, P ₂ O ₅ , K ₂ O	–	–
Sesame	40	40	20	All P ₂ O ₅ , K ₂ O and 50% N	50% N at 21 days sowing	–
Niger	20	20	20	All N, P ₂ O ₅ and K ₂ O	–	–
Rapeseed Mustard	20	30	20	All N, P ₂ O ₅ and K ₂ O	–	–
Linseed	20	20	20	All N, P ₂ O ₅ and K ₂ O	–	–
Safflower	20	20	20	All N, P ₂ O ₅ and K ₂ O	–	–
Chickpea	20	20	20	All N, P ₂ O ₅ and K ₂ O	–	–
Lentil	20	20	20	All N, P ₂ O ₅ K ₂ O	–	–
Barley	20	20	20	All P ₂ O ₅ K ₂ O and 50% N	50% N at panicle initiation	–
Wheat	20	20	20	All P ₂ O ₅ K ₂ O and 50%	50% N at panicle initiation	–

Suitable cropping systems

Non arable lands

- Tree farming (Sal, Teak, *Shorea robusta*)
- Silvipastoral system (Shisham/ *Leucaena*/ gamhar + Stylo/ *Cenchrus*/ mixture)
- Arable wastelands
- Agri-horticulture: Fruit crops (Nungo/ citrus/ sapota/ pomegranate/ custard apple/ litchi/ Jack fruit jamun) + Field crops (pulses/ oilseeds)
- Alley cropping: *Leucaena* + turmeric/ginger

Low fertility, unbunded uplands

- Transplantation of finger millet, niger (Birsa niger, N5)
- Cowpea – Niger

Uplands

Mono-cropping

- Upland, finger millet, pulses, oil seeds and *khari* vegetables like cauliflower, capsicum, okra and French bean etc.

Sequence cropping

- Rice (Brown gora 23 –19, Birsa dhan 101, and Vandana), Niger and Toria

Intercropping

Pigeonpea based

- Pigeonpea (T21) + rice (Brown gora 23-19): 3 rows of rice 20 cm apart between 2 rows of pigeonpea spaced 90 cm apart.
- Pigeonpea (BR 65) + rice (Birsa dhan 101): 3 rows of rice 20 cm apart in between 2 rows of pigeonpea spaced 90 cm
- Pigeonpea (BR-165) + rice (Brown gora 23-19, Vandana and Birsa dhan 101): 3 rows of rice 20 cm apart in between 2 rows of pigeonpea spaced 90 cm
- Pigeonpea (BR 65) + okra (Parbhani Kranti): 2 rows of lady finger 25 cm apart in-between 2 rows of pigeonpea spaced 75 cm apart.
- Pigeonpea (BR-65) + blackgram (T9): 2 rows of blackgram 25 cm apart in between 2 rows of pigeonpea spaced 75 cm apart.
- Pigeonpea (BR 65) + greengram (Sunaina): 2 rows of blackgram 25 cm apart in between 2 rows of pigeonpea spaced 75 cm apart.
- Pigeonpea (BR 65) + soybean (Punjab-1): 2 rows of soybean 30 cm apart in between 2 rows of pigeonpea spaced.
- Pigeonpea (BR 65) + groundnut (AK 12-24): 2 rows of groundnut 30 cm apart in between 2 rows of pigeonpea spaced 90 cm apart.
- Pigeonpea (BR 65) + maize (Suwan composite-1): One row of maize in between 2 rows of maize spaced 60/75 cm apart.
- Rice (Vandana) + okra (Parbhani Karanti): 2 rows of paddy 25 cm apart, alternate 2 rows of lady finger 25 cm apart.
- Pigeonpea (BR 65) + finger millet (direct sown): 2 rows of Fingermillet 25 cm apart in between 2 rows of pigeonpea 60 x 25 cm.
- Sorghum (CSH 6) + blackgram (T9): 2 rows of blackgram 25 cm apart in between 2 rows of sorghum 50 cm
- Safflower (59-2-1) + linseed (T397) : One row of linseed in between 2 rows of safflower 45 cm apart
- Safflower (59-2-1) + toria (BR 23): One row of toria in between 2 rows of safflower
- Safflower (59-2-1) + rai (BR 40): One row of toria in between 2 rows of safflower 45 cm
- Safflower (59-2-1) + chickpea (Pant G 14): One row of chickpea in between 2 rows of safflower 45 cm

Medium lands

- Rice (IR 36, IR 64, Pant 4) / linseed (T 397)/ chickpea (BR 17, BR 77 and C 235)/ safflower (A 300, 59-2-1)/ lentil (BR 25) Rai (BR 40) and Niger (N5)
- Relay cropping
- Rice (Ladut, Swarna, IR 36 etc)- Lathers (local)

Lowland

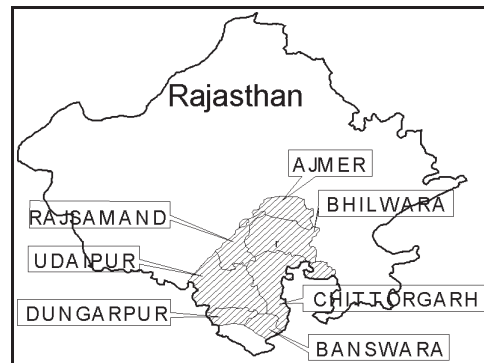
Sequence cropping

- Rice (Tulegi, Pusa-44)- Late sown wheat (HPI 744)/ tomato without irrigation

2. Maize based Production System

2.1. *Kharif* Semi Arid Shallow to Deep Vertisols in Sub-Humid Southern Plain and Aravalli Hill Zone of Rajasthan

Recommendation domain: Comprises Bhilwara, Chittorgarh, Udaipur, Banswara, Dungarpur, Rajsamand and parts of Ajmer districts in Rajasthan.



Recommended Crop(s) And Cultural Calendar for a normal season

Month	Crop/Variety	Cultural /operations	Remarks
January		Fruit harvesting in anola and ber orchards	
February		Live Fencing (Cactus) Harvesting of Rabi crops Nursery of fruit plants	
March		Harvesting of <i>Rabi</i> crops Fertilization of anola orchards	
April		Summer Tillage once in three years by disc plough or MB plough Basin Preparations in anola	
May		Pruning in Ber orchard primary tiullage using pre monsoon rains	
June	Maize –(Navjot ,pratap early makka -3 ,PEHM -2) Sorghum-(CSH-6,CSH-14 ,CSV-15) Ground nut –(JL-24 & TAG -24) Intercropping systems Maize +blackgram (2:2) Groundnut +sesame(6:2)	Application of FYM Primary tillage with pre monsoon Secondary Tillage by Cultivator/Rotator	
July	Maize-Pratap early makka -3,PEHM -2 Sorghum-(CSH-6,CSH-14 ,CSV-15) Sesame –RT -46,RT-125& RT-127 Groundnut – JL-24 & TAG -24 Black gram – RMG -62 ,K-851 Green gram –T-9RBU-38 Horseggram –AK -21 and AK-42 Intercropping systems	Secondary Tillage Sowing Thinning ,weeding ,hoeing Plant protection in fruit plants Sowing of sunhemp fro green manuring Manure and fertilizer application in fruit plants	Long Duration crops like maize, ground nut should be discouraged after first fortnight of July

August	Maize +blackgram (2:2) Maize +Pigeonpea (1:2) Groundnut +sesame(6:2)	<i>Insitu</i> moisture conservation. Measures like ridging after sowing maize topdressing of urea at appropriate soil moisture condition. Basin green manuring in fruit plants. Hoeing and interculture Runoff water harvesting	Good scope for harvesting runoff in Dug out /farm pond due to heavy rainfall probability in August
September	If Rains Received towards end of September or Early October then <i>rabi</i> crops be sown early Taramira –RTM & T-27 mustard –Bio-902 ,Laxmi	Early seeding of <i>rabi</i> crops picking of pods in greengram, Irrigation in fruit plants, Recycling of harvested rain water for life saving supplemental irrigation	
October	Chickpea- Dahod yellow & ICCV -10 Mustard –Bio -902 Laxmi Chickpea+ Mustard(4:1) intercropping	Harvesting of <i>kharif</i> crops Deep ploughing Interculture operations Sowing of <i>Rabi</i> crops Irrigation, Hoeing and weeding in fruit plants	In Tank bed conditions after the release of stored water
November	Wheat Raj-3077,Lok -1 , Barley RD -2052,RD-2552	Sowing of wheat plant protection for mustard and grasses.Irrigationto fruit plants	In Tank Bed situation
December	Wheat Lok -1	Sowing of wheat, Picking of aonla	In Tank Bed situation

Recommended *kharif* contingency plans for delayed monsoon or others aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	I Fortnight	-		
	II Fortnight	Maize –(Navjot, pratap early makka -3 ,PEHM -2) Sorghum-(CSH-6,CSH-14,CSV-15) Groundnut –(JL-24 & TAG -24) Intercropping systems Maize +blackgram (2:2) Groundnut +sesame (6:2)	Field preparations using pre monsoon shower secondary tillage operations .seed bed preparation and sowing of crops	
July	I Fortnight	Maize-Pratap early makka-3,PEHM-2 Sorghum-(CSH-6,CSH-14, CSV-15) Sesame –RT -46,RT-125& RT-127 Groundnut – JL-24 & TAG -24 Black gram – RMG -62 ,K-851 Green gram –T-9 RBU-38 Horsegram –AK -21 and AK-42 Intercropping systems Maize +blackgram (2:2) Maize + pigeonpea (1:2) Groundnut +sesame (6:2)	Seed bed preparation and sowing of crops seed treatment	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
August	II Fortnight	Green gram(K-851) Black gram (T-9) Sesame (RT -46) Horsegram(AK-42) Dual purpose sorghum (CSV-15)	Seed bed preparation and sowing seed treatment Plant protection	
	I Fortnight			
	II Fortnight		Thinning of alternate plants if prolonged drought prevails, removal of weeds earthlings in groundnut and ridging of N in cereals, Life saving irrigation in case of mid season drought	
September	I Fortnight		Thinning of alternate rows if acute drought prevails, recycling of harvested rainwater Interculture Picking of pods in greengram and harvesting of sorghum fodder	
	II Fortnight		Harvesting of maize, Black gram and groundnut. Tillage and field preparation for early <i>rabi</i> seeding if rain received or moisture conserve	
October	I Fortnight	Chickpea, Mustard, linseed, barley, wheat (-C-306, RSP -81)	Harvesting of maize and groundnut. Threshing and winnowing of products,	
	II Fortnight			
November	I Fortnight			
	II Fortnight			
December	I Fortnight			
	II Fortnight			

Recommended *Rabi* Contingency plans for absence or delayed rains or failed kharif

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
April			
May			
June			
July			
August	Blade harrow for moisture conservation	<i>Kharif</i> fallow or failed <i>Kharif</i> situation	
September	I Shallow tillage for moisture conservation Seed bed preparation	If late <i>kharif</i> rains are received or adequate soil moisture conserved	
	II Shallow tillage for seed bed preparation Shallow, basal application of fertilizer Seed treatment	Ensure adequate plant protection measure for establishment of <i>rabi</i> crops	
October	Mustard Chickpea	Pre sowing supplemental irrigation from stored harvested water, Thinning, hoeing	Sowing of mustard across grams at

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	Chickpea- (ICCV -10, Dahod yellow)	and weeding in taramira and mustard soil mulching soil mulching Sowing Chickpea and mustrad	4m interval
November	Wheat Raj-3077,Lok-1	Sowing	Under tank bed conditions after release of stored wtaer
December		Plant Protection measures	
January		Harvesting of Toria, taramira and mustard	
January		Harvesting of wheat Deep ploughing for summer tillage	Disc/Mould board ploug

Crops and varieties

Crop	Varieties hybrids composites	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Maize	Navjot	4.0	45	80-85		—
	Surya	3.5	40	70-75		
	PEHM-2	4.0	45	75-80		
Sorghum	SPV-245	3.5	70	95-110	Susceptible to shoot fly and shoot borer	
	CSH-6	3.5	55	85-90	-do-	
	CSH-14	4.5	55	85-90	-do-	
	GSH-1	—	—	—	—	—
	CSH-5					
	CSH-6					
	CSH-1					
	GJ-36					
	GJ-37					
	GJ-38					
	GJ-39					
	Fodder: GFS-4					
Pigeonpea	ICPL-87	1.2-1.5	85	135-140	—	Suitable for intercropping
	ICPL-151	1.2-1.5	80	130-135		-do-
	BDN – 2,	—	—	—	—	-do-
	G. Tur – 100					-do-
	ICPI –87119					-do-
Greengram	K-851	0.8-1.0	38	60-70		Suitable for intercropping and double cropping
	RMG-62	1.0-1.2	40	65-70	—	-do-
	GM-1	—	—	—	—	-do-
	GM-2					-do-
	GM-3					-do-
Groundnut	JI-24-	1.2-1.5	40	120-130	Susceptible to bud necrosis	Suitable for intercropping
	Spreading:					-do-
	GAUG – 10	—	—	—	—	
	GG-12	—	—	—		
	GG – 11 GG – 13					

Crop	Varieties hybrids composites	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Blackgram	Bunch: GAUG – 1, GG – 2, GG - 5 Semispreading:GG-20					
	T-9	0.8-1.0	34	70-75	—	—
	RBV-38	1.0-1.2	38	75-80	—	—
Cowpea	TVU-4					
	C-152 Pusa Phalguni, GC – 1, GC – 2, GC – 3, GC – 4	1.0-1.2	40	70-80		
Horsegram	AK-21	1.0-1.2	55-60	90-95	—	—
Soybean	JS-71-05	1.2-1.5	35-40	90-100		
	JS-335	1.2-1.5	35-40	95-105		
	G.Soybean – 1 G. Soybean – 2					
Clusterbean	RGC-986	1.0-1.2	35-40	115-120	—	—
	RGC-936	0.8-1.0	30-35	90-100		
	HG – 75, G.Guar –1					
Sesame	RT-46	0.8-0.9	30-35	70-80	—	—
	RT-125	0.8-1.0	30-35	70-75		
	G.Til – 1 G.Til – 2					
Mustard	Semi <i>Rabi</i> : Purva – 1					
	T-59	1.5-1.6	60-70	115-120	—	—
	BIO-902	1.8-2.0	65-70	110-115	—	—
Barley	RD-31	3.0-3.5	70	120-130		
	RDB-1	3.0-3.5	70	120-130		
	RD-2052	3.5-4.0	70	120-130	—	—
Chickpea	Dohad Yellow	1.2-1.4	65-70	105-115	—	—
	RSG-2	1.4-1.6	75-80	145-150		
	RSG-44	1.4-1.6	70-75	140-145		
Wheat	LOK-1	3.5-4.0	65	100-110		
	Raj-3077	4.0-4.5	70	115-120		
Taramira	T-27	1.2-1.4	40-45	45-120	—	—
Mothbean	Bileshvar, G. Guar – 1				—	—
Cotton	G.Cot – 10 CJ – 73 V-797					
	G.Cot – 13 G.Cot – 15				—	—
	G. Sunflower – 1 EC – 68414,					
Castor	Morden	—	—	—	—	—
	GAUC – 1	—	—	—	—	—
	GAUCH – 1, GCH – 2, GCH – 4					
Pearlmillet	GHB-27	—	—	—	—	—
	GHB-30, GHB-32, GHB-235, GHB-181, GHB-15					

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm) Inter row
Sorghum	10	45
Maize	25	60
Pigeonpea	10	75
Clusterbean	25	30
Greengram	16	30
Blackgram	16	30
Wheat	100	22
Barley	100	25
Mustard	5	30
Chickpea	80	30
Pearlmillet	3.75	60
Fodder sorghum	40 to 50	30
Groundnut	80 to 100	60
Spreading	120	45
Bunch	100	45
Castor	10	90
Sesame	3	45
Sunflower	10 to 12	60
Soybean	50 to 60	45
Cotton	12 to 15	60-90
Mothbean	20	30
Cowpea	20	45

Nutrient management

Crop	Nutrients (kg/ha)		Mode of application
	N	P ₂ O ₅	
Maize	50	30	N in 2 splits + as basal and + at knee high stage
Sorghum	50	30	
Greengram/ blackgram/ cowpea	15	30	All drilled at sowing
Wheat/barley/ safflower/ mustard	30	15	
Chickpea/ lentil	15	30	
Pearlmillet	80	40	At sowing 20 kg N, 40 kg N at 25 to 30 days after sowing, 20 kg N at 45 to 50 days after sowing
Groundnut	12.5	25	At sowing
Castor	15	30	
Sesame	25	25	Half dose of N at sowing and full dose of P ₂ O ₅ . Remaining half dose at 30 to 40 days after sowing
Semi <i>rabi</i> : Purva-1	12.5	12.5	At sowing
Sunflower	60	60	Full dose of P ₂ O ₅ and half dose of N at sowing and remaining half dose at 30 to 45 days
Soybean	30	60	At sowing
Cotton	25	40	Half of N at sowing time and remaining half at 50 to 55 days. If 25 kg of N it is applied at sowing time
Mothbean	20	40	At sowing time
Clusterbean	20	40	
Pigeonpea	20	40	

Suitable cropping systems

Sequence cropping on heavy soils with good rainfall

- Sorghum/ maize – mustard
- Blackgram/ greengram/ cowpea/ sorghum fodder - mustard
- Sorghum (fodder) – mustard
- Sorghum – safflower

Intercropping

- Maize + blackgram (2:2 row ratio in paired planting 37 cm.)
- Maize + pigeonpea (alternate rows at 30 cm.)
- Maize + castor (1: 1 row ratio)
- Groundnut + sesame (6:2 row ratio at 30 cm apart)
- Chickpea + mustard (4:1 row ratio at 30 cm apart)
- Chickpea + safflower (2:1 row ratio at 30 cm apart)
- Cotton + blackgram
- Pigeonpea + groundnut
- Castor + greengram (2:1)
- Groundnut + sesame (6:1)
- Sorghum/ pearl millet + cowpea (fodder)
- Groundnut + pigeonpea (3:1)
- Groundnut + castor (3:1)
- Groundnut + sesame (6:3)
- Cotton + groundnut (1:2)
- Pearl millet + pigeonpea (2:1)

2.2 *Kharif – Rabi* Semi Arid Inceptisols in Undulating Plain Zone of Punjab

Recommendation domain : Western plain Punjab including Rohilkhand plains, hot dry/moist sub-humid transitional eco-sub region (AESR 9.1). Patiala and Navanshahrdistricts in Kandi reason of Punjab.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
May	-	Summer ploughing	
June	Maize, black gram, green gram sesame, groundnut, pearl millet (F) & cluster bean (F)	Field preparations for sowing of kharif crops Sowing of crops in last week with pre-monsoon showers	
July	Maize Green gram, black gram, pearl millet (F), cluster bean	Weed control, application of second dose of nitrogen followed by earthing up Interculture operations	
August	Oilseed and pulses Pearlmillet (fodder)	Pest control Harvesting	
September	Maize, black gram, green gram & cluster bean (F) -	Harvesting & threshing Ploughing up of vacant fields to conserve moisture for the sowing of rabi crops	
October	Groundnut, sesame Taramira, raya, chickpea, lentil, barley	Harvesting & threshing Field preparation and sowing	
November	Wheat, wheat + raya, raya, lentil, barley	Sowing	
December	Cereal	Weed control, intercultural operations and application of second dose of N Interculture operations	
January	Raya	Pest control	
February	Raya and chickpea	Pest control	
March	Chickpea Barley, lentil, raya & taramira	Pest control Harvesting and threshing	
April	Wheat & chickpea	Harvesting and threshing	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations mid-season corrections	Remarks
June	I Fortnight	-	-	
	II Fortnight	-	-	
July	I Fortnight	-	-	
	II Fortnight	Maize Green gram, black gram, pearlmillet (f), cluster bean (f)	Re-sowing Sowing	Due to dry spell Late onset of monsoon
August	I Fortnight	Maize	Weed control, intercultural operations, application of 2 nd dose of N fb earthing-up	July II fortnight sown maize
		Green gram, black gram, pearlmillet (f), cluster bean (f)	Sowing	Late onset of monsoon
		-do-	Intercultural operations	July II fortnight sown crops
	II Fortnight	Pearlmillet (f)	Harvesting	July II fortnight sown
		Pearlmillet (f)	Sowing	Late onset of monsoon
		Green gram, black gram	Pest control	July II fortnight sown
September	I Fortnight	Green gram, black gram, pearlmillet (F), cluster bean (F)	Intercultural operations	August I fortnight sown crops
		Green gram, black gram	Pest control	August I fortnight sown
	II Fortnight	Pearlmillet (f)	Intercultural operations	August II fortnight sown crops
October	I Fortnight	Pearlmillet (f)	Harvesting	
		Maize, green gram, black gram & clusterbean (f)	Harvesting & threshing	July II fortnight sown crops
		Pearlmillet (f)	Harvesting	August II fortnight sown crops
		-	Soil moisture conservation practices for sowing of rabi crops	
	II Fortnight	Green gram, black gram & clusterbean (f)	Harvesting & threshing	August I fortnight sown crops
		-	Soil moisture conservation practices for sowing of rabi crops	

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	-	Soil and moisture conservation practices	
	II Fortnight	Raya, taramira, chickpea, lentil & barley	Deep sowing under low seed zone moisture conditions	
November	I Fortnight	Wheat, barley & raya	Deep sowing under low seed zone moisture conditions	
		Raya & taramira	Intercultural operations	October II fortnight sown

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
December	II Fortnight	Chickpea , lentil & barley	Intercultural operations	
	I Fortnight	Wheat, barley & raya	Intercultural operations	November I fortnight sown
	II Fortnight	Wheat Wheat, barley, taramira, African sarson	Second dose of N Sowing	With the receipt of winter rains
January	I Fortnight	-	-	
	II Fortnight	Wheat, barley, taramira, African sarson	Intercultural operations	December II fortnight sown
February	I Fortnight	Raya & taramira	Pest control	Oct II & Nov I fortnight sown
March	II Fortnight	Chickpea	Pest control	
	I Fortnight	-	-	
	II Fortnight	Barley, raya, taramira & lentil	Harvesting & threshing	October II fortnight sown
April	I Fortnight	Chickpea	Harvesting & threshing	
		Barley, taramira & African sarson	Harvesting & threshing	December II fortnight sown
		Wheat	Harvesting & threshing	Nov I & Dec II fortnight sown

Crops and varieties

Crops	Varieties/	Yield potential (t/ha)	Duration from seed to seed (days)	Disease and pest reaction	Remarks
<i>Kharif</i>					
Maize - grain crop	JH-3459 (hybrid)	4.8	84	Moderately resistant to bacterial stalk rot	Drought tolerance
	Prakash (hybrid)	4.5	84	—	
	Megha (Composite)	3.0	80-83	—	
Pearlmillet - grain crop	PCB-138 (composite)	2.0	74-78	Resistant to downy mildew. Escape ergot due to earliness	Terminal drought
Greengram	ML-613	1.25	85	Resistant to yellow mosaic virus, cercospora leaf spot and bacterial leaf diseases. Tolerant to jassids and white flies	Grains are bold and staining with good cooking quality. Determinate growth habit
	ML-267	1.45	85	Resistant to yellow mosaic virus	Determinate growth habit. Grains with good cooking quality
Blackgram	Mash 48	0.75	115	Susceptible to yellow mosaic virus in humid areas	Indeterminate growth habit
	Mash 338	0.87	90	Resistant to yellow mosaic virus, bacterial leaf spot and cercospora leaf spot diseases. Tolerant to jassids and white flies	Determinate growth habit
	Mash 1-1	0.87	115	Resistant to fungal and viral diseases	Indeterminate growth habit

Crops	Varieties/	Yield potential (t/ha)	Duration from seed to seed (days)	Disease and pest reaction	Remarks
Groundnut	M 37	1.62	120	—	—
Sesame	TC 289	0.52	80	—	—
	Punjab Til No. 1	0.50	80	—	—
Fodder-Maize	J 1006	41.2	—	Moderately resistant to maydis leaf blight and brown strips downy mildew diseases	—
Fodde-Sorghum	SL 44	60.0	—	—	—
Fodder-Pearlmillet	PCB 141	60.0	—	Dual purpose variety Highly resistant to downy mildew	—
	PCB 15	57.5	—	Dual purpose composity Highly resistant to downy mildew disease	—
Fodder-Clusterbean	Guar 80	31.0	—	Late maturing variety Resistant to clusterbean leaf blight and stem breakage	—
Fodder-Cowpea	Cowpea 88	27.5	—	Dual purpose variety Highly resistant to yellow mosaic virus and Anthracnose disease	—
<i>Rabi</i>					
Wheat	PBW 396 (Double dwarf variety)	3.6	150	Resistant to yellow and brown rusts. Susceptible to Karnal bunt and loose smut	Recommended for timely sown conditions (End Oct.- end Nov.)
	PBW 175 (Single dwarf variety)	3.62	165	Highly resistant to yellow and brown rusts and Karnal bunt.	
	PBW 299 (Double dwarf variety)	3.62	165	Resistant to yellow and brown rusts and Karnal bunt. Susceptible to loose smut.	
	PBW 373 (Double dwarf variety)	3.75	140	Highly resistant to yellow and brown Susceptible to loose smut rusts	Recommended for late sown conditions (from end Nov. onwards)
	PBW 138 (Double dwarf variety)	3.75	140	Resistant to loose smut and flag smut. Susceptible to yellow and brown rusts	
<i>Triticale</i>	TL 1210 (Single dwarf variety)	4.5	135	Resistant to yellow and brown rusts. Karnal bunt, loose smut, flag smut and powdery mildew	Suitable as poultry feed
Barley	PL 419 (Six row variety)	4.0	130	Resistant to yellow rust, loose and covered smuts. Moderately susceptible to stripe disease	Throughout the state
Chickpea	PBG 1	1.6	160	Highly resistant to chickpea blight and wilt complex	Bold seed

Crops	Varieties/	Yield potential (t/ha)	Duration from seed to seed (days)	Disease and pest reaction	Remarks
Lentil	C 235	1.25	165	Fairly resistant to chickpea blight	Medium sized seeds
	LL 699	1.42	145	Moderately resistant to rusts and blight Tolerant to pod borer	Early in flowering
	LL 147	1.37	150	—	—
	LL 56	1.29	155	—	—
	Mansar 9-12	1.0	155	—	—
Mustard (raya)	PBR 97	1.34	136	—	Medium bold seeds with oil content 40.0%
	RLM 619	1.5	143	Greater resistant to white rust, <i>Alternaria</i> blight and downy mildew	—
Taramira	TMLC 2	0.72	150	—	Oil content 36.6%
Linseed	LC 2023	1.24	158	Resistant to wilt, rust <i>Alternaria</i> blight and moderately resistant to powdery mildew	Oil content, 40% Bears blue flowers and brown seeds of medium size
	LC 54	1.25	170	Fairly resistant to wilt, rust and powdery mildew	Oil content 46% Bears white flowers and brown seeds

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Maize	20	40-50	20-25
Pearlmillet	3.75	60	15
Greengram	20	30	10
Blackgram	15-20	30	—
Groundnut	65	30	22.5
Sesame	2.5	30	15
Rabi Wheat	100	22-25	—
If soil moisture is low		30	—
Barley	112	18-20	—
Chickpea	40-45	30	—
Lentil	30-37.5	22.5	—
Mustard	3.75	30	10-15
Taramira	3.75	30	15
Linseed	37.5	23	7.10
Fodder Maize	75	30	—
Sorghum	50-60	22	—
Pearlmillet	15-20	22	—
Clusterbean	45-50	30	—
Cowpea	50-60	30	—

Nutrient management

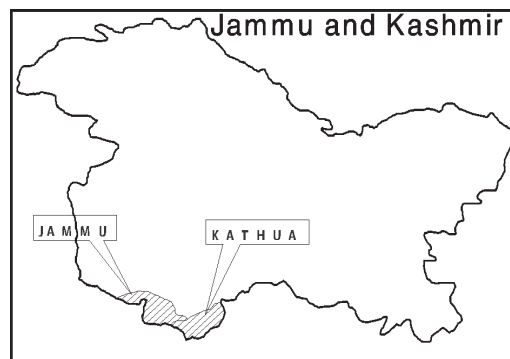
Crop	Nutrients (kg/ha)			Mode of application
	N	P ₂ O ₅	K ₂ O	
Kharif				
Maize				
Sandy loam to clay loam	80	40	20	Apply half N and all P ₂ O ₅ as well as K ₂ O at sowing and top dress remaining half N one month after sowing
Loamy sand to sandy	40	20	10	Apply potassium on soil test basis and if soils show deficiency
Pearlmillet	62.5	30	—	Apply half N and full dose of P ₂ O ₅ with last ploughing and remaining half N about one month after sowing with a shower of rain
Greengram	12.5	40	—	Drill all nutrients at sowing
Blackgram	12.5	25	—	
Groundnut	15	20	25	Drill all nutrients at sowing. Prefer phosphorus from single superphosphate. Apply potassium only when soil test indicates its deficiency.
Sesame	35	—	—	Drill at sowing
Rabi Wheat				
Sandy loam to clay loam	80	40	25	Drill half N and full P2O5 fertilizer at sowing at broadcast remaining half N at winter rains
Loamy sand to sandy loam	40	20	15	
Barley	40	30	15	Drill fertilizer at sowing
Chickpea	15	20	—	
Lentil	12.5	20	—	
Mustard	37.5	20	—	Drill the fertilizer before sowing, Prefer phosphorus from single super phosphate.
Taramira	30	—	—	Drill the fertilizer before sowing. Prefer single super phosphate as source of phosphorus.
Linseed	62.5	40	—	Drill all fertilizer before sowing. Prefer single super phosphate as source of phosphorus.
Fodder Maize	—	—	—	
Sorghum	50	20	—	Drill all fertilizer at field preparations
Pearlmillet	50	—	—	Half at sowing and remaining half 3 weeks after sowing
Clusterbean	—	—	—	
Cowpea	18	55	—	Drill all fertilizer at sowing

Suitable cropping systems

- Sandy loam – clay loam (Medium to heavy textured) soils with high moisture retention capacity:
- Maize – wheat
- Maize – mustard
- Maize – chickpea
- Pearl millet – wheat/ barley
- Fallow – chickpea
- Fallow – wheat + chickpea
- Loamy sand to sandy (Light to medium textured) soils with low moisture storage capacity:
- Fallow – wheat
- Fallow – wheat + raya
- Sunhemp (green manure) – wheat + chickpea
- Sunhemp (green manure) – wheat + chickpea + raya
- Cowpea (fodder) – wheat + chickpea
- Cowpea (fodder) – wheat + chickpea + raya
- Fallow – wheat + chickpea/ barley/ raya/ taramira
- Pearl millet – chickpea

2.3 *Kharif and Rabi* Sub – Humid Deep Inceptisols in Low Altitude Sub-Tropical Zone of Jammu and Kashmir

Recommendation domain: Comprises parts of districts of Jammu and Kathua of Jammu and Kashmir



Recommended Crop(s) and Cultural Calendar For a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Wheat RAj-3765,UP 2425,HD -2402, PBW -396,PBW -26	Sowing, weeding hoeing and Top dressing of urea.	The Recommendations are subject to prevailing climatic conditions in areas under domain
February	Wheat Raj -3765,PBW -373,UP 2425, HD -2402, PBW-396, PBW-226	Hoeing and weeding ,and top dressing	
March	Wheat Raj-3765, PBW-373, HD-2402, PBW-396, PBW-226	Hoeing and weeding, harvesting of early sown sarson	
April	Wheat Raj-3765, PBW-373, HD-2402, PBW-396, PBW-226	Harvesting and threshing of Wheat	
May	Wheat Raj-3765, PBW-373, HD-2402, PBW-396, PBW-226	Harvesting and threshing of Wheat	
June	Sowing of early maize depending on pre monsoonal showers	Land preparations for kharif crops and sowing of early maize on pre monsoonal showers	
July	Maize, Pearl millet greengram, pearl millet (transplanting)	Sowing, weeding hoeing and top dressing	
August	Maize, Pearl millet greengram, cowpea, pearl millet (transplanting) + cowpea /guar fodder sorghum + cowpea/ guar fodder sorghum / maize +cowpea (fodder)	Sowing, weeding hoeing and top dressing	
September	Maize, Pearl millet cowpea, greengram, pearl millet (transplanting), Toria,	Earthing maize crop sowing of Toria and Toria and Toria +gobisarson	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	Toria + gobisarson		
October	Maize, Pearl millet greengram, cowpea pearl millet (transplanting) chickpea, mustard linseed, barley Wheat –C-306,RSP-81	Harvesting and Threshing of maize, Sowing of gram Mustard, linseed, barley Wheat –C-306-RSP-81	
November	Wheat PBW 396, PBW-175, Lentil L-9/12, PL-406	Sowing ,weeding ,hoeing and top dressing nipping of chickpea	
December	Wheat PBW 396, PBW-175, Lentil L-9/12, PL-406	Sowing, weeding ,hoeing and top dressing nipping of chickpea	

Recommended kharif Contingency plans for delayed monsoon or others aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	I Fortnight	-		The Contingent plan pertains to recommendations domain comprising parts of Jammu and Kathua Districts of J&K state
	II Fortnight	-		
July	I Fortnight	-		
	II Fortnight	Cultivation of Short duration varieties of Normal sown crops ,dry sowing of maize transplanting of pearl millet and sow the seed with first ploughing to use the available moisture for germination of <i>Kharif</i> crops.	Sowing	
August	I Fortnight	Pearlmillet + Cowpea /guar fodder, maize +cowpea /guar fodder jowar +cowpea guar /fodder		
	II Fortnight	Pearlmillet /Jowar/maize+cowpea(fodder)	Sowing	
September	I Fortnight	Toria	Sowing	
	II Fortnight	Toria, Gobisarson , Toria +Gobisarson	Sowing	
October	I Fortnight	Chickpea , Mustard, linseed, barley, wheat –c-306,RSP -81	Sowing	
	II Fortnight	Wheat PBW -175,PBW -299,PBW-396, HD 2380, Lentil L-9/12, PL 406	Sowing	

Recommended Rabi Contingency plans for absence or delayed rains or failed kharif

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Chickpea +Gobisarson, Mustard, linseed, barley, wheat –C-306,RSP -81	Normal Sown conditions	When there is no moisture is the soil during October November and then dry sowing of wheat is done so that when ever small shower rain is received ,it will be helpful in the germination of crop Sown
	II Fortnight	Wheat PBW -396.PBW-175, IWP-72,Lentil L-9/12,PL 406		
November	I Fortnight	Wheat PBW -396.PBW -175 Lentil L-9/12,PL 406		<ul style="list-style-type: none"> Minimum tillage operation be adopted (sowing of seed with kera and application of fertilizer with Pora method) to save the moisture loss from the soil and time The contingent plan pertains to recommendation domain comprising parts of Jammu and Kathua districts of J&K state
	II Fortnight	Wheat HD-2329, HD-2285, Lentil L-9/12,PL 406		
December	I Fortnight	Wheat HD-1553,HD-2285,Raj-3077		
	II Fortnight	Wheat Raj-3765,PBW-226		
January	I Fortnight	Wheat Raj-3765, PBW-373, UP-2425,HD -2402		
	II Fortnight	Wheat PBW-396, PBW-226, oat Kent, sabzar, local		

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Maize	GS-2	2.0-2.5	65-70	100-105	Partially susceptible to stem borer	Suitable for mono and intercropping systems
	Mansar	1.8-2.2	55-60	90-95		
	C – 5	1.8-2.2	55-60	90-95		
Pearlmillet	WCC-175	1.4-1.6	70-75	100-105	Partially susceptible to downy mildew	Suitable for mono cropping system
	MHB-110	1.8-2.0	70-75	105-110		
	MHB-179	1.8-2.0	70-75	105-110		
Greengram	PDM-54	0.6-0.8	50-55	80-85	Partially resistant to yellow mosaic	Suitable for mono and intercropping systems
	ML -13168	0.6-0.8	50-55	80-85		
Cowpea	C-152	0.7-0.9	45-50	70-75	Partially resistant to yellow mosaic	Suitable for mono and intercropping
	PS-42	0.7-0.9	45-50	70-75		
Blackgram	Plant-U-19	0.6-0.7	60-65	110-115	Resistant to yellow mosaic	Suitable for mono cropping
Wheat	PBW-396	2.5-3.0	110-115	155-160	Partially resistant to loose smut and yellow rust	Suitable for mono cropping
	RDP-81	2.0-2.5	125-130	175-180		
Chickpea	C-35	0.8-1.0	90-95	135-140	Partially resistant to bacterial wilt and pod borer	Suitable for mono cropping
	PBG-1	1.0-1.2	95-100	150-155		
Lentil	L-9/12	0.5-0.6	105-110	155-160	—	Suitable for mono

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Peas	PL-406	0.5-0.6	105-110	155-160	—	cropping
	T-163	1.0-1.2	90-95	140-150	Partially resistant to powdery mildew and root rot	Suitable for mono cropping
	Rachna	1.2-1.5			Powdery mildew and root rot	—
Mustard	RLM-619	1.0-1.2	90-95	130-135	Partially resistant to aphids and white rust	Suitable for mono cropping
	Pusa Bahar	1.0-1.2		120-125	—	—

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Wheat	100	25	Thick sowing
Barley	100	25	Thick sowing
Maize	20	60	30
Pearlmillet	5	45	20
Greengram	15-20	30	15
Blackgram	15-20	30	15
Cowpea	20-25	30	15
Chickpea	—	30	15
Mustard	—	30	15

Nutrient management

Crop	Nutrients (kg/ha)			Mode of application
	N	P ₂ O ₅	K ₂ O	
Maize	60	40	20	P ₂ O ₅ + K ₂ O + 2/3rd of N as basal, remaining N though urea in 2 splits doses 1st at knee high stage and 2nd before tassel formation stage
Pearlmillet	50	30	15	P ₂ O ₅ + K ₂ O + 1/2 N as basal, remaining N though urea after 30 to 40 days of sowing
Wheat	60	30	20	Full diammonium phosphate + muriate of potash + 2/3rd urea should be applied as basal. Remaining 1/3rd urea should be top dressed on receipt of rains
Barley	40	20	20	All N, P ₂ O ₅ and K ₂ O
Greengram/ Blackgram	16	40	0	-do-
Cowpea	16	40	0	-do-
Mustard	60	30	15	Full P ₂ O ₅ + K ₂ O + 1/2 N as basal, remaining N through urea should be top dressed when first rain is received
Chickpea	15	40	—	All N, P ₂ O ₅ and K ₂ O

Suitable cropping systems

Sequence cropping

- Maize – wheat
- Maize – barley
- Maize – rapeseed
- Maize – chickpea/ lentil/ pea
- Pearl millet – wheat
- Greengram – wheat
- Blackgram – wheat
- Blackgram – rapeseed
- Cowpea/ greengram/ blackgram – pea
- Maize – toria (local) – wheat

Intercropping

- *Kharif*
 - Two rows of cowpea + blackgram + one row of maize each at 30 cm
 - Maize + okra (1:1 row ratio at 30 cm each)
- *Rabi*
 - Barley + peas (2:1)
 - Wheat + chickpea (4:2)
 - Wheat + rapeseed (8:1)
 - Chickpea + mustard (4:1)

3. Oilseed based production system

3.1 Groundnut based production system

3.1.1 *Kharif* Arid Shallow Alfisols in Scarce Rainfall Zone of Rayalaseema of Andhra Pradesh

Recommendation domain: Comprises Kurnool, Chittoor and Anantapur districts in Andhra Pradesh



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Groundnut + pigeonpea	pigeonpea harvesting	—
February	—	—	—
March	—	—	—
April	—	—	—
May	Groundnut	Summer ploughing	—
June	—	Cleaning of the fields	—
July	—	Sowing of crops	—
August	—	Sowing and intercultural operations	—
September	—	Interculture and weeding	—
October	—	Harvesting	—
November	—	Harvesting	—
December	—	Threshing and drying	—

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	Groundnut		—
	II Fortnight	Groundnut + pigeonpea/castor	Top dress of urea to castor	—
July	I Fortnight	Groundnut + pigeonpea/castor	„	—
	II Fortnight	Groundnut + pigeonpea/castor	„	—
August	I Fortnight	Groundnut + pigeonpea/castor	„	—
	II Fortnight	Fodder sorghum, horsegram, sunflower	Application of urea to fodder jowar whenever rainfall is there	—
September	I Fortnight	Horsegram	—	—
	II Fortnight	„	—	—
October	I Fortnight	—	—	—
	II Fortnight	—	—	—

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

The *rabi* contingency doesn't arise in the existing situation

Crops and varieties

Crops	Varieties/ Hybrids	Duration (days)	Reaction to pests and diseases	Remarks
Groundnut	TMV - 2	105-110	Susceptible for foliar diseases	Suitable for scarce rainfall areas, no dormancy
	Vemana	105-110	Tolerant to foliar diseases	Tolerant to drought, Dormancy present.
	TPT-4	105-110	—	Tolerant to drought
Sorghum	CSH-5	105-110	Tolerant to grain molds	—
	CSH-9	105-110	Tolerant to grain molds	—
	CSH-13	110-115	—	Tall and yields more fodder
	NTJ-1	105	—	Drought tolerant and grain is easily separated from the panicle
	NTJ-2	95-100	—	Early in duration, bold white shiny grain and easily separated from the panicle
	NTJ-3	100-105	Tolerant to leaf spot disease	Yields more fodder and drought tolerant
Pearlmillet	ICTP-8203	80-85	Tolerant to green ear disease	Grain white and bold, tolerant to drought
	ICMV-221	85-90	Tolerant to green ear disease	Composite variety
	ICMH-451	85-90	Tolerant to green ear disease	Hybrid, grows upto 175 cm; 2-3 tillers, grain medium bold, ash colour
Setaria	Lepakshi	80-85	—	Tolerant to drought, suitable for shallow soils with low rainfall areas, more tillers and quality straw
	Krishnadevaraya	80-85	—	Bold grain, light yellow colour, plant height up to 110 cm, 4-6 tillers with quality straw
	Narasimharaya	80-85	—	Bold grain and yellow in colour, plant height up to 110-120 cm, more number of tillers
Castor	Kranthi	90-150	—	Drought tolerant, bold seed
	GCH-4	150-210	Tolerant to wilt and dry root rot diseases	—
Pigeonpea	Palnadu (LRG -30)	170-180	—	Bushy plant, yellow flowers, medium bold grain with brown pod coat. Suitable for intercropping in groundnut

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern spacing (cm)	
		Inter row	Intra row
Groundnut	100	30	10
Castor	10	90	30
Pigeonpea	15	90	20
Pearlmillet	5	45	10
Setaria	5	30	5
Sorghum	8	45	15

Nutrient management

Crop	Nutrients (kg/ha)			Remarks
	N	P ₂ O ₅	K ₂ O	
Groundnut	20	40	40	For groundnut apply P ₂ O ₅ and K ₂ O as per soil test values. Reduce to 50% of recommendation if soil test value is medium; do not apply if soil test value is high. If soil test value is low, apply as per recommendation
Castor	60	40	30	—
Pigeonpea	20	40	40	—
Pearlmillet	40	40	40	N dose ranges from 40-80 kg N/ha depending on rainfall
Setaria	40	40	40	

Suitable cropping systems

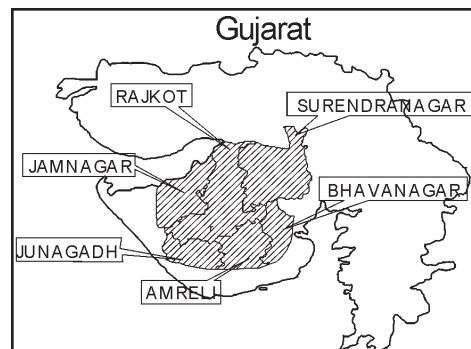
- Pigeonpea mostly as an intercrop in groundnut. Groundnut + pigeonpea in 7:1 ratio is the most popular intercropping system. Groundnut + pigeonpea in 11:1 ratio and a tamarind tree for every one ha.
- Horsegram mostly as contingent crop.
- Groundnut + castor in 7:1 or 11:1 ratio

Alternate land use

- Crop + livestock (sheep 10/ha) system of farming will give 80% more income than cropping system alone

3.1.2 *Kharif* Arid Deep Vertic / Vertisols in North Saurashtra Zone of Gujarat

Recommendation domain: Comprises the districts of Amreli, Bhavnagar, Junagadh, Jamnagar, Surendranagar and Rajkot in Gujarat



Recommended Crop(s) and Cultural Calendar for a normal season

1. Groundnut:-

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	-	-
February	-	-	-
March	-	Deep ploughing alternate years Cleaning of drainage Maintenance of Bund	-
April	-	-	-
May	Bunch : GG-2, 4,5,6 & 7 Semi SP: GG-20 Spreading : GG-11, 12 & 13	Furrow opening and application of FYM	6 t/ha
June	Spray fluchloralin 0.9 kg/ha in 500 liter of water as pre-emergence for controlling of weeds. Intercropping Groundnut + castor (3:1) Groundnut + pigeonpea (3:1)	Sowing of seed and fertilizer seed treatment with (1) thirum/mancozeb (2) bio fertilizer: Azetobactor 625 gm/ha application of Trichogerma culture @ 1.5 kg with 3 kg castor cake in furrow Gap filling & weeding	100 kg
July	-	Interculturing & weeding Plant Protection measures for Aphids ETL at 1.5 Index	20 DAS Dimethoate 0.03 %
August	-	During soil moisture stress supplement irrigation at pegging and pod development stage Plant Protection measures	Spray Metasystox 0.3 % Mancozeb 0.2 %
September	-	For control of Chlorosis. Apply life saving irrigation if and when required	FeSO ₄ (100 gm) + citric acid (10 g) in 10 liter of water
October	-	For control of tikka and rust Harvesting at maturity Drying, threshing, clearing	Spraying of Dimethoate 0.03 % + Carbendazim 0.025 %

2. Cotton :-

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	Picking of seed cotton	-
February	-	Uprooting the plants Speding of stalk for preparation of compost by adopting scientific method	-
March	-	Deep ploughing	-
April	-	Cleaning of drainage Maintenance of Bund	-
May	G-cot-10,13,21 Cotton Hy-6,8 Deshi Hy-7,9	Delinting of seeds Opening of Furrow	-
June	Spray Diuron 0.9 kg/ha in 500 liter of water as pre-emergence for controlling of weeds Intercrop Cotton + green gram/ black gram (I:I) Cotton + groundnut (1:1) Cotton + sesame (1:1)	Application of FYM / compost Seed Treatment Mancozeb, Imidachlopride Applied fertilizer in intercropping as per RDF to respective crop Application of chemical fertilizer Apply Azetobacter	10 t/ha 3 gm/kg of seed 7.5 ml /kg of seed 20-0-0 kg NPK/ha as basal 625 gm/ha
July	-	Gap filling & thinning Interculturing & weeding	90 x 30 cm 30 DAS
August	-	Interculturing & Weeding Top dressing of fertilizer at 60 DAS To control the angular leaf spot apply 0.5 gm streptocycline + 30 gm copper oxichloride/10 liter of water For control of sucking pest spray dimethoate @ 3gm / 10 liter of water If weed drought occur apply life saving irrigation	30 DAS 20 kg Nitrogen/ha
September	-	Adopt IPM strategy to control the insect and pest Apply straw mulch @ 5 t/ha for conserving soil moisture	-
October	-	Apply irrigation at 25 days after cessation of rainfall	-
November	-	Apply irrigation at an interval of 15-20 days if irrigation facility is available Picking of seed cotton when opening of boll	-
December	-	Picking of seed cotton	-

3. Castor :-

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	Picking of capsule, uprooting the plants, speeding of stalk for preparation of compost by adopting scientific method	-
February	-	Cultivating and harrowing the land	-
March	-	Cleaning of drainage, maintain the bund	-
April	-	Deep ploughing alternate year	-
May	-	Opening the furrow	-
June	GAUCH-1, GCH-2,6	Application of FYM Dibbling of seed Sowing of seed Apply chemical fertilizer Add gypsum 12.5 kg/ha or sulphur 20 kg/ha	6 t/ha 90 x 20 cm 8-10 kg/ha 15-30-0 kg NPK/ha
July	-	Gap filling & thinning Inter culturing & weeding Top dressing of 15 kg N	30 DAS 30 & 60 DAS 45 DAS
August	-	To control the blight diseases spray mancozeb 0.2 % To control the semi looper spray endosulfan 20 ml / 10 liter of water	-
September	-	To control the blight diseases spray mancozeb 0.2 % If mid drought occur apply life saving irrigation	-
October	-	To control the semi looper spray endosulfan 20 ml / 10 liter of water	-
November	-	Picking of capsule	-
December	-	Picking of capsule	-

4. Sesame :-

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	-	-
February	-	-	-
March	-	Cultivating and harrowing the soil	
April	-	-	-
May	-	Apply FYM	@ 6 t/ha
June	-	Mix sand with seed for even distribution of seeds Sowing of seeds Apply fertilizer Seed treatment with fungicide	3 kg / ha 25-25-0 kg NPK/ha 3 gm/kg of seed

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	-	Thinning, interculturing & weeding	20 DAS
August	-	Interculturing & weeding To control the Phytophthora blight, copper oxychloride 0.2 % should be sprayed Spray endosulfan 0.7 % to control leaf Webber To control the leaf spot diseases, @ mancozeb 0.2 % should be applied If drought occur, apply life saving irrigation at flowering and capsule formation	40 DAS
September	-	Harvesting of the crop, threshing, winnowing and cleaning	-
October	-	Grading, speding of stalk for preparation of compost	-
November	-	Cultivating and harrowing the soil	-
December	-	-	-

5. Pearlmillet :-

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	-	-
February	-	-	-
March	-	Cleaning of drainage Maintain the bund	-
April	-	Cultivating and harrowing the land	-
May	-	Apply FYM @ 6 t/ha	-
June	GHB-558, 538, 577	Seed treatment with mancozeb / thirum Sowing of seed at 60 cm distance Apply fertilizer	3 gm of seeds 3.75 kg/ha 40-40-0 kg NPK/ha
July	-	Thinning at distance of 10 to 15 cm in rows. Inter culturing and weeding	20 DAS
August	-	Inter culturing and weeding Top dressing of fertilizer To control the rust mancozeb @ 0.2 % should be spray	40 DAS 40 kg N/ha
September	-	Harvesting of the crop. Drying the ear head, threshing, winnowing and cleaning the seed	-
October	-	Cultivating and harrowing the land	-
November	-	Collect the stubble and use for composting	-
December	-	-	-

6. Black gram/Green gram :-

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	-	-
February	-	Cultivating and harrowing the land	-
March	-	Cleaning of drainage Maintain the bund	-
April	-	-	-
May	-	Apply FYM @ 6 t/ha	-
June	Blackgram T-9 Greengram GM-4 & K-851	Seed treatment with mancozeb / thirum 3 gm/1 kg seed and Rhizobium culture + PSM each of 625 gm/20-25 kg seed Sowing of seed at 45 cm distance Apply fertilizer	40-40-0 kg NPK/ha
July	-	Thinning at distance of 45 x 10 cm Inter culturing and weeding	20DAS
August	-	Inter culturing and weeding To control the pod borer endosulfan 0.07 % should be spray	40DAS
September	-	Harvesting of the crop. Drying the ear head, threshing, winnowing and cleaning the seed	-
October	-	Cultivating and harrowing the land	-
November	-	-	-
December	-	-	-

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	Follow normal cropping pattern using short duration varieties like Groundnut : Spreading GG-11,12,13 Semi spreading : GG-20, Bunch : GG-2,5,7 Pearl millet : GHB-558,538	As per recommended package of practice of the crop	Additional information is given below Table 4.2.
	II Fortnight (Normal onset of monsoon)	Sesame G-Til-1,2 Blackgram T-9 Pigeonpea BDN-2,ICPL-87, Gujarat Tur-100 Cotton Hy-6,8, G-cot-13,15,21 Castor : GAUCH-1, GCH-6 Intercropping : To minimize risk under sole crop of groundnut follow intercropping of bunch groundnut with castor, sesamum and pigeonpea (3:1 ratio)	Seed treatment and sowing of seed at the time of onset of monsoon	-
July	I Fortnight (Delayed onset of monsoon)	According to I and II fortnight of June excluding spreading groundnut GG-11,12,13	As per recommended package of practice of the crop	-
	II Fortnight (Late onset of monsoon)	Forage maize, sorghum gundari and sholapuri, Castor GAUCH-1 & Groundnut GG-2,4,5,6 & 7	As per recommended package of practice of the crop	-

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
August	I Fortnight	Fodder sorghum GSF-5, Gundari Fodder maize, Castor-GAUCH-1, Sesame Purva-1 & Black gram T-9	As per recommended package of practice of the crop	-
	II Fortnight	Fodder sorghum & maize, Castor-GAUCH-1, Sesamum Purva-1	As per recommended package of practice of the crop	-
September	I Fortnight	Sesamum Purva-1, Ajama	As per recommended package of practice of the crop	-
	II Fortnight	Sorghum Gundari, Sesamum Purva-1	As per recommended package of practice of the crop	-
October	I Fortnight	Chickpea G-2, Rainfed Mustard	As per recommended package of practice of the crop	-
	II Fortnight	nil		-

(1) Normal onset of monsoon followed by long dry spell :

Commencing after sowing: Suggestion

- | | |
|--------------------|---|
| 1-2 week of sowing | If the drought spell prolongs the crop sown may wither. Re-sowing of early duration rate is or alternate crops should be recommended as follow if sufficient rainfall is received.
Hy pearl millet : 235-558 & 538, Hy jowar : CSH-5,6, Sesame : Gujarat Til-1-2,
Castor GAUCH-1 & GCH-6 |
| 4-5 week of sowing | Intercultural operation like weeding, hoeing and mulching may be taken up. If drought spell prolongs for 2 weeks of more, thinning of rows may be taken up depending upon the severity of the moisture stress. If dry spell is long ratooning of jowar may be done and if rain occurs, top dressing of fertilizer should be suggested. In case crop sown have been damaged, re-sowing of alternative crops should be recommended as above. |
| Other suggestions | <ol style="list-style-type: none"> 1) Apply protective irrigation to groundnut, pearl millet, sorghum and cotton in order of performance during dry spell if irrigation water is available. 2) Timely interculturing should done to minimize loss of water due to evaporation 3) The weed should be removed completely to stop the loss of moisture and nutrients 4) Mulching should be done if possible. 5) Earthening up should be done in bunch groundnut 6) If dry spell is long, minimize plant stand by thinning in row |

(2) Normal onset of monsoon but early stoppage of rainfall

- 1 Minimize evaporation losses so complete removal of weeds
- 2 Perform interculturing to feel soil cracks and to conserve soil moisture
- 3 Apply life saving irrigation if water is available
- 4 Thin out the plant population within the row
- 5 In intercrops, the leaves should trimmed from the lower portion of the plant
- 6 If the crop failed or sowing was not carried out due to less moisture and soil is rich in nutrient then "Ajma" sowing should carried out after receiving sufficient rainfall for harvesting good yield as well as return.
- 7 The government agencies are requested to experiment for the artificial rain in the cloudy and low wind speed areas

8 Harvest the crop according intervals as per physiological maturity

(3) Excess rain

At early stage of crop growth	Excess rain at early stages may affect the crop severally. One rains stop, re-sowing / gap filling of shorter duration crop varieties/ alternative crops should be done as suggested above
At late stage of the crop growth	If kharif crops at a later stage of growth are damage due to excess rainfall sowing of rabi crops like safflower, fodder sorghum and mustard may be taken up after the rain is received. Ratooning of the Hy-sorghum may be taken up if sufficient soil moisture is available. Sowing of gram may also be done.

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Nil	Nil	Nil
	II Fortnight	Nil	Nil	Nil
November	I Fortnight	Nil	Nil	Nil
	II Fortnight	Nil	Nil	Nil
December	I Fortnight	Nil	Nil	Nil
	II Fortnight	Nil	Nil	Nil
January	I Fortnight	Nil	Nil	Nil
	II Fortnight	Nil	Nil	Nil

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed (days)	Reaction to disease and pest	Remarks
Pearlmillet	GHB-235	2.9	47.52	73-77	Downy mildew	Suitable for scanty
	GHB-316	3.3	52-55	77-82	Downy mildew	rainfall areas of Gujarat
	GHB-558	3.5	55-60	82	Downy mildew	Suitable for arid and
	MH-169	3.4	42.47	67-22	Downy mildew	semiarid areas of Gujarat
Sorghum grain	GJ-39	3.4	62-65	95-100	—	Suitable for mono
	GJ-40	3.5	67	104-108	—	and intercropping
	GJ-41	4.0	70-75	90-100	—	systems in Gujarat
	GJ-42	4.1	77	121	—	
Sorghum	GFS-4	3.5	40-45	—	—	—
Fodder	GFS-5	3.8	58	—	—	—
Cotton	G.Cot-10	1.0	60-70	180	—	Mathio cotton suitable for
	G.Cot-13	0.4	140	245-280		Saurashtra region, Amreli,
	G.Cot-15	0.3	40-50	120-150		Bhavnagar and part of Rajkot
	G.Cot-18	0.4	60-70	175-180		districts and Vagad cotton
	G.Cot-21	0.5	142	217		suitable for part of
	V-797	0.8	140	260-300		Surendranagar, Ahmedabad
	G.Cot-H-8	1.0	50-60	170-190		and Rajkot districts
Greengram	GM-4	1.4	35-40	60-65	Yellow mosaic	Suitable for mono and

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed (days)	Reaction to disease and pest	Remarks
Pigeonpea	K-851	1.2		65-70	Yellow mosaic	intercropping systems
	GT-100	0.9	80-90	145-155	—	Suitable for sole crop and also for intercropping system with groundnut
Clusterbean	ICPL-87	0.9	75-85	134-145	—	-do-
	GG-1	1.0	46-54	85-90	—	Suitable for mono /
	HG-75	1.1	45-52	82-88	—	intercropping system in North Saurashtra and Kachch
Groundnut (bunch)	GG-2	3.5	24-29	100-105	—	Suitable for mono
	GG-5	3.7	25-30	101	—	and intercropping
	GG-7	3.9	25-29	100	—	systems
Groundnut Semi-spreading	GG-20	2.2	28-33	109	—	—
Groundnut Spreading	GAUG-10	2.1	29-34	110-120	—	Suitable as
	GG-11	2.2	31-37	111	—	sole crop
	GG-12	2.4	30-35	112-115	—	-do-
	GG-13	2.3	30-35	120	—	-do-
Sesame	G-Til-1	1.1	45	90	—	Suitable as sole crop
	G-Til-2	1.1	42	85	—	-do-
	Purva (semi-rabi)	0.7	55	115-120	—	Suitable for intermediate kharif – rabi season
Castor	GAUCH-1	1.53	55-60	210-260	—	Suitable for mono cropping and
	GCH-4	1.75	55-60	210-240	Wilt	also for intercropping system
	GCH-5	1.71	60-61	210-240	—	with groundnut recommended
	GCH-6	0.89	50-58	210-240		for north and middle Gujrat
	GC-2	7.92	45-50	150-180		and Saurashtra, Kachch area
Maize	G.Maize-2	4.42	50-55	75-80	—	—
	G.Maize-4	4.54	45-50	70-75	—	—

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Sorghum	8-1	45	15
Pearlmillet	3.75	60	15
Groundnut (bunch)	100	45	10
Groundnut (semi-spreading)	100	45	10
Groundnut (spreading)	80	60	10
Cotton	12-15	90	30
Castor	10	9	30/45
Greengram	20	30	10
Sesame	3	45	15
Pigeonpea	12-15	60	30

Nutrient management

Crop	Nutrients (kg/ha)		Mode of application
	N	P ₂ O ₅	
Groundnut	12.5	25	All basal
Sorghum	90	30	N in 3 splits 25% as basal + 50% at tillering + 25% at flag leaf stage or 2 splits 50% as basal and 50% at tillering
Pearlmillet	80	40	N in 2 splits 50% as basal + 50% at tillering or nitrogen in 3 splits 25% as basal + 50% at tillering + 25% at flag leaf stage
Cotton (G-Cot-10)	40	0	In 2 splits, half as basal + half as 45-50 days after sowing
Cotton (V-797 & CJ-73)	25	25	All basal
Sesame	25	25	-do-
Castor	40	40	-do-
Greengram	20	40	-do-
Pigeonpea	20	40	-do-

Crop	Nutrients (kg/ha)		Mode of application
	N	P ₂ O ₅	
Sorghum (fodder)	50	30	N in 2 splits half as basal + half at 30 days after sowing
Soybean	30	60	N as basal
Blackgram	20	40	All basal
Maize (fodder)	60	0	N in 2 splits 50% as basal + 50% at 30 days after sowing + farm yard manure 10 t/ha

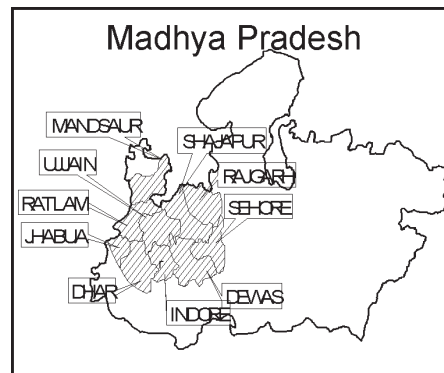
Suitable cropping systems

- Groundnut + castor (3:1)
- Groundnut + pigeonpea (3:1)
- Groundnut + sesame (AHT –60 / GUJ.TIL –1)
- Cotton (Pusa Phalguni) (paired rows) + greengram (G-2)
- Pearlmillet + pigeonpea (4:1/2:1)
- Pearlmillet + kidney bean
- Pearlmillet should be grown in paired rows (40 cm apart) with spacing of 30 cm X 15 cm between two rows of pigeonpea

3.2. Soybean based Production System

3.2.1. *Kharif – Rabi Semi – Arid* Medium to Deep Vertisols in Malwa Plateau Zone of Madhya Pradesh

Recommendation domain: Comprises the districts of Dhar, Indore, Ujjain, Dewas, Ratlam, Rajgarh, Mandsaur, Jhabua, Sehore and Shajapur in Madhya Pradesh



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	-	Weeding and P.P. in Chickpea, Safflower and Mustard Crop	
February	-	P.P. in Chickpea, Safflower and Mustard Crop	
March	-	Harvesting and Threshing of Chickpea and Mustard	
April	-	Harvesting and Threshing of Wheat and Safflower	
May	-	Deep Ploughing of the Field and S.W.C. Measures.	
June	Sowing of Soybean, Pigeonpea-ICS, in 6:3 Row Ratio with JS-335 and JA-4 Maize-Navjot, NLD, Pigeonpea-ICPL-8863, ICPL-88039, Green Gram-Poosa Baisakhi, J.M.-721 Black Gram- IU-8-6, Pant U-30 Sorghum-JJ-938, CSH-18 Fodder Crops- Sudan Chari.	Precurement of Inputs for Kharif, Application of Organic Matters in the Field & Tillage Operation Application of Pre-emergence weedicide and sowing of all Kharif	
July	Sowing of Soybean, Pigeonpea-ICS, in 6:3 Row Ratio with JS-335 and JA-4 Maize-Navjot, NLD, Pigeonpea-ICPL-8863, ICPL-88039 Sorghum-JJ-938, CSH-18. Fodder Crops- Sudan Chari.	Application of Pre-emergence weedicide and sowing of all <i>Kharif</i> Crops. Application Post-emergence weedicide, Interculture Operations, Weeding and Earthing etc.	
August	Sunflower-Morden Sesame-JT-21, JT-55 Cowpea-Pusa Komal	Intercultural Operations and Spraying of Pesticides in all the <i>Kharif</i> Crops as and when needed.	
September	Sunflower-Morden,	Sowing of Chickpea for Green pods. Spraying	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	Chickpea-ICCV-2, JG-412 Torla- T-9, JT-1 Safflower-JSI-97, JSF-73	of Pesticides in all the <i>Kharif</i> Crops as and when needed. Harvesting of Early varieties of Greengram, Blackgram, Soybean and Maize.	
	Chickpea-JG-218, JG-412,Vijay Mustard- Varuna, Pusa Bold Safflower-JSI-97, JSF-73 Wheat- Sujata, HI-1500, HW-2004 Lentil- K-75, JLS-1	Harvesting and Threshing of <i>Kharif</i> Crops. Tillage Operation and Sowing of <i>Rabi</i> Crops.	
November	Chickpea-JG-218, JG-412,Vijay Wheat- Sujata, HI-1500, HW-2004	Tillage Operation and Sowing of Chickpea and Wheat where pre-sowing irrigation is available.	
December	Chickpea	If pre-sowing irrigation or winter rains received. Spraying of Post-emergence Weedicide in Wheat. Spraying of Pesticide in other Crops as and when needed.	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	-	Tillage Operations	
	II Fortnight	Sowing of Soybean-J.S. 9305 Sorghum-C.S.H-18 Maize- Navjot Soybean-P.P.-ICS Marigold and Leafy Vegetables	Sowing and Gap Filling	Transplanting of Marigold & Sowing of Hy.Beans
July	I Fortnight	-Do-	Sowing & Interculture Operations	
	II Fortnight	Maize-Sathi,Jam-8 Pigeonpea-ICPI-87119, Cowpea-Pusa Komal, Castor-Gauch	Sowing & Interculture Operations	
August	I Fortnight	Sunflower-Morden Sesame-J.T.-21 Cowpea-Pusa Komal Fodders Crops	Sowing & Interculture Operations; Earthing, Safe disposal excess rain water from field.	
	II Fortnight	Sunflower-Morden Sesame-J.T.-21 Cowpea-Pusa Komal Fodders Crops	Sowing & Interculture Operations; Earthing, Safe disposal excess rain water from field.	
September	I Fortnight	Sunflower-Morden Amaranthus-Co.-1 Fodder Crops- Barley, Oat	Sowing & Interculture Operations	
	II Fortnight	Safflower-J.S.F.-73 Torla- T.-9	Sowing & Interculture Operations	Recycling of Rainwater for sowing of Crops as pre-sowing Irr.

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
October	I Fortnight	Safflower-J.S.F.-73 Chickpea-J.G.-218, 315 Lantil- Sehore-37 Mustard- Varuna	Sowing & Interculture Operations	Recycling of Rainwater for sowing of Crops as pre-sowing Irri.
	II Fortnight	Safflower-J.S.F.-73 Chickpea-J.G.-218, 315 Lantil- Sehore-37 Mustard- Varuna	Sowing & Interculture Operations	Recycling of Rainwater for sowing of Crops as pre-sowing Irri.

Recommended *Rabi* Contingency plans for absence or delayed rains or failed kharif

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Chickpea-JG-218,JG-412, Mustred- Pusa Bold	Tillage Operation and Sowing	
	II Fortnight	Chickpea-JG-218, JG-412,	Tillage Operation	
November	I Fortnight	Chickpea-JG-218, JG-412,	and Sowing	Sowing of Chickpea under rainfed condition is possible if winter rains received or pre-sowing irrigation is available
	II Fortnight	Chickpea-JG-218, JG-412,		
December	I Fortnight	-	-	-
	II Fortnight	-	-	-
January	I Fortnight	-	-	-
	II Fortnight	-	-	-

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Soybean	JS-335	2.5-3.0	35	98-102	Tolerant to mosaic, Resistant to bacterial pustules and blight	Violet flower, very small & sparse pubescence on stem and leaves, glabrous pods, yellow testa, blackish hilum, semi- determinate plant type
	JS-71-05	2.0-2.5	30	90-95	Resistant to Bacterial pustules <i>Myrothesium</i> and Anthracnose	Violet flower, very small & sparse pubescence on stem and leaves, glabrous pods, light black hilum, dwarf and determinate plant type
	JS-90-41	2.5-3.0	30	87-98	Tolerant to Water stagnation	Violet flower, tiny pubescence greenish yellow testa lanceolate leaves, four seeded pods, blackish hilum, semi-determinate plant type
Samrat (local)		2.5-3.0	28	85-90	Susceptible to	

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Monetta		2.0-2.3	30	80-85	mealy bug —	Suitable for intercropping.
NRC 7 (Ahilaya-3)		2.5-3.5	35	90-99	Resistant to leaf biting insects	Violet flower, gray pubescence, brown hilum, yellow testa, determinant plant.
Maize JM 8 (Composite) JM 12		4.7-5.0	55	90-95 85-90	— —	Tolerant to drought
Navjot		4.5-5.0	55-60	90-95		Tolerant to drought
Chandan-3		4.5-5.0				
Chandan		4.5-5.0				
Safed-2		4.5-5.0				
NLD		4.5-5.0				
Maize Ganga-5 (hybrid) Deccan-101		5.0-6.0	60	90-100 110-115	Tolerant to stem borer	Suitable for intercropping
Deccan-109		5.0-6.0				
KH-510		5.0-6.0				
Pigeonpea JA-4		1.8	80	165-175	Tolerant to wilt	Medium tall, semi spreading in determinant, brown red seed, test weight 9.5g.
	ICPL-87	2.0	6.0-6.5	130-150	Tolerant to wilt, Susceptible to pod borer	Short stature, determinant, brown streaks in pods, brown seed, test weight 9.5 to 10 g
	No.148	1.7	9.0-9.5	180-185	Susceptible to wilt	Medium tall, semi spreading indeterminate, brown red and oval seed, test weight 9 to 9.5g
	JK-7	1.8-2.0	110+	180-190	Tolerant to wilt and pod borer	Tall statured plant, dark brown and round seed.
	Pusa -33	1.7	62	130-135	—	Short stature and indeterminate
	ICPL-151 (Jagrati)	2.0	60	120-130	Resistant to wilt	Short stature and determinate
	ICPL-87119 (Asha)	2.0-2.1	110	195-200	Resistant to wilt/ Sterility mosaic	Medium tall, semi compact and semi determinate
Sorghum (hybrid)	CSH-6	3.3-4.0	65	95-115	Moderately	Suitable for intercropping
	CSH-9		70	110-115	Resistant to all	
	CSH-14		65	95-100	leaf spot diseases,	
	CSH-18		70	115-120	Resistant to Shoot fly/ stem borer	
Sorghum (variety)	JJ-741	3.0-3.5	68	100-105		Excellent Bread
	JJ-938		70	110-115		(chapati) making
	JJ-1041		70	110-115		quality. Suitable for
	SPV-1022		65	90-100		fodder also
Greengram	JM-721	0.8-1.0	25-28	65-70	Moderately tolerant to leaf spot and	Medium size pods in clusters on top, dull green colour of seed

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Blackgram	K-851		25-28	60 to 65	powdery mildew Susceptible to leaf spot and powdery mildew	with 25 to 28 g per 1000 seeds Long size pods, shiny green colour of seed, medium bold with 30 g per 1000 seeds
	Pusa-16	0.8-1.0	25-28	60-70	—	Shiny green colour
	Pusa-105	0.8-1.0	25-28	60-65	—	of seed, medium
	Pusa-9531	0.9-1.0	28	60-65	Tolerant to yellow mosaic	bold
	Khargone-1	0.7-0.8	28	60-65	—	
	T9	1.0-1.2	30	70-80	Susceptible to powdery mildew	Medium light black seed, 35 g per 1000 seeds
	Khargone-3	0.8-1.0	30	85-90	—	Tall spreading plant, bold black seed 42 g per 1000 seeds
	JU-2	1.3	28-30	65-80	—	Medium shining black seed, 33 g per 1000 seeds
	JU-3	1.0-1.2	30	70-75	—	Medium shining black seed, 38 g per 1000 seeds
Sunflower (varieties)	Morden	0.7-0.8	40-45	80-90	Semilooper, white fly and <i>Heliothis</i> are common pests	
	Surya	0.8-1.0		90-100		
Sunflower (hybrid)	KBSH-1	1.5-1.6		90-95		
	MSFH-17	1.2-1.5		90-95		
	Jwalamukhi	1.8-2.0		85-90		
Safflower	JSI-7	1.3-1.4	85-90	140-145		Non-spiny,
	JSI-73					Non-spiny,
	JSF1	1.4-1.5	85-90	140-145		Spiny
	JG-315	1.5	45-50	110-115	Wilt resistant	120-125 g per 1000 seeds
Chickpea	JG-74	1.5-1.8	50	120-125	Wilt resistant	150 g per 1000 seeds
	JG-218	1.8	45	115-120	Wilt tolerant	180-200 g per 1000 seeds
	JG-322	1.8	45-50	110-120		130 g per 1000 seeds
	Ujjain-21	1.8-2.5	40-45	110-115	Wilt tolerant	150 g per 1000 seeds
	Ujjain-24	1.8-2.5	50-55	115-125	Wilt tolerant	120 g per 1000 seeds
	ICCV-2	1.0-1.2	30-35	85-90	Wilt tolerant	140 g per 1000 seeds
	ICCV-37	1.0-1.2	40	95-100	Wilt tolerant	125 g per 1000 seeds
Mustard	Varuna	1.0-1.2	45-50	115-125	Tolerant to powdery mildew	—
	Pusabold	1.0-1.2		125-135		
	Kranti	1.0-1.2		130-135		
Linseed	Kiran	0.8-1.0	65-70	130-140	Wilt tolerant.	Blue flower
	R-552	1.0-1.2		120-125	Susceptible to alternaria.	White flower
	Jawahar-23	1.0-1.2		120-125		Blue flower
	R-17	1.0-1.2		115-125	Wilt resistant. Resistant to rust and gallfly	
Wheat	Sujata	1.5-1.8	70-75	130-35		Aestivum
	C-306	1.5-1.8				Aestivum
	HW-2004	1.5-1.8				Aestivum
	JWS-17	1.5-1.8				Aestivum
	HD-4672	1.5-1.8				Durum

Seeding rate and planting pattern

Crops	Seed rate (Kg/ha)	Planting pattern (cm)		Time of sowing
		Inter row	Intra row	
Soybean	80 - 100	30 - 40	5.0	25th June to 7th July.
Maize (composite)	18-20	60	20	Onset of monsoon
Maize (hybrid)	16-18	75	20	Onset of monsoon
Pigeonpea	18-20	45	15	Second week of June to Third week of July.
Sorghum (variety)	8-10	45	12-15	Second week to Third week of June after the receipt of rains
Sorghum (hybrid)	6-8	45	15-20	-do-
Greengram/ Blackgram	20-25	30	8-10	Last week of June to Second week of July
Sunflower variety)	10	45	30	Onset of monsoon to mid of
Sunflower (hybrid)	5-6	45	30	August
Safflower	20	45	15-20	Last week of September to last week of October.
Chickpea	80-100	30	10	First week of October.
Mustard	5-6	30	10	Mid September to mid October
Linseed	20-25	30	5	Mid September to mid October
Wheat	100	30		October end to first week of November

Nutrient management

Crops	Nutrient (kg/ha)				*Remarks
	N	P ₂ O ₅	K ₂ O	S	
Soybean	30-40	40	20	20-40	Basal
Maize (composite)	80	60	20	—	50 % N as basal and 50 % in two splits at knee high and tasseling
Maize (hybrid)	100	60	40	—	Basal
Pigeonpea	20	60	20	—	50% N as basal and 50% after
Sorghum (varieties)	80	40	20	—	25-30 days after sowing
Sorghum (hybrid)	120	60	40		Basal
Greengram	20	50	0	20	Basal
Blackgram	20	50	0	20	Basal
Sunflower (varieties)	60	40	20	20	50% N as basal and 50% after
Sunflower (hybrid)	80	40	20		25-30 days after sowing
Safflower	40	40	20	—	Basal
Chickpea	20	40	0	—	Basal
Mustard	40	20	20	20	Basal
Linseed	40	40	20	—	Basal
Wheat	30-40	20	10	—	Basal

Suitable cropping systems**For shallow black soils**

- Only *kharif* cropping of soybean (about 90 days duration), blackgram (about 70 days duration), and maize (for cobs).

For medium deep black soils

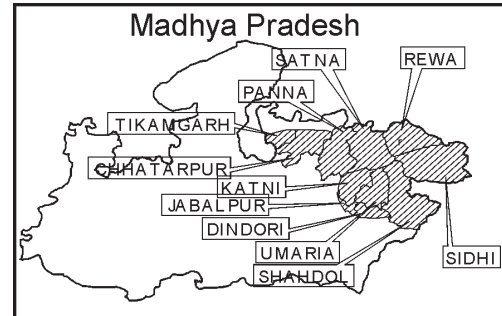
- Intercropping of soybean + pigeonpea (4:2), and sorghum + pigeonpea (2:2) is recommended.

For deep black soils

- Intercropping systems as above may be adopted. Where moisture regime in soil at sowing time of *rabi* crops is favorable, sequential cropping should be preferred. The productive and remunerative sequential systems are:
- Soybean in *kharif* – safflower/ chickpea in *rabi*
- Maize/ sorghum in *kharif* – chickpea/ safflower in *rabi*
- Greengram/ blackgram in *kharif* – safflower/ chickpea in *rabi*

3.2.2. *Kharif Rabi* Sub – Humid Medium Deep Vertisols in Keymore Plateau and Satpura Hill Zone of Madhya Pradesh

Recommendation domain: Comprises Satna, Sidhi, Shahdol, Umaria and Panna districts, North Eastern parts of Katni, Jabalpur and Dindori districts and Southern parts of Tikamgarh and Chhatarpur district of Madhya Pradesh.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January		Nil	
February		Nil	
March		Harvesting and threshing of <i>Rabi</i> crops.	
April		Harvesting and threshing of <i>Rabi</i> crops.	
May		Nil	
June		Nil	
July	Soybean, Paddy, Soybean +Arhar	Field preparation, sowing of crops, weeding	
August		Weeding and hoeing, Insect & Pest management	
September		Insects & Pest management, if appear harvesting & Threshing of <i>Kharif</i> crops.	
October	Lentil, Linseed, Chickpea, Wheat	Field preparation& sowing of the crops. Harvesting & Threshing of late <i>kharif</i> crops	
November	Lentil, Linseed, Chickpea, Wheat	Field preparation& sowing of the crops and weed management in sown crops.	
December		Nil	

Recommended *Kharif* / Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	Soybean pigeon pea inter cropping	recommended package of practices timely sowing with improved varieties	
	II Fortnight	Soybean pigeon pea inter cropping	recommended package of practices timely sowing with improved varieties	
July	I Fortnight	Sowing of early maturing varieties as sole crop or intercropping	Increased seed rate with recommended use of fertilizer	
	II Fortnight	Sowing of early crop of inter cropping	Bukharing for weed control	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
August	I Fortnight	Sowing of black gram, moong and Til	Weed control operations	Sowing of Oil seed crops
	II Fortnight	Use 100 kg Paddy seed under Lehi method	Adoption of improved technology	
September	I Fortnight	Deep ploughing by Bukhar for weed control	Weed control	
	II Fortnight	Adoption of water harvesting technology	Inter culture by hand hoe and use of FYM for increasing WHC	
October	I Fortnight	Use of water conservation practices	Land preparation for <i>Rabi</i> crops	
	II Fortnight	Practices		

Recommended *Rabi* Contingency plans for absence or delayed rains or failed *Kharif*.

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
October	I Fortnight	Sowing of Oil seed crops	Preparation of land	Use of proper seed & fertilizers
	II Fortnight	Intercropping of wheat +chickpea	Inter culture practices	-
November	I Fortnight	Intercropping of wheat +chickpea	Inter culture practices	-
	II Fortnight	Sowing of crops must be completed under rainfed conditions	weeding through hoe	-
December	I Fortnight	Sowing must be completed under rainfed conditions	Inter culture practices	-
	II Fortnight	-	use of plant protection measures	-
January	I Fortnight	-	-	-
	II Fortnight	-	-	-

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease and pest & stress condition	Remarks
Upland rice	Prasanna (IET 7564)	2.0	53	90	Blast resistant also resistant to moisture stress	Good quality suitable sequential cropping
	Kalinga 3	2.5	58	90	Resistant to blast	Good to medium quality rice
	Govinda	3.0	90	115	Tolerance to drought	Medium quality rice
	IR-50	2.5	80	105	Resistant to leaf blast and white backed plant hopper	Good quality rice
	JR 3-45	2.5	67	93	Resistant to stem borer, moderate resistant to blast	hopper Suitable for sequential cropping
	Vandana	1.80	65	95	Tolerant to bacterial leaf blight, leaf blast and moisture stress	Suitable for sequence cropping
Lowland rice	JR 353	3.5	90	115	Drought tolerance	Suitable for lai parching
	IR 64	4.0	90	115	Resistant to blast, white hoper also	—
	Jaya	4.5	105	140	For limited irrigation	Bold seeded
	Kranti	4.5	105	—	—	Suitable for all paddy areas
	Mahamaya	4.5	110	135	Resistance to Gall midge	For low land
	Kbasmati	3.0	100	125	Susceptible for	Fine export quality

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease and pest & stress condition	Remarks
Soybean cropping germination	JS 335	1.6	58	105	Ghundi bug	scented rice
		JS 72-44	2.0	68	Resistant to disease blight 110	Suitable for double Moderately resistant High
	JS 80-21	2.4	60	107	to yellow mosaic	capacity
	JS 90-41	2.2	58	90	Resistant to bacterial blight	Good germination capacity
	—	—	—	—	—	—
Sorghum (hybrid)	CSH 5	5.0	87	115	Produce protected grains which will not be damaged due to rains	Suitable for entire state
	CSH 6	4.5	85	110	-do-	-do-
	CSV 4	3.5	90	115	-do-	Suitable for heavy soils and rainy areas
Sorghum (desi)	Vidisha 60-1	2.5	120	150	Susceptible for attack of cob caterpillar	Suitable for Malwa region
Kodo millet	JK 155	2.9	65	90	Resistant to head smut and shootfly	Suitable for skeletal soil
	JK 76	2.2	62	85	Tolerant to head smut and shootfly	Suitable for rainfed
	JK 136	2.2	70	105	-do-	Suitable for intercropping
Kutki	Jawahar Kutki 1	0.8	50	75	Free from pest and disease	Suitable for rainfed and marginal soils
	J.Kuthi 2	0.8	50	72	—	—
	J.Kutki 8	1.0	45	75	Resistant to shootfly	Suitable for rainfed and marginal soils
Maize	Chandan 2	2.5	48	75	Resistant to blight	Suitable for Chhatisgarh
	Chandan 3	6.0	62	95	—	—
	Ganga 5	6.5	80	110	—	Plants are strong
Pigeonpea	Asha (ICPL 87)	1.8	130	180	Resistant to sterility mosaic virus	Suitable for rainfed upland areas
	NP (WR) 15	2.0	200	240	Wilt resistant	Suitable for intercropping
	JA 4	2.0	160	200	—	Suitable for rainfed
Blackgram	DU 4	1.8	55	80	Resistant to yellow mosaic	Suitable for rainfed upland area
	JU 2	1.2	40	75	Susceptible to yellow mosaic	Suitable for intercropping
	T-9	1.2	50	80	—	Suitable for sequence cropping
Greengram	K 851	1.2	40	70	Tolerant to yellow mosaic	Synchronous maturity suitable for summer sowing
	JM 45	1.2	45	75	-do-	—
	Pusa Baisakhi	0.6	32	60	—	Suitable for arid areas
Sesame	JT 7 (Kanchan)	1.1	60	85	Resistant to leaf spot disease	Suitable for arid areas
	Jawahar	0.95	42	66	Resistant to cercospora leaf spot	Suitable for rainfed areas
	Sesame 21	—	—	—	—	—
Groundnut	Jawahar Jyoti	2.5	—	100	—	Suitable for MP
	Exotic 1-1	2.5	—	105	—	Suitable for north region
	Jawahar-2	—	—	—	—	—
Sunflower	BSH-1	1.4	70	95	Rust resistant	—
	Morden	1.0	67	90	—	Suitable for multiple cropping

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease and pest & stress condition	Remarks
Wheat	JW 17 irr	2.0	90	120	Rust resistant and tolerant to rust	Suitable for rainfed areas and partially irrigated areas
	C 306	2.5	90	120		
	GW 173	2.0	85	110		
Chickpea	JG 315	4.0	90	125	Rust resistant	Suitable for late sowing
	JG 322	1.4	90	125	-do-	Suitable for timely sowing
Linseed	J 23	1.8	85	125	Wilt resistant	White flowers
	R 552	1.2	82	120	Susceptible to gall midge	Blue flower suitable for rainfed farming
Lentil	JL 1	1.5	90	120	Wilt resistant	Bold seeded
Safflower	JSF 1	1.5	96	135	Rust resistant	Suitable for arid area
	JSF 7	1.3	90	130	-do-	-do-
Barley	K 603	3.5	72	118	Resistant to disease and pest	Suitable for rainfed area
	K 560	3.6	75	120	-do-	-do-
Lathyrus	LSD 1	1.8	75	115	Tolerant to powdery mildew	Suitable for rainfed area with low BOA content
Mustard	Pusa bold	1.8	108	135	Susceptible to aphid attack	Bold seeded
	Varuna	1.5	90	125	Susceptible to aphid attack	Suitable for late sowing

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Rice (drilled)	100	20	5
Soybean	100	30	8
Sorghum	12	45	15
Kutki	6	30	5
Maize	20	45	15
Pigeonpea	25	60	20
Blackgram	20	30	8
Greengram	20	30	8
Sesame	5	30	8
Groundnut	100	30	8
Sunflower	20	45	10
Wheat	100	25	5
Chickpea	80	25	5
Linseed	25	25	5
Lentil	25	25	5
Safflower	20	30	8
Barley	100	25	5
Lathyrus	30	30	8
Berseem	30	15	5
Mustard	6	30	8

Nutrient management

Crop	Nutrients (kg/ha)		Mode of application
	N	P ₂ O ₅	
Rice	40	40	If rainfall is low – all P basal and N in splits, 1/2 at tillering and 1/4 at panicle initiation. If rainfall is good, 80 kg n three splits viz., 1/4 at sowing, 1/2 at tillering and 1/4 at panicle initiation
Groundnut	10	25	All basally placed
Wheat	40	40	All basal. To be placed in the moist zone at sowing
Chickpea	20	40	All basal. To be placed in the moist zone at sowing
Sorghum (desi)	40	40	Full quantity of P ₂ O ₅ and half dose of N should be applied at sowing and rest half of N after first weeding
Sorghum (hybrid)	80	60	Full quantity of P ₂ O ₅ and half dose of N should be applied at sowing and rest half of N after first weeding
Maize (desi)	40	40	Full quantity of P ₂ O ₅ and half dose of N should be applied at sowing and rest half at N after first weeding
Maize (hybrid)	80	60	Full quantity of P ₂ O ₅ and half dose of N should be applied at sowing and rest half at N after first weeding
Kodokutki	20	20	Full dose of fertilizer should be applied at sowing
Pigeonpea	20	40	All basal application
Blackgram	20	40	All basal application
Greengram	20	40	All basal application
Soybean	20	50	All basal application
Sunflower (<i>kharif</i>)	80	40	Half N + full P ₂ O ₅ as basal and half N after first weeding
Sunflower (<i>rabi</i>)	40	40	All basal application
Barley	40	40	The fertilizer should be applied at sowing preferably with Dufan (seed cum fertilizer drill below the seed). This method enhances the yield by 20 percent.
Lentil	20	40	
Linseed	40	30	
Mustard	40	30	

Suitable cropping systems**Arable**

- Agri-horticulture: Fruit crops (mango/ guava/ amla) + field crops (wheat, barley, pulses and oilseeds)

Upland

- Rice upland (JR3-45) – wheat (c-306)
- Soybean (J-335) – wheat/ chickpea (JG-315)

Monocropping

- Pigeonpea [NP (WR) 15] planted commonly in the farmers field

Sequence cropping

- Rice – wheat
- Rice – chickpea
- Soybean – wheat
- Soybean – chickpea

Intercropping

Kharif

- Sorghum + pigeonpea (2:1)
- Soybean + pigeonpea (2:1)

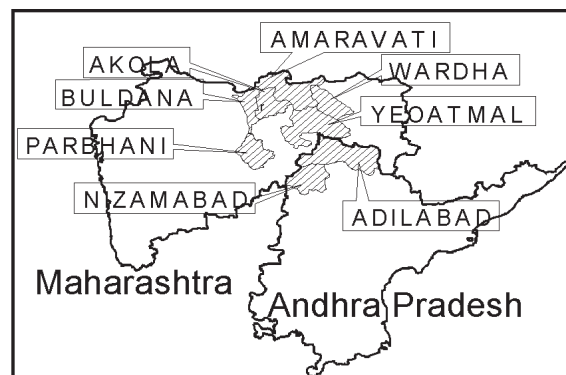
Rabi

- Wheat + chickpea (2:1)
- Wheat + mustard (2:1 or 4:2)
- Chickpea + linseed (2:1)

4. Cotton based production system

4.1. *Kharif* /Semi – Arid Vertic Inceptisols / Vertisols in Central Maharashtra Plateau Zone of Maharashtra

Recommendation domain: Comprises Akola, part of Amravati, Wardha, Parbani, Buldana, Yeotmal, east and west Khandesh districts of Maharashtra.



Recommended Crop(s) and Cultural Calendar for a normal season

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	Crops be considered as per Sr.No.2.8.1	Seed rate be increased by 20 to 25% Spacing be reducing fertilizer dose be reducing to the tune of 20 to 30% Short duration varieties be preferred for assured productivity	
	II Fortnight	Intercropping be taken only in medium to heavy soils		
July	I Fortnight			
	II Fortnight			
August	I Fortnight			
	II Fortnight			
September	I Fortnight			
	II Fortnight			
October	I Fortnight			
	II Fortnight			

Recommended *Rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Not applicable		
	II Fortnight			

Contingent Planning

Normal Monsoon

- The monsoon starts from 24th metrological week.
- Light soils (depth 20 to 35 cm)
 - Graded bunding of lands
 - Growing of strips of erosion resistant (greengram – Kopergaon/ blackgram – T-9) in the upper half of the plot and sorghum (CSH-9) in the lower half of the plot.
- Medium deep soils (35 to 75 cm depth)
 - Cotton AKH 84635 with greengram (Kopergaon) as an intercrop in 1:1 to row ratio
 - Sorghum CSH-9 with intercrop of greengram/ blackgram in 1:1 row ratio.
 - Groundnut intercropped with sunflower in the row ratio of 6:2 (Groundnut: JL-42, Sunflower - Morden)
- Deep soils (>75 cm depth)
 - Cotton - interspecies cultivation of *hirsutum* cotton AKA-7 with AKH 4
 - Hybrid cotton AKH 4
 - Sorghum CSH-9/ CSH-5 intercropped with pigeonpea (C-11) in 6:2 row ratio

Delayed onset of monsoon by 15 days

If the rains start by end of June the sowing may start in the first week of July. The following changes should be made in the cropping plans.

- Area under cotton be reduced and replaced by sorghum.
- Sowing of sorghum should be completed before 10th July. Sorghum CSH-1 variety is sown instead of CSH-5/ CSH-9.
- Area under greengram /blackgram should be replaced by early pigeonpea varieties such as ICPL 8863 or ICPL 87119
- Area under groundnut be reduced and replaced by sunflower (EC 68414)

Normal monsoon followed by long gaps

- Wherever possible, life – saving irrigation be given
- Cotton can sustain some stress, but sorghum, groundnut; Chickpea are not able to sustain such stress. Therefore use of some conditioner such as spray of urea, not exceeding to 2 percent concentration, may be useful.
- If there is a total failure of crop, sowing of photo-intensive crops such as pearl millet (BJ-104) or sunflower (EC- 68414) may be attempted.
- In deep soils, the land may be tilled properly, in case; *Kharif* crop fails, to follow *rabi* crop safflower (Bhima), pigeonpea (C.11) in September.

Extended monsoon

- Advantage of this situation is exploited for double cropping with safflower and chickpea; Safflower (No.7) may be sown after sorghum till 15th October. Beyond 15th October Chickpea may be sown.

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed (days)	Reaction to disease and pest	Remarks
Cotton	AKH 84635 (PKV Rajat)	1.3	73	170-180	—	Suitable for intercropping
	AKH 081	1.1	55	150-160	—	-do-
	AKHA 8401	0.9	78	200-210	Resistant to wilt	-do-
	AKA 5	0.8	68	120-180	Resistant to black arm. Tolerant to grey mildew and jassids	Tolerant to drought. Suitable as pure crop
	AKA 7	1.1	63	140-150	Resistant to wilt	Suitable for intercropping
	AKH-4	0.8	73	180-190	Resistant to black arm. Tolerant to grey mildew and jassids	Tolerant to drought. Suitable for intercropping
Sorghum	CSH 5 2.5		70	115	Susceptible to stem borer, shoot fly, midge fly, charcoal rot and ergot. Moderately tolerant to headmold (escapes charcoal rot in early sowing)	Good grain quality
	CSH-9 3.0-3.5		70	115		Suitable for intercropping
	SPV-102 3.1		72	117	Susceptible to midge fly, head-mold and ergot. Moderately tolerant to charcoal rot. Tolerant to shootfly and stem borer	Good grain Suitable for cropping
Pigeonpea	C-11 1.2		115	190-200	Moderately Tolerant pod borer. Resistant to <i>Fusarium</i> wilt	Suitable for heavy soils
	Asha (ICPL 1.2 87119)		11	180-200	Resistant for wilt and sterility mosaic	-do-
	Maroti (ICPL 8863) 1.0		90	165-170	Resistant to wilt	-do-
Greengram	Kopergaon 0.7		35	65	Moderately susceptible to root rot. Susceptible to powdery mildew	Good grain quality Suitable for sole cropping
	TARM 18 0.9		35	68	Resistant to powdery mildew	Bold seeded and suitable for sole cropping
	AKM 8803 0.9		40	65	Moderately susceptible to powdery mildew	Good grain quality Suitable for sole cropping
Blackgram	TAU-1 0.8-1.0		40	70	Tolerant to powdery mildew	Bold seeded and high yielding
Groundnut	JL-24 1.8		25-27	90-100	Moderately susceptible to tikka. Susceptible to leaf miner and aphids. Moderately resistant to rust and <i>Colletotrichum</i>	Suitable for sole cropping
	SB-11 1.0		30-32	100-105	Susceptible to leaf minor and aphids. Moderately resistant to rust, fairly resistant to tikka and <i>Colletotrichum</i>	Suitable for sole cropping
Sunflower	EC 68414	0.9	50-55	85-95	Susceptible to jassids. Fairly	—

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed (days)	Reaction to disease and pest	Remarks
Safflower	PKVSH-27	1.4	45-50	80-85	—	Hybrid
	PKVSF-9	1.0			—	High yielding
	N-7	0.9	75	140	Susceptible to aphids. Moderately resistant to powdery mildew, <i>Alternaria</i> leaf spot and wilt complex	Widely adopted
	Bhima	1.5	70	130	Susceptible to aphids	

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Sorghum	10	45	15
Pearlmillet	4	30	15
Cotton	10	120/90	30/60
Groundnut	100* (Kernels)	30	10/15
Pigeonpea	10	60	30

If planted beyond 10th July more and rate is required

Nutrient management

Crop	Nutrients (kg/ha)			FYM (t/ha)	Mode of application
	N	P ₂ O ₅	K ₂ O		
Sorghum	80	40	—	—	Placement
Cotton	60-90	60	50	10-15	N— in three splits (1/2 at sowing + 1/4 at squaring + 1/4 at flowering)

Suitable cropping systems

Sequence cropping

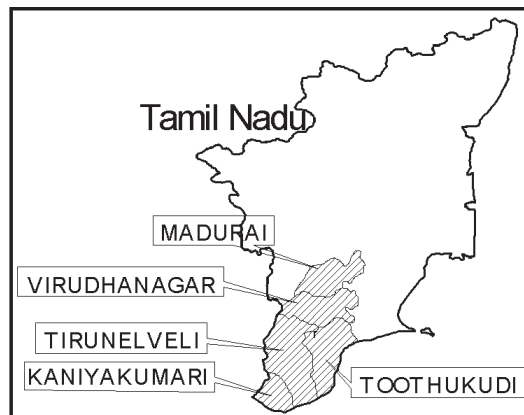
- Greengram (Kopergaon) – safflower (N.7, Bhima)
- Sorghum (CSH-9) – safflower (N.7, Bhima) If late rains are received.

Intercropping

- Cotton AKA-7 uniform (60 x 30 cm) or paired (40 - 80 cm) + greengram (Kopergaon) in inter rows of cotton
- Cotton AKH 84635 (uniform sowing) + greengram/ blackgram/ soybean in 1:1 row proportion
- Cotton + sorghum + pigeonpea + sorghum (CSH-9) in 6:1:2:1 row ratio
- Sorghum (CSH-9) + greengram (Kopergaon) in paired planting (30-60 cm)
- Sorghum (CSH-9) + blackgram (TAU-1) in paired planting (30-60 cm)

4.2 *Late Kharif-Rabi* Semi arid Deep Vertisols in Southern Zone of Tamil Nadu

Recommendation domain: Comprises Toothukudi, Tirunelveli, Madurai, Virudhanagar and other southern districts of Tamil Nadu.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Pulses	Harvesting, threshing and grain storage at 10 to 12 percent moisture	
	Sorghum	Harvesting, threshing and grain storage at 10 to 12 percent moisture	
	Cotton	Plant protection and first picking of cotton	
February	Cotton	Picking cotton kapas in the morning hours and storage	
March	Cotton	Picking cotton kapas in the morning hours and storage	
April	-	Summer ploughing with disc plough for rain water harvesting	
May	-	Summer ploughing with disc plough for rain water harvesting	
June	-	Harrowing with cultivator	
July	-	Harrowing with cultivator	
August	-	Harrowing with cultivator	
September	1. Cotton (KC2) + Blackgram (Co 5, VBN 3) 2. Sorghum (K8) + Cowpea (P 152) 3. Pure pulses (Blackgram-Co 5, VBN 3) (Greengram-Co 6, VBN 2)	Seed hardening and seed treatment with fungicides and sowing during last week of September under premonsoon conditions.	
October	Monsoon crops 1. Cotton (KC2) + Blackgram (Co 5, VBN 3)	Monsoon sowing Thinning and first hand weeding of pre monsoon crops	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	2. Sorghum (K8) + Cowpea (P 152) 3. Pure pulses (Blackgram-Co 5, VBN 3), (Greengram-Co 6, VBN 2) Late monsoon crops Pearlmillet (ICMV 221), Sunflower (K1, K2, modern) and coriander (Co1,Co2) and Senna (KKM 1)	Plant protection measures for cotton Sowing of Pearl millet, sunflower, coriander and senna during late October	
November	Pearlmillet (ICMV 221), Sunflower (K1, K2), Coriander (Co1, Co2) and Senna (KKM 1) Pre-monsoon and monsoon crops	Sowing of sunflower, coriander and senna under of late monsoon situation Weeding in all crops Plant protection measures Foliar spraying of urea (1%) / DAP (2%)	
December	All crops	Plant protection measures	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations
No *kharif* season crops in this district under rainfed situation

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight II Fortnight			
July	I Fortnight II Fortnight			
August	I Fortnight II Fortnight	Does not arise	Does not arise	Does not arise
September	I Fortnight II Fortnight			
October	I Fortnight II Fortnight			

Recommended *Rabi* Contingency plans for delayed North East monsoon rains

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight II Fortnight	Pulses, Sorghum, Cotton Pearlmillet, Sunflower, Senna, Coriander	Sowing on receipt of normal monsoon rain. If the monsoon is delayed and received during II fortnight sowing will be taken up.	- -
November	I Fortnight II Fortnight	Sunflower, Coriander, Senna For all crops	Sowing can be taken up if rains delayed upto I fortnight of November Sowing could not be taken up after second fortnight of November as the crop will suffer moisture stress at reproductive stages.	- -

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
December	I Fortnight	For all crops	Weeding and plant protection for late sown crops.	-
	II Fortnight	For all crops	Weeding and plant protection for late sown crops.	-
January	I Fortnight	For all crops	Plant protection	-
	II Fortnight	For all crops	Plant protection	-

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Cotton	KC-2	0.7	90-95	150	Resistant to jassids	Suitable for September-October sowing
Sorghum	K-Tall	3.7	55-56	90	Moderately tolerant to stem borer	Suitable for September-October sowing
	K-8	2.4	60-65		Moderately resistant to stem borer and shoot fly	-do-
Fodder sorghum	K-3	1.7	60-65	90-95	—	—
Pearlmillet	K-2	2.0	45	80	Tolerant to downy mildew	—
	Co-6	2.0	50	90	—	—
	WCC-75	2.0		95	—	—
Maize <i>Kudiraivali</i> (fodder)	K-1	2.0	50-55	80-85	—	—
	K-2	2.0	55	90	—	—
Blackgram	Co-4	0.6	35	70	—	—
	Co-5	0.7	35-40	70-75	—	Suitable for intercropping
	K-1		40-45		Tolerant to mosaic	-do-
Greengram	Co-1	0.9	50-55	87	—	—
	Co-5	0.9	40-43	70-75	—	—
	KM-2	0.7	35	68	—	Suitable for intercropping
Pigeonpea	K-1	0.7		70-75	—	—
	Co-1	1.0	95-100	145	—	—
	SA -1	0.9		140	—	—
Cowpea	Co-1	1.2	45	80	—	Suitable for intercropping
	Co-3	1.3	40	75	—	-do-
	C-152	1.3		70-75	—	-do-
Fieldbeans	Co-1	1.0	50	100	—	—
	KPT-local	0.9	45	85	—	—
Sunflower	K-1	1.0	45	85	—	—
Sesame	TMV-3	0.6	45	80-85	—	—

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Cotton	20	45	30
Sorghum	10	45	15
Maize	15	45	15
Pearlmillet	6	45	15
Greengram	20	30	10
Cowpea	30	30	15
Sunflower	15	45	30
Sesame	5	30	30

Nutrient management

Crop	Nutrients (kg/ha)		Mode of application
	N	P ₂ O ₅	
Cotton	40	20	Basal
Sorghum	40	20	-do-
Pearlmillet	40	20	-do-
Pulses	40	20	-do-
Sesame	40	20	-do-
Sunflower	20	40	-do-
Fingermillet	40	20	-do-
Pigeonpea	20	40	-do-

Suitable cropping systems**Intercropping**

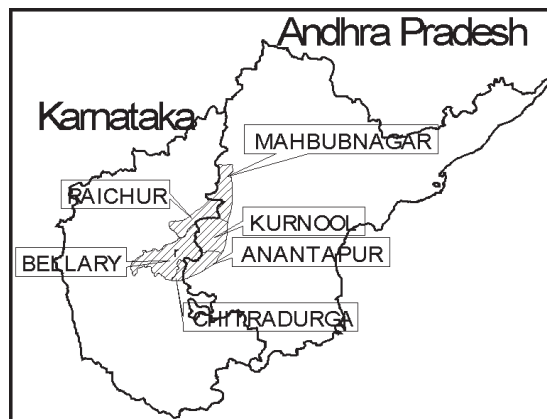
- Sorghum (K8) + cowpea (C.152) or pigeonpea in interspaces
- Cotton (KC.2) + blackgram (K1) or greengram (CO 5) in paired row system (2:1)
- Cotton + blackgram
- Cotton + coriander
- Cotton + clusterbean (2:1)
- Sorghum + cowpea
- Sorghum + blackgram
- Sorghum + greengram
- Sorghum + siratro (fodder) (1:1)
- Maize + greengram
- Pearlmillet + clusterbean

5. Nutritious Cereal based Production System

5.1. Rabi Sorghum based production system

5.1.1. *Rabi* Semi Arid Vertisols in Northern Dry Zone of Karnataka

Recommendation domain: Comprises parts of Chitradurga, Bellary, Raichur districts of Karnataka state and parts of Anantapur (black soils), Kurnool and Mahabubnagar (black soils) districts of Andhra Pradesh.



Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Sorghum	SPV-86	1.5-2.0	70	122	—	—
	M-35-1	0.5-1.0	70	124	—	—
	SPV-1341	2.0-2.5	65	110	—	—
Safflower	S.144	0.8	73	112	Susceptible to wilt under excessive moisture condition	Suitable for monocropping
	A.300	0.8	71	109	Susceptible to wilt under excessive moisture condition	Suitable for monocropping
	7-13-3	0.7-0.8	72	109	Susceptible to wilt under excessive moisture condition	Suitable for monocropping
Chickpea	A.1	1.0-1.1	32	76	—	—
	N-52	1.0-1.1	32	76	—	—
Beans (<i>Dolichos lab</i>)	CO.7	1.1	45	91	—	—
	CO.8	1.1	48	91	—	—

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
<i>Rabi</i> sorghum (M.35-1)	5-6	60-75	
Improved <i>rabi</i> hybrid and varieties (CSH.8R and SPV-86)	7-8		
Safflower	3.5-4.0	60-90	
Sunflower	3.5-4.0	60-75	
Fieldbean	15	60-75	
Chickpea	50	30-45	
Coriander + safflower (4:1)	50+2	30	

Nutrient management

Crop	Nutrients (kg/ha)		Mode of application
	N	P ₂ O ₅	
<i>Rabi</i> Sorghum	30	30	All basal drilled
Safflower	20	30	-do-
Chickpea	15	30	-do-
Fieldbeans	15	30	-do-

Contingent crop planning

Normal rains with timely onset of monsoon in September • Sorghum (SPV 86, CSH 7R/CSH 8R, : Complete sowing within one week after the

5-4-1), sunflower and fieldbeans (CO.7) receipt of first soaking rains.

- Safflower (A 300) : Complete sowing with 15-20 days after first soaking rains
- Chickpea (A-1, N-52) : Complete sowing within a month after soaking rains

Delayed onset of monsoon in October

Sorghum, fieldbeans and sunflower : Sow SPV 86 up to mid October. Beyond mid October, sorghum may be sown only for fodder. However sorghum M-35-1 may be sown for grain upto first fortnight of November

Safflower and chickpea : Sow up to early November and complete sowing within a fortnight after the receipt of first soaking rains

For failure of post-sowing rains in October

Thin every second or third row within 45 days depending on severity of stress in case of sorghum.

5.1.2. *Kharif-Rabi* Semi-Arid Medium /Deep Vertisols in Northern Dry Zone of Karnataka

Recommendation domain: Comprises Bijapur, Bagalkot, Gulbarga, Eastern parts of Belgaum, Lingsugur of Raichur districts of Karnataka and Southern parts of Maharashtra.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	1. Pearl millet <ul style="list-style-type: none"> ICTP-8203 ICMV-221 Maruti Asha TS-3 	<ul style="list-style-type: none"> Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	Rotate with pigeonpea
June	2. Groundnut <ul style="list-style-type: none"> TMV-2 R-8808 S-206 S-230 GPBD-4 	<ul style="list-style-type: none"> Treat the seeds with Captan/Thiram/Carboxyn @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. Use 125 kg seeds per ha Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) Applying 500 kg Gypsum at 30-35 DAS Open conservation furrows after every 8th row for moisture conservation Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner Spray Hexokonazol @ 1ml/litre or Carbandazim (0.5 g/ litre) for the control of leaf spot disease. 	Take up alternate crops such as Navane, Sunflower, Castor, Horsegram
June	3. Pigeonpea <ul style="list-style-type: none"> GS-1 BJ-221 Maruti 	<ul style="list-style-type: none"> Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm 	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	<ul style="list-style-type: none"> Asha TS-3 ICPC-87 	spacing <ul style="list-style-type: none"> Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. Control of Helicoverpa <ul style="list-style-type: none"> Spray Diiodcarb (0.6 g/litre) or propenophos (2ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering Spray NSKE @ 2 ml/litre as second spray Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	
June	4. Greengram <ul style="list-style-type: none"> Chinamung Pusa baisaki Sel-4 PS-16 TS-3 	<ul style="list-style-type: none"> Soak the seeds in CaCl_2 solution (2%) for 1 hour and dry under shade for 8 hours. Then treat the seeds with Azospirillum (500 g/ha seeds) and PSB (500 g/ha seeds) Sow 15 kg seeds/ha at 37.5 cm row spacing Apply 12.5:25 kg N and P/ha at the time of sowing 	After harvest of pods, incorporate the residues in the soil
June	5. Black gram <ul style="list-style-type: none"> T-9 TAW-1 	<ul style="list-style-type: none"> Soak the seeds in CaCl_2 solution (2%) for ½ hours and dry under shade for 8 hours. Then treat the seeds with rhizobium (375 g/ha seeds) Sow 15-20 kg seeds/ha at 30x10 cm spacing 	After harvest of pods, incorporate the residues in the soil
June	6. Pearl millet + Pigeonpea (2:1)	Same as per entire crop	
June	7. Pearl millet + Groundnut (1:3 or 2:4)	Same as per entire crop	
June	8. Pigeonpea + Groundnut (2:4 or 1:3)	Same as per entire crop	
July	1. Pearl millet <ul style="list-style-type: none"> ICTP-8203 ICMV-221 Maruti Asha TS-3 	<ul style="list-style-type: none"> Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P_2O_5) at the time of sowing. Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	Sow the crop before July 15
July	2. Bunch Groundnut <ul style="list-style-type: none"> TMV-2 R-8808 S-206 S-230 	<ul style="list-style-type: none"> Treat the seeds with Captan/Thiram/Carbaxyn @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. Use 125 kg seeds per ha Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. 	Sow the crop before July 15

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	GPBD-4	<ul style="list-style-type: none"> Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) Applying 500 kg Gypsum at 30-35 DAS Open conservation furrows after every 8th row for moisture conservation Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner Spray Hexokonazol @ 1ml/litre or Carbandazim (0.5 g/litre) for the control of leaf spot disease. 	Sow the crop before July 15
	3. Pigeonpea <ul style="list-style-type: none"> GS-1 BJ-221 Maruti Asha TS-3 ICPC-87 	<ul style="list-style-type: none"> Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. Control of Helicoverpa <ul style="list-style-type: none"> Spray Diodicarb (0.6 g/litre) or propenophos (2 ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering Spray NSKE @ 2 ml/litre as second spray Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	
July	4. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 DSH-1 RSFH-1 MSFH-17 SH-41 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	
July	5. Sesame <ul style="list-style-type: none"> E-8 DS-1 	<ul style="list-style-type: none"> Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) Treat the seeds with Captan/Thiram/Carbendazim (3 g/kg seeds) Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	<ul style="list-style-type: none"> Don't sow below 2.0 cm depth Land should be well prepared before sowing Don't sow beyond July

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	6. Navane • HMT 100-1 • RS-118	<ul style="list-style-type: none"> Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	<ul style="list-style-type: none"> Recommended for shallow back and red soils Recommended for shallow to medium black soils.
July	7. Horsegram • GPM-6	<ul style="list-style-type: none"> Treat seeds with Captan (2g/kg seeds) before sowing Use 25-30 kg seeds/ha and sow at 30x10 spacing Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of sowing 	<ul style="list-style-type: none"> Recommended for shallow and medium black soils.
July	8. Pearl millet + Pigeonpea (2:1)	Same as per entire crop	
July	9. Pearl millet + Castor (2:1)	Same as per entire crop	
August	1. Sunflower • KBSH-1 • KBSH-44 • DSH-1 • RSFH-1 • MSFH-17 • SH-41	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathion (2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	<ul style="list-style-type: none"> Recommended for shallow and medium black soils.
August	2. Cotton • Jayadhar • Renuka • Suyodhar • RAHS-14 • DLSA-17	<ul style="list-style-type: none"> Use 7.5 – 10 kg seeds/ha for sowing at 60 x 30 cm or 90 cm x 20 cm Treat the seeds with 375 g Azospirillum and 375 g PSB per ha seeds Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (25:25:12 kg NPK/ha) at sowing 	
August	3. Horsegram • GPM-6	<ul style="list-style-type: none"> Treat seeds with Captan (2g/kg seeds) before sowing Use 25-30 kg seeds/ha and sow at 30x10 spacing Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of sowing 	
August	4. Sesame • E-8 • DS-1	<ul style="list-style-type: none"> Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) Treat the seeds with Captan/Thiram/Carbendazim (3 g/kg seeds) Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
August	5. Castor	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing 	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	<ul style="list-style-type: none"> • RC-8 • 48-1 • GCH-4 	<ul style="list-style-type: none"> • Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing • Apply 40:40:20 kg NPK/ha at the time of sowing • Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of semi-looper • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers 	
September	1. Sunflower <ul style="list-style-type: none"> • KBSH-1 • KBSH-44 • DSH-1 • RSFH-1 • MSFH-17 • SH-41 	<ul style="list-style-type: none"> • Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum • Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing • Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing • Take up frequent deep intercultivation • Spray borax (0.25%) at flowering stage. • Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera • Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa • Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	
September	2. Rabi sorghum <ul style="list-style-type: none"> • M 35-1 • 5-4-1 • DSV-4 	<ul style="list-style-type: none"> • Apply FYM (3t/ha) before 15 days of sowing and chemical fertilizer (50:25 kg N & P) at the time of sowing • Use 7.5 kg seeds/ha for sowing at 60 cm x 10 cm spacing • Soak the seeds in the solution of CaCl₂ (3%) for 8 hours and dry under shade. Then treat the seeds with sulphur (2g/kg seeds) or Tricoderma (24 g/ha seeds) and Azospirillum (500 g/ha seeds) • Incorporate phorate granules (40 kg/ha) or carboheran granules (30 kg/ha) for the control of shoot fly at the time of sowing <p>Frequent intercultivation helps to conserve moisture</p>	
September	3. Safflower <ul style="list-style-type: none"> • A-1 • A-300 • S-144 • H-2 	<ul style="list-style-type: none"> • Apply FYM (5t/ha) before 15 days of sowing and chemical fertilizer (40:40:12 kg NPK/ha) at the time of sowing • Use 7.5 kg seeds/ha for sowing at 60 cm x 30 cm spacing • Treat the seed with 200 g Azospirillum per ha • Frequent intercultivation helps to conserve moisture • Spray Dimethoate 30 EC (1.7 ml/litre or parathion 50 EC (1ml/litre) or Monocrotophos 36 SL (1ml/litre) for the control of Aphids, leaf eating caterpillars and capsule borer. <p>Spray Mancozeb (2g/litre) for the control of alternaria leaf spot</p>	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
September	4. Chickpea • Annigeri-1	<ul style="list-style-type: none"> Sow 50 kg seeds/ha at 30 cm x 10 cm spacing Soak the seeds in water for 8 hours or in CaCl_2 solution (2%) for half an hour and dry under shade. Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (10:25 kg NP/ha) at sowing. Nipping at 35 to 40 DAS will increase the yield. Spray 2.5 ml chloropyriphos 20 EC or 2 ml quinolphos or 2 ml endosulfan/litre of water for the control of helicoverpa 	
September	5. <i>Rabi</i> sorghum + Chickpea (2:1)	Same as per entire crop	
October	1. <i>Rabi</i> sorghum " M 35-1 " 5-4-1 " DSV-4	<ul style="list-style-type: none"> Apply FYM (3t/ha) before 15 days of sowing and chemical fertilizer (50:25 kg N & P) at the time of sowing Use 7.5 kg seeds/ha for sowing at 60 cm x 10 cm spacing Soak the seeds in the solution of CaCl_2 (3%) for 8 hours and dry under shade. Then treat the seeds with sulphur (2g/kg seeds) or Tricoderma (24 g/ha seeds) and Azospirillum (500 g/ha seeds) Incorporate phorate granules (40 kg/ha) or carboheran granules (30 kg/ha) for the control of shoot fly at the time of sowing <p>Frequent intercultivation helps to conserve moisture</p>	
October	2. Safflower • A-1 • A-300 • S-144 • H-2	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing and chemical fertilizer (40:40:12 kg NPK/ha) at the time of sowing Use 7.5 kg seeds/ha for sowing at 60 cm x 30 cm spacing Treat the seed with 200 g Azospirillum per ha Frequent intercultivation helps to conserve moisture Spray Dimethoate 30 EC (1.7 ml/litre or parathion 50 EC (1ml/litre) or Monocrotophos 36 SL (1ml/litre) for the control of Aphids, leaf eating caterpillars and capsule borer. Spray Mancozeb (2g/litre) for the control of alternaria leaf spot 	
October	3. Chickpea • Annigeri-1	<ul style="list-style-type: none"> Sow 50 kg seeds/ha at 30 cm x 10 cm spacing Soak the seeds in water for 8 hours or in CaCl_2 solution (2%) for half an hour and dry under shade. Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (10:25 kg NP/ha) at sowing. Nipping at 35 to 40 DAS will increase the yield. Spray 2.5 ml chloropyriphos 20 EC or 2 ml quinolphos or 2 ml endosulfan/litre of water for the control of helicoverpa 	
October	4. <i>Rabi</i> sorghum + Chickpea (2:1)	Same as entire crop	
October	5. Safflower + Chickpea (2:4)	Same as entire crop	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
For shallow black/red soils				
June	I Fortnight	1. Pearl millet <ul style="list-style-type: none"> • ICTP-8203 • ICMV-221 • Maruti • Asha • TS-3 	<ul style="list-style-type: none"> • Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. • Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing • Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. • Spray Ziram @ 2.2 g/litre of water for the control ergot disease • If there is dry spell soon after germination, Take rotoon crop <p>Frequent deep intercultivation for moisture conservation</p>	
June	I Fortnight	2. Bunch Groundnut <ul style="list-style-type: none"> • TMV-2 • R-8808 • S-206 • S-230 • GPBD-4 	<ul style="list-style-type: none"> • Treat the seeds with Captan/Thiram/Carboxyn @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. • Use 125 kg seeds per ha • Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. • Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) • Applying 500 kg Gypsum at 30-35 DAS • Open conservation furrows after every 8th row for moisture conservation • Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner • Spray Hexokonazol @ 1ml/litre or Carbandazim (0.5 g/litre) for the control of leaf spot disease. • Take up urea spray for rejuvenation of groundnut crop, after rain in case of dry spell 	
June	I Fortnight	3. Sesame <ul style="list-style-type: none"> • E-8 • DS-1 	<ul style="list-style-type: none"> • Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) • Treat the seeds with Captan/Thiram/Carbandazim (3 g/kg seeds) • Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing • Sow 10-12 kg seeds/ha at 30 cm row spacing • Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	II Fortnight	1. Pearlmillet <ul style="list-style-type: none"> • ICTP-8203 • ICMV-221 • Maruti • Asha • TS-3 	<ul style="list-style-type: none"> • Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. • Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing • Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. • Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	
June	II Fortnight	2. Bunch Groundnut <ul style="list-style-type: none"> • TMV-2 • R-8808 • S-206 • S-230 • GPBD-4 	<ul style="list-style-type: none"> • Treat the seeds with Captan/Thiram/Carboxyn @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. • Use 125 kg seeds per ha • Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. • Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) • Applying 500 kg Gypsum at 30-35 DAS • Open conservation furrows after every 8th row for moisture conservation • Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner • Spray Hexokonazol @ 1ml/litre or Carbandazim (0.5 g/litre) for the control of leaf spot disease. 	
June	II Fortnight	3. Pigeonpea <ul style="list-style-type: none"> • GS-1 • BJ-221 • Maruti • Asha • TS-3 	<ul style="list-style-type: none"> • ICPC-87 Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. • Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing • Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. <p>Control of Helicoverpa</p> <ul style="list-style-type: none"> • Spray Diodicarb (0.6 g/litre) or propenophos (2ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering • Spray NSKE @ 2 ml/litre as second spray • Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray • Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. • Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	II Fortnight	4. Greengram <ul style="list-style-type: none"> Chinamung Pusa baisaki Sel-4 PS-16 TS-3 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 1 hours and dry under shade for 8 hours. Then treat the seeds with Azospirillum (500 g/ha seeds) and PSB (500 g/ha seeds) Sow 15 kg seeds/ha at 37.5 cm row spacing Apply 12.5:25 kg N and P/ha at the time of sowing 	After harvest of pods, incorporate the residues in the soil
June	II Fortnight	5. Sesame <ul style="list-style-type: none"> E-8 DS-1 	<ul style="list-style-type: none"> Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) Treat the seeds with Captan/Thiram/Carbendazim (3 g/kg seeds) Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
June	II Fortnight	6. Niger <ul style="list-style-type: none"> No.71 RCR-18 	<ul style="list-style-type: none"> Sow 1.5 kg seeds/ha at 30 cm x 10 cm Soak the seeds in water for 6 hours and dry under shade. Then treat seeds with Thiram/Captan (3 g/kg seeds) Spray Dimethoate (1.7 ml/litre) or parathion (1 ml/litre) for the control of leaf and bud eating caterpillars. 	
June	II Fortnight	7. Navane <ul style="list-style-type: none"> HMT 100-1 RS-118 	<ul style="list-style-type: none"> Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
June	II Fortnight	8. Horsegram <ul style="list-style-type: none"> GPM-6 	<ul style="list-style-type: none"> Treat seeds with Captan (2g/kg seeds) before sowing Use 25-30 kg seeds/ha and sow at 30x10 spacing Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of woiing 	
June	II Fortnight	9. Castor <ul style="list-style-type: none"> RC-8 48-1 GCH-4 	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing Apply 40:40:20 kg NPK/ha at the time of sowing Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of semi-looper Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	II Fortnight	10. Pearl millet + Pigeonpea (2:1)	Same as per entire crop	
June	II Fortnight	11. Pearl millet + Groundnut (2:4)	Same as per entire crop	
June	II Fortnight	12. Pearl millet + Castor (2:1)	Same as per entire crop	
July	I Fortnight	1. Pearl millet • ICTP-8203 • ICMV-221 • Maruti • Asha • TS-3	<ul style="list-style-type: none"> • Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. • Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing • Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. • Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	
July	I Fortnight	2. Pigeonpea • GS-1 • BJ-221 • Maruti • Asha • TS-3 • ICPC-87	<ul style="list-style-type: none"> • Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. • Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing • Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. <p>Control of Helicoverpa</p> <ul style="list-style-type: none"> • Spray Diodicarb (0.6 g/litre) or propanophos (2ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering • Spray NSKE @ 2 ml/litre as second spray • Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray • Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. • Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	
July	I Fortnight	3. Sesame • E-8 • DS-1	<ul style="list-style-type: none"> • Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) • Treat the seeds with Captan/Thiram/Carbendazim (3 g/kg seeds) • Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing • Sow 10-12 kg seeds/ha at 30 cm row spacing • Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	I Fortnight	4. Groundnut • TMV-2 • R-8808 • S-206 • S-230 • GPBD-4	<ul style="list-style-type: none"> • Treat the seeds with Captan/Thiram/Carbaxyn @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. • Use 125 kg seeds per ha • Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. • Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) • Applying 500 kg Gypsum at 30-35 DAS • Open conservation furrows after every 8th row for moisture conservation • Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner • Spray Hexokonazol @ 1ml/litre or Carbandazim (0.5 g/litre) for the control of leaf spot disease. 	
July	I Fortnight	5. Niger • No.71 • RCR-18	<ul style="list-style-type: none"> • Sow 1.5 kg seeds/ha at 30 cm x 10 cm • Soak the seeds in water for 6 hours and dry under shade. Then treat seeds with Thiram/Captan (3 g/kg seeds) • Spray Dimethoate (1.7 ml/litre) or parathion (1 ml/litre) for the control of leaf and bud eating caterpillars. 	
July	I Fortnight	6. Navane • HMT 100-1 • RS-118	<ul style="list-style-type: none"> • Sow 10-12 kg seeds/ha at 30 cm row spacing • Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
July	I Fortnight	7. Horsegram • GPM-6	<ul style="list-style-type: none"> • Treat seeds with Captan (2g/kg seeds) before sowing • Use 25-30 kg seeds/ha and sow at 30x10 spacing • Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of sowing 	
July	I Fortnight	8. Castor • RC-8 • 48-1 • GCH-4	<ul style="list-style-type: none"> • Apply FYM (5t/ha) before 15 days of sowing • Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing • Apply 40:40:20 kg NPK/ha at the time of sowing • Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of semi-looper • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	I Fortnight	9. Pearl millet + Pigeonpea (2:1)	Same as entire crop	
July	I Fortnight	10. Pearl millet + castor (2:1)	Same as entire crop	
July	I Fortnight	11. Groundnut + Pigeonpea (4:2)	Same as entire crop	
July	I Fortnight	12. Pearl millet + Groundnut (2:4)	Same as entire crop	
July	II Fortnight	1. Pearl millet <ul style="list-style-type: none"> • ICTP-8203 • ICMV-221 • Maruti • Asha • TS-3 	<ul style="list-style-type: none"> • Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. • Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing • Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. • Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	Sow the crop before July 15
July	II Fortnight	9. Sunflower <ul style="list-style-type: none"> • KBSH-1 • KBSH-44 • DSH-1 • RSFH-1 • MSFH-17 • SH-41 	<ul style="list-style-type: none"> • Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum • Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing • Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing • Take up frequent deep intercultivation • Spray borax (0.25%) at flowering stage. • Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera • Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helicoverpa • Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	
July	II Fortnight	9. Pigeonpea <ul style="list-style-type: none"> • GS-1 • BJ-221 • Maruti • Asha • TS-3 • ICPC-87 	<ul style="list-style-type: none"> • Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. • Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing • Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. <p>Control of Helicoverpa</p> <ul style="list-style-type: none"> • Spray Diodicarb (0.6 g/litre) or propenophos (2ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
			<ul style="list-style-type: none"> Spray NSKE @ 2 ml/litre as second spray Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	
July	II Fortnight	4. Spreading groundnut <ul style="list-style-type: none"> DSG-1 S-230 	<ul style="list-style-type: none"> Apply FYM (7.5 t/ha) before 15 days of sowing Treat seeds with Captan, Thiram/Carboxyn (2 g/kg seeds) or Trichoderma (4 g/kg seeds). Then treat with Rhizobium (375 g/ha seeds) and PSB (375 g/ha seeds) Sow 75 kg seeds/ha at 45 cm x 15 cm spacing Follow other practices as that of bunch groundnut 	
July	II Fortnight	5. Niger <ul style="list-style-type: none"> No.71 RCR-18 	<ul style="list-style-type: none"> Sow 1.5 kg seeds/ha at 30 cm x 10 cm Soak the seeds in water for 6 hours and dry under shade. Then treat seeds with Thiram/Captan (3 g/kg seeds) Spray Dimethoate (1.7 ml/litre) or parathion (1 ml/litre) for the control of leaf and bud eating caterpillars. 	
July	II Fortnight	6. Navane <ul style="list-style-type: none"> HMT 100-1 RS-118 	<ul style="list-style-type: none"> Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
July	II Fortnight	7. Horsegram <ul style="list-style-type: none"> GPM-6 	<ul style="list-style-type: none"> Treat seeds with Captan (2g/kg seeds) before sowing Use 25-30 kg seeds/ha and sow at 30x10 spacing Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of woiing 	
July	II Fortnight	8. Castor <ul style="list-style-type: none"> RC-8 48-1 GCH-4 	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing Apply 40:40:20 kg NPK/ha at the time of sowing Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of semi-looper Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	II Fortnight	9. Pearlmillet + Pigeonpea (2:1)	Same as per entire crop	
July	II Fortnight	10. Pearlmillet + Castor (2:1)	Same as per entire crop	
July	II Fortnight	11. Pearlmillet + groundnut (2:4)	Same as per entire crop	
August	I Fortnight	1. Pearl millet • ICTP-8203 • ICMV-221 • Maruti • Asha • TS-3	<ul style="list-style-type: none"> • Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. • Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing • Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. • Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	Sow the crop before July 15
August	I Fortnight	2. Sunflower • KBSH-1 • KBSH-44 • DSH-1 • RSFH-1 • MSFH-17 • SH-41	<ul style="list-style-type: none"> • Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum • Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing • Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing • Take up frequent deep intercultivation • Spray borax (0.25%) at flowering stage. • Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera • Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa • Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	Recommended for shallow and medium black soils.
August	I Fortnight	3. Pigeonpea • GS-1 • BJ-221 • Maruti • Asha • TS-3 • ICPC-87	<ul style="list-style-type: none"> • Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. • Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing • Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. <p>Control of Helicoverpa</p> <ul style="list-style-type: none"> • Spray Diodicarb (0.6 g/litre) or propenophos (ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering • Spray NSKE @ 2 ml/litre as second spray 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
			<ul style="list-style-type: none"> Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	
August	I Fortnight	4. Spreading groundnut <ul style="list-style-type: none"> DSG-1 S-230 	<ul style="list-style-type: none"> Apply FYM (7.5 t/ha) before 15 days of sowing Treat seeds with Captan, Thiram/Carboxyn (2 g/kg seeds) or Trichoderma (4 g/kg seeds). Then treat with Rhizobium (375 g/ha seeds) and PSB (375 g/ha seeds) Sow 75 kg seeds/ha at 45 cm x 15 cm spacing Follow other practices as that of bunch groundnut 	
August	I Fortnight	5. Navane <ul style="list-style-type: none"> HMT 100-1 RS-118 	<ul style="list-style-type: none"> Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing Treat seeds with Captan (2g/kg seeds) before sowing 	
August	I Fortnight	6. Horsegram <ul style="list-style-type: none"> GPM-6 	<ul style="list-style-type: none"> Use 25-30 kg seeds/ha and sow at 30x10 spacing Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of sowing 	
August	I Fortnight	7. Pearl millet + Pigeonpea (2:1)	Same as per entire crop	
August	I Fortnight	8. Spreading groundnut + pigeonpea (4:2)	Same as per entire crop	
August	II Fortnight	1. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 DSH-1 RSFH-1 MSFH-17 SH-41 	<ul style="list-style-type: none"> Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	Recommended for shallow and medium black soils.

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
August	II Fortnight	2. Navane <ul style="list-style-type: none"> HMT 100-1 RS-118 	<ul style="list-style-type: none"> Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
August	II Fortnight	3. Horsegram <ul style="list-style-type: none"> GPM-6 	<ul style="list-style-type: none"> Treat seeds with Captan (2g/kg seeds) before sowing Use 25-30 kg seeds/ha and sow at 30x10 spacing Apply entire chemical fertilizer (10:30 NP kg/ha) at the time of sowing For Medium Black Soil 	
June	I Fortnight	1. Pearl millet <ul style="list-style-type: none"> ICTP-8203 ICMV-221 Maruti Asha TS-3 	<ul style="list-style-type: none"> Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. Spray Ziram @ 2.2 g/litre of water for the control ergot disease If there is dry spell soon after germination, Take rotoon crop Frequent deep intercultivation for moisture conservation 	
June	I Fortnight	2. Groundnut <ul style="list-style-type: none"> TMV-2 R-8808 S-206 S-230 GPBD-4 	<ul style="list-style-type: none"> Treat the seeds with Captan/Thiram/Carboxin @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. Use 125 kg seeds per ha Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) Applying 500 kg Gypsum at 30-35 DAS Open conservation furrows after every 8th row for moisture conservation Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner Spray Hexaconazol @ 1ml/litre or Carbandazim (0.5 g/litre) for the control of leaf spot disease. Take up urea spray for rejuvenation of groundnut crop, after rain in case of dry spell 	
June	I Fortnight	3. Greengram <ul style="list-style-type: none"> Chinamung Pusa baisaki 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 8 hours. Then treat the seeds with Azospirillum (500 g/ha seeds) and PSB (500 g/ha seeds) 	After harvest of pods, incorporate the residues in the soil

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> Sel-4 PS-16 TS-3 	<ul style="list-style-type: none"> Sow 15 kg seeds/ha at 37.5 cm row spacing Apply 12.5:25 kg N and P/ha at the time of sowing 	
June	I Fortnight	4. Cucumber <ul style="list-style-type: none"> Japanese long green Straight Chaina Belgaum local North Karnataka local 	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing Sow 2.5 kg seeds/ha at 90 cm x 90 cm spacing Spray carbendizem (3g/litre) or Bayleton (1g/litre) for the control of powdery mildew 	
June	I Fortnight	5. Ridgegourd <ul style="list-style-type: none"> Pusa Nasadar Co-1 Sel 4-12 Arka Sujata Arka Sumit Satputiya Raichur local 	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing Sow 5 kg seeds/ha at 120 cm x 90 cm spacing Spray carbendizem (0.5g/litre) or Dinacap (1.5g/litre) for the control of powdery mildew 	
June	II Fortnight	1. Pearlmillet <ul style="list-style-type: none"> ICTP-8203 ICMV-221 Maruti Asha TS-3 	<ul style="list-style-type: none"> Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	
June	II Fortnight	2. Sesame <ul style="list-style-type: none"> E-8 DS-1 	<ul style="list-style-type: none"> Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) Treat the seeds with Captan/Thiram/Carbendazim (3 g/kg seeds) Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
June	II Fortnight	5. Pigeonpea <ul style="list-style-type: none"> GS-1 BJ-221 Maruti Asha TS-3 ICPC-87 	<ul style="list-style-type: none"> Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2g) or Thiram (2g) or Carboryl (2.5 g) or Trichoderma (4g) per kg seeds. Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing Apply FYM (6t/ha) before 15 days sowing and 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
			entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. Control of Helicoverpa <ul style="list-style-type: none"> • Spray Diodicarb (0.6 g/litre) or propanophos (2ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering • Spray NSKE @ 2 ml/litre as second spray • Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray • Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. • Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary 	
June	II Fortnight	4. Navane <ul style="list-style-type: none"> • HMT 100-1 • RS-118 	<ul style="list-style-type: none"> • Sow 10-12 kg seeds/ha at 30 cm row spacing • Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
June	II Fortnight	5. Groundnut <ul style="list-style-type: none"> • TMV-2 • R-8808 • S-206 • S-230 • GPBD-4 	<ul style="list-style-type: none"> • Treat the seeds with Captan/Thiram/Carboxyn @ 2g/kg seeds or Trichoderma @ 4g/kg seeds. Then treat seeds with 500 g Azospirillum and 500 g PSB/ha seeds. • Use 125 kg seeds per ha • Sow the crop at 30 cm x 10 cm spacing. Not more than 5 cm depth. • Applying FYM (7.5 t/ha) before 15 days of sowing and entire chemical fertilizer at sowing (25:50:25 kg NPK/ha) • Applying 500 kg Gypsum at 30-35 DAS • Open conservation furrows after every 8th row for moisture conservation • Spray monocrotophos (1.0 ml/litre) or Quinalphos or Carbaryl (2 ml/litre) for the control of leaf miner • Spray Hexokonazol @ 1ml/litre or Carbandazim (0.5 g/litre) for the control of leaf spot disease. 	
June	II Fortnight	6. Greengram <ul style="list-style-type: none"> • Chinamung • Pusa baisaki • Sel-4 • PS-16 • TS-3 	<ul style="list-style-type: none"> • Soak the seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 8 hours. Then treat the seeds with Azospirillum (500 g/ha seeds) and PSB (500 g/ha seeds) • Sow 15 kg seeds/ha at 37.5 cm row spacing • Apply 12.5:25 kg N and P/ha at the time of sowing 	After harvest of pods, incorporate the residues in the soil
June	II Fortnight	7. Castor <ul style="list-style-type: none"> • RC-8 	<ul style="list-style-type: none"> • Apply FYM (5t/ha) before 15 days of sowing • Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> 48-1 GCH-4 	<ul style="list-style-type: none"> Apply 40:40:20 kg NPK/ha at the time of sowing Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of semi-looper Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers 	
June	II Fortnight	8. Cucumber <ul style="list-style-type: none"> Japanese long green Straight Chaina Belgaum local North Karnataka local 	<ul style="list-style-type: none"> Apply FYM (5 t/ha) before 15 days of sowing Sow 2.5 kg seeds/ha at 90 cm x 90 cm spacing Spray carbendizem (3 g/litre) or Bayleton (1g/litre) for the control of powdery mildew 	
June	II Fortnight	9. Ridgogourd <ul style="list-style-type: none"> Pusa Nasadar Co-1 Sel 4-12 Arka Sujata Arka Sumit Satputiya Raichur local 	<ul style="list-style-type: none"> Apply FYM (5 t/ha) before 15 days of sowing Sow 5 kg seeds/ha at 120 cm x 90 cm spacing Spray carbendizem (0.5g/litre) or Dinacap (1.5g/litre) for the control of powdery mildew 	
June	II Fortnight	10. Chilli + Onion (2:4) <ul style="list-style-type: none"> Chilli – Byadgi Onion-Bellary red 	<ul style="list-style-type: none"> Treat seeds of chilli with Captan (3g/kg seeds). Then with Azospirillum (200 g/kg seeds) Sow onion seeds (7.5 kg/ha) and chilli seeds (1.250 kg/ha) in the row ratio of 4:2 respectively with seed drill. Spray 1.7 ml Dimethoate 30 EC or 0.5 ml phosphomidon 85 WSC or 1 ml methyl parathion for the control of murla complex 	
June	II Fortnight	11. Pearlmillet + Groundnut (2:4) 12. Pearlmillet + Pigeonpea (2:1) 13. Pearlmillet + Castor (2:1)	Same as per entire crop Same as per entire crop Same as per entire crop	
July	I Fortnight	1. Pearl millet <ul style="list-style-type: none"> ICTP-8203 ICMV-221 Maruti Asha 	<ul style="list-style-type: none"> Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. Spray Ziram @ 2.2 g/litre of water for the 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	I Fortnight	<ul style="list-style-type: none"> • TS-3 2. Spreading groundnut <ul style="list-style-type: none"> • DSG-1 • S-230 	control ergot disease • Apply FYM (7.5 t/ha) before 15 days of sowing • Treat seeds with Captan, Thiram/Carboxyn (2 g/kg seeds) or Trichoderma (4 g/kg seeds). Then treat with Rhizobium (375 g/ha seeds) and PSB (375 g/ha seeds) • Sow 75 kg seeds/ha at 45 cm x 15 cm spacing • Follow other practices as that of bunch groundnut	
July	I Fortnight	3. Pigeonpea <ul style="list-style-type: none"> • GS-1 • BJ-221 • Maruti • Asha • TS-3 • ICPC-87 	• Soak seeds in CaCl_2 solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2 g) or Thiram (2 g) or Carbaryl (2.5 g) or Trichoderma (4 g) per kg seeds. • Use 10-12 kg seeds/ha and sow at 45-60 cm x 30 cm spacing • Apply FYM (6 t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. Control of Helicoverpa • Spray Diodicarb (0.6 g/litre) or propanophos (2 ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering • Spray NSKE @ 2 ml/litre as second spray • Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray • Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyriphos (2.5 ml/litre) as fourth spray. • Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary	
July	I Fortnight	4. Chilli+Onion(2:4) <ul style="list-style-type: none"> • Chilli – Byadgi • Onion-Bellary red 	• Treat seeds of chilli with Captan (3g/kg seeds). Then with Azospirillum (200 g/kg seeds) • Sow onion seeds (7.5 kg/ha) and chilli seeds (1.250 kg/ha) in the row ratio of 4:2 respectively with seed drill. • Spray 1.7 ml Dimethoate 30 EC or 0.5 ml phosphomidon 85 WSC or 1 ml methyl parathion for the control of murla complex	
July	I Fortnight	5. Castor <ul style="list-style-type: none"> • RC-8 • 48-1 • GCH-4 	• Apply FYM (5t/ha) before 15 days of sowing • Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing • Apply 40:40:20 kg NPK/ha at the time of sowing • Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
			10 EC (0.5 ml/litre) for the control of semi-looper <ul style="list-style-type: none"> Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers 	
July	I Fortnight	6. Sesame <ul style="list-style-type: none"> E-8 DS-1 	<ul style="list-style-type: none"> Apply 5 t FYM/ha before 15 days of sowing and entire chemical fertilizer (50:25:25 NPK kg/ha) Treat the seeds with Captan/Thiram/Carbendazim (3 g/kg seeds) Use 2.5 kg seeds/ha and sow at 30 x 15 cm spacing Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
July	I Fortnight	7. Navane <ul style="list-style-type: none"> HMT 100-1 RS-118 	<ul style="list-style-type: none"> Sow 10-12 kg seeds/ha at 30 cm row spacing Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing 	
July	I Fortnight	8. Groundnut + Pigeonpea (4:2)	Same as entire crop	
July	I Fortnight	9. Pearl millet + Pigeonpea(2:1)	Same as entire crop	
July	I Fortnight	10. Pearl millet + castor(2:1)	Same as entire crop	
July	I Fortnight	11. Pearl millet + Groundnut fodder crops(2:4)	Same as entire crop	
July	II Fortnight	1. Pearl millet <ul style="list-style-type: none"> ICTP-8203 ICMV-221 Maruti Asha TS-3 	<ul style="list-style-type: none"> Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500 g/ha seeds before sowing. Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	Sow the crop before July 15
July	II Fortnight	2. Spreading groundnut <ul style="list-style-type: none"> DSG-1 S-230 	<ul style="list-style-type: none"> Apply FYM (7.5 t/ha) before 15 days of sowing Treat seeds with Captan, Thiram/Carboxyn (2 g/kg seeds) or Trichoderma (4 g/kg seeds). Then treat with Rhizobium (375 g/ha seeds) and PSB (375 g/ha seeds) Sow 75 kg seeds/ha at 45 cm x 15 cm spacing Follow other practices as that of bunch groundnut 	
July	II Fortnight	3. Pigeonpea <ul style="list-style-type: none"> GS-1 BJ-221 Maruti Asha 	<ul style="list-style-type: none"> Soak seeds in CaCl₂ solution (2%) for 1 hour and dry under shade for 7 hours. Then treat seeds with Rhizobium (375 g/ha seeds) and Captan (2 g) or Thiram (2 g) or Carbaryl (2.5 g) or Trichoderma (4g) per kg seeds. Use 10-12 kg seeds/ha and sow at 45-60 cm 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> • TS-3 • ICPC-87 	x 30 cm spacing • Apply FYM (6t/ha) before 15 days sowing and entire chemical fertilizer (25:50:25 kg NPK/ha) at the time of sowing. Control of Helicoverpa • Spray Diodicarb (0.6 g/litre) or propenophos (2 ml/litre) or Mithomil (0.6 g/litre) at 25-50% flowering • Spray NSKE @ 2 ml/litre as second spray • Spray NPV 100 LE (0.75 ml/litre) during morning hours as an third spray • Spray Indacsicarb 15 EC (0.3 ml/litre) or spinosad 45 SC (0.1 ml/litre) or Monocrotophos 36 SL (1ml/litre) or Chlorophyrriphos (2.5 ml/litre) as fourth spray. • Spray Alfathrin (0.5 ml/litre) or Fenvelrate (0.5 ml/litre) as an fifth spray if necessary	
July	II Fortnight	4. Castor <ul style="list-style-type: none"> • RC-8 • 48-1 • GCH-4 	• Apply FYM (5t/ha) before 15 days of sowing • Use 8-10 kg seeds/ha for sowing at 60 cm x 45 cm spacing • Apply 40:40:20 kg NPK/ha at the time of sowing • Spray Quinalphos (1.5%) or Methyl parathion for control of red headed hairy caterpillar • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of semi-looper • Spray Monocrotophos 36 SL (2ml/litre) or Fenvelrate 10 EC (0.5 ml/litre) or Cypermethrin 10 EC (0.5 ml/litre) for the control of pod borers	
July	II Fortnight	5. Navane <ul style="list-style-type: none"> • HMT 100-1 • RS-118 	• Sow 10-12 kg seeds/ha at 30 cm row spacing • Apply entire chemical fertilizer (30:15:15 kg NPK/ha) at sowing	
July	II Fortnight	6. Cotton Varieties <ul style="list-style-type: none"> • Jayadhar • Renuka • Suyodhar • RAHS-14 • DLSA-17 	• Use 7.5 – 10 kg seeds/ha for sowing at 60 x30 cm or 90 cm x 20 cm • Treat the seeds with 375 g Azospirillum and 375 g PSB per ha seeds • Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (25:25:12 kg NPK/ha) at sowing	
July	II Fortnight	7. Groundnut + pigeonpea (4:2)	Same as entire crop	
July	II Fortnight	8. Pearl millet + pigeonpea (2:1)	Same as entire crop	
July	II Fortnight	9. Pearlmillet + castor (2:1)	Same as entire crop	
		10. Pearlmillet + Groundnut (2:4)	Same as entire crop	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
August	I Fortnight	1. Pearl millet <ul style="list-style-type: none"> • ICTP-8203 • ICMV-221 • Maruti • Asha • TS-3 	<ul style="list-style-type: none"> • Soak the seeds in water for 10 hours and dry under shade. Then treat the seeds with Azospirillum @ 500g/ha seeds before sowing. • Sow the crop with 4 kg seeds/ha at 45cm to 135 cm spacing • Apply FYM (2.5 t/ha) 15 days before sowing and chemical fertilizers (50:25 kg N & P₂O₅) at the time of sowing. • Spray Ziram @ 2.2 g/litre of water for the control ergot disease 	Sow the crop before July 15
August	I Fortnight	2. Sunflower <ul style="list-style-type: none"> • KBSH-1 • KBSH-44 • DSH-1 • RSFH-1 • MSFH-17 • SH-41 	<ul style="list-style-type: none"> • Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum • Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing • Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing • Take up frequent deep intercultivation • Spray borax (0.25%) at flowering stage. • Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera • Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa • Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	Recommended for shallow and medium black soils.
August	I Fortnight	3. Cotton <ul style="list-style-type: none"> • Jayadhar • Renuka • Suyodhar • RAHS-14 • DLSA-17 	<ul style="list-style-type: none"> • Use 7.5 – 10 kg seeds/ha for sowing at 60 x30 cm or 90 cm x 20 cm • Treat the seeds with 375 g Azospirillum and 375 g PSB per ha seeds • Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (25:25:12 kg NPK/ha) at sowing 	
August	I Fortnight	4. Fodder crops	<ul style="list-style-type: none"> • Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum 	
August	II Fortnight	1. Sunflower <ul style="list-style-type: none"> • KBSH-1 • KBSH-44 • DSH-1 • RSFH-1 • MSFH-17 • SH-41 	<ul style="list-style-type: none"> • Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing • Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing • Take up frequent deep intercultivation • Spray borax (0.25%) at flowering stage. • Spray Methylparathian(2%) or Quinalphos (2ml/litre) for the control of spodoptera • Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
August	II Fortnight	2. Cotton <ul style="list-style-type: none"> Jayadhar Renuka Suyodhar RAHS-14 DLSA-17 	<ul style="list-style-type: none"> Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. Use 7.5 – 10 kg seeds/ha for sowing at 60 x30 cm or 90 cm x 20 cm Treat the seeds with 375 g Azospirillum and 375 g PSB per ha seeds Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (25:25:12 kg NPK/ha) at sowing 	
August	II Fortnight	3. Fodder crops		
September	I Fortnight	1. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 DSH-1 RSFH-1 MSFH-17 SH-41 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*.

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
For shallow black/red soils				
September	I Fortnight	1. Cotton <ul style="list-style-type: none"> Jayadhar Renuka Suyodhar RAHS-14 DLSA-17 	<ul style="list-style-type: none"> Use 7.5 – 10 kg seeds/ha for sowing at 60 x30 cm or 90 cm x 20 cm Treat the seeds with 375 g Azospirillum and 375 g PSB per ha seeds Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (25:25:12 kg NPK/ha) at sowing 	
September	I Fortnight	1. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 DSH-1 RSFH-1 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> MSFH-17 SH-41 	<ul style="list-style-type: none"> Applying FYM (8 t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	
September	II Fortnight	1. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 DSH-1 RSFH-1 MSFH-17 SH-41 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. 	
September	II Fortnight	1. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 DSH-1 RSFH-1 MSFH-17 SH-41 	<ul style="list-style-type: none"> Soak the seeds in CaCl₂ solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. Close the cracks by frequent intercultivation 	
September	II Fortnight	2. <i>Rabi</i> sorghum <ul style="list-style-type: none"> M 35-1 	<ul style="list-style-type: none"> Apply FYM (3 t/ha) before 15 days of sowing and chemical fertilizer (50:25 kg N & P) at the time of sowing 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> 5-4-1 DSV-4 	<ul style="list-style-type: none"> Use 7.5 kg seeds/ha for sowing at 60 cm x 10 cm spacing Soak the seeds in the solution of CaCl_2 (3%) for 8 hours and dry under shade. Then treat the seeds with sulphur (2g/kg seeds) or Tricoderma (24 g/ha seeds) and Azospirillum (500 g/ha seeds) Incorporate phorate granules (40 kg/ha) or carboheran granules (30 kg/ha) for the control of shoot fly at the time of sowing Frequent intercultivation helps to conserve moisture Top dress with 10 to 15 kgN /ha if moisture is available to <i>rabi</i> sorghum 	
September	II Fortnight	1. Safflower <ul style="list-style-type: none"> A-1 A-300 S-144 H-2 	<ul style="list-style-type: none"> Apply FYM (5 t/ha) before 15 days of sowing and chemical fertilizer (40:40:12 kg NPK/ha) at the time of sowing Use 7.5 kg seeds/ha for sowing at 60 cm x 30 cm spacing Treat the seed with 200 g Azospirillum per ha Frequent intercultivation helps to conserve moisture Spray Dimethoate 30 EC (1.7 ml/litre or parathion 50 EC (1ml/litre) or Monocrotophos 36 SL (1ml/litre) for the control of Aphids, leaf eating caterpillars and capsule borer. Spray Mancozeb (2g/litre) for the control of alternaria leaf spot 	
September	II Fortnight	4. Chickpea <ul style="list-style-type: none"> Annigeri-1 	<ul style="list-style-type: none"> Sow 50 kg seeds/ha at 30 cm x 10 cm spacing Soak the seeds in water for 8 hours or in CaCl_2 solution (2%) for half an hour and dry under shade. Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (10:25 kg NP/ha) at sowing. Nipping at 35 to 40 DAS will increase the yield. Spray 2.5 ml chloropyriphos 20 EC or 2 ml quinolphos or 2 ml endosulfan/litre of water for the control of helicoverpa 	
September	II Fortnight	5. Rabi sorghum + chickpea (2:1)	<ul style="list-style-type: none"> Remove alternate rows of every third row of <i>rabi</i> sorghum if early withdrawal of monsoon 	
September	II Fortnight	6. Safflower + chickpea (2:4)		
October	I Fortnight	1. Sunflower <ul style="list-style-type: none"> KBSH-1 KBSH-44 	<ul style="list-style-type: none"> Soak the seeds in CaCl_2 solution (2%) for 8 hours, dry under shade, then treat the seeds with Imidachloprid (5 g/kg seeds) and 500 g Azospirillum 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> DSH-1 RSFH-1 MSFH-17 SH-41 	<ul style="list-style-type: none"> Sow 5.0 kg seeds/ha at 60 cm x 20 cm or 135 cm x 10 cm spacing Applying FYM (8t/ha) before 15 days and entire chemical fertilizer (35:50:35 kg NPK/ha) at the time of sowing Take up frequent deep intercultivation Spray borax (0.25%) at flowering stage. Spray Methylparathian(2%) or Quinalphos (2 ml/litre) for the control of spodoptera Spray Endosulfan 35 EC (2 ml/litre) or Phosalon (2ml/litre) for control of Helocoverpa Spray Zineb or Mancozeb (2g/litre) for the control of Alternaria leaf spot and rust. Close the cracks by frequent intercultivation 	
October	I Fortnight	2. <i>Rabi</i> sorghum <ul style="list-style-type: none"> M 35-1 5-4-1 DSV-4 	<ul style="list-style-type: none"> Apply FYM (3t/ha) before 15 days of sowing and chemical fertilizer (50:25 kg N & P) at the time of sowing Use 7.5 kg seeds/ha for sowing at 60 cm x 10 cm spacing Soak the seeds in the solution of CaCl_2 (3%) for 8 hours and dry under shade. Then treat the seeds with sulphur (2g/kg seeds) or Tricoderma (24 g/ha seeds) and Azospirillum (500 g/ha seeds) Incorporate phorate granules (40 kg/ha) or carboheran granules (30 kg/ha) for the control of shoot fly at the time of sowing Frequent intercultivation helps to conserve moisture Top dress with 10 to 15 kgN /ha if moisture is available to <i>rabi</i> sorghum Use only 50% of RDF for <i>rabi</i> sorghum and sunflower 	
October	I Fortnight	3. Safflower <ul style="list-style-type: none"> A-1 A-300 S-144 H-2 	<ul style="list-style-type: none"> Apply FYM (5t/ha) before 15 days of sowing and chemical fertilizer (40:40:12 kg NPK/ha) at the time of sowing Use 7.5 kg seeds/ha for sowing at 60 cm x 30 cm spacing Treat the seed with 200 g Azospirillum per ha Frequent intercultivation helps to conserve moisture Spray Dimethoate 30 EC (1.7 ml/litre or parathion 50 EC (1ml/litre) or Monocrotophos 36 SL (1ml/litre) for the control of Aphids, leaf eating caterpillars and capsule borer. Spray Mancozeb (2g/litre) for the control of alternaria leaf spot 	
October	I Fortnight	4. Chickpea	<ul style="list-style-type: none"> Sow 50 kg seeds/ha at 30 cm x 10 cm spacing 	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
		<ul style="list-style-type: none"> Annigeri-1 	<ul style="list-style-type: none"> Soak the seeds in water for 8 hours or in CaCl_2 solution (2%) for half an hour and dry under shade. Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (10:25 kg NP/ha) at sowing. Nipping at 35 to 40 DAS will increase the yield. Spray 2.5 ml chloropyriphos 20 EC or 2 ml quinolphos or 2 ml endosulfan/litre of water for the control of helicoverpa 	
October	I Fortnight	5. <i>Rabi</i> sorghum + chickpea (2:1)	<ul style="list-style-type: none"> Close the crack by frequent intercultivation 	
October	I Fortnight	6. Safflower + chickpea (2:4)		
October	II Fortnight	1. <i>Rabi</i> sorghum Varieties <ul style="list-style-type: none"> M 35-1 5-4-1 DSV-4 	<ul style="list-style-type: none"> Apply FYM (3t/ha) before 15 days of sowing and chemical fertilizer (50:25 kg N & P) at the time of sowing Use 7.5 kg seeds/ha for sowing at 60 cm x 10 cm spacing Soak the seeds in the solution of CaCl_2 (3%) for 8 hours and dry under shade. Then treat the seeds with sulphur (2g/kg seeds) or Tricoderma (24 g/ha seeds) and Azospirillum (500 g/ha seeds) Incorporate phorate granules (40 kg/ha) or carboheran granules (30 kg/ha) for the control of shoot fly at the time of sowing Frequent intercultivation helps to conserve moisture Top dress with 10 to 15 kgN /ha if moisture is available to <i>rabi</i> sorghum Use only 50% of RDF for <i>rabi</i> sorghum and sunflower Frequent intercultivation to close the cracks 	
October	II Fortnight	1. Chickpea <ul style="list-style-type: none"> Annigeri-1 	<ul style="list-style-type: none"> Sow 50 kg seeds/ha at 30 cm x 10 cm spacing Soak the seeds in water for 8 hours or in CaCl_2 solution (2%) for half an hour and dry under shade. Apply FYM (5t/ha) before 15 days of sowing and entire chemical fertilizer (10:25 kg NP/ha) at sowing. Nipping at 35 to 40 DAS will increase the yield. Spray 2.5 ml chloropyriphos 20 EC or 2 ml quinolphos or 2 ml endosulfan/litre of water for the control of helicoverpa 	
October	II Fortnight	3. Sorghum + chickpea (2:1)	<ul style="list-style-type: none"> Remove alternate row or every third row in case of withdrawal of monsoon 	

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
<i>Kharif</i>						
Greengram	PS-16	0.3-0.4	30	65-70	Susceptible to powdery mildew and pod borer	Suitable for sequence cropping in medium deep black soils
Blackgram	K-3	0.4-0.5	45	85	Susceptible to powdery mildew and pod borer	Suitable for sequence cropping in medium deep black soils
	T-9	0.75-1.0		80		
Cowpea	C-152	0.50-0.60	50	90-100	Susceptible to leaf blight mosaic and pod borer	Suitable for sequence cropping in medium deep black soils
	S-488	0.75-1.0		80-90		
Pigeonpea	C-28	1.0-1.2	120	180	Susceptible to sterility mosaic and pod borer	Suitable for monocropping in shallow to medium deep black soils and red soils
	PT-221	1.0-1.2		180	Susceptible to sterility mosaic and pod borer	Suitable for monocropping in shallow to medium deep black soils and red soils
	G.S -1	1.0-1.2		180-185	—	—
	KGT-1	1.0-1.2	125	180-190	Tolerant to wilt, sterility mosaic	
Cotton	Suyodhar (<i>Herbaceum</i>)	0.7-0.8	90	190-200	No major pests and diseases	Suitable for monocropping in medium deep soils
<i>Rabi</i>						
<i>Rabi</i> Sorghum	M-35-1	1.0-1.2	65-70	125-130	Susceptible to charcoal rot and shoot bug	Suitable for medium to deep soils
	5-4-1	1.0-1.2		125-130		
Safflower	A-1	0.8-1.0	85	125-130	Susceptible to aphids and caterpillar	Suitable for monocropping in medium to deep soils
Sunflower	KBSH-1	0.7-1.0	45	90-95	Susceptible to virus	Suitable for shallow soils when sown during July/ August and during September first week in medium to deep black soils.
Chickpea	A-1	0.6-0.7	45	90-95	Susceptible to caterpillar and pod borer	Suitable for monocropping and intercropping systems

Seeding rate and planting pattern

Crop	Plants/ha	Seed rate (kg/ha)	Planting pattern (cm)	
			Inter row	Intra row
<i>Rabi</i> sorghum	90,000 to 1,00,000	8 to 10	45-60	15
Safflower	60,000 to 70,000	8 to 10	60	30
Cotton	60,000	10	60	30
Chickpea	30,000 to 50,000	60 to 65	30	10
Sunflower	80,000 to 84,000	8	60	20

Nutrient management

Crop	Nutrients (kg/ha)		
	N	P ₂ O ₅	K ₂ O
Greengram followed by <i>rabi</i> sorghum	25	50	—
	30	—	—
Hybrid pearl millet	40	40	40
<i>Rabi</i> sorghum (sole)	50	25	—
Safflower	50	25	
Chickpea	25	50	
Sunflower	50	25	
Pearl millet	50	25	
Groundnut	25	50	
Sesame	50	25	

- If soil profile is wetted to a depth of 150 cm, 100 percent recommended dose of fertilizer to be applied
- if soil profile is wetted to a depth of 60 – 70 cm, 50 percent recommended dose of fertilizer to be applied
- if soil profile is wetted to a depth of 30 cm, no fertilizer is applied at sowing but after receipt of good rains, 10-15 kg N / ha top dressing advocated.
- *Rabi* sorghum: Green manure (Glyricidia/ leucaena/ sunhemp) at 5 t/ha + 50 percent recommended dose of fertilizer to be applied
- Crop residues (Sorghum Stubble/ cotton stalks/ pigeonpea stalks/ green manuring crops like *leucaena*, sunhemp and glyricidia) incorporation 3-4 months earlier to sowing of sorghum with 50% or 100% recommend dose of fertiliser, (crop residues + 100 % recommend dose of fertiliser, or crop residues + green manure + 50% recommend dose of fertiliser).
- Farm yard manure to meet 50% N + 50% recommend dose of fertilizer or Vermi compost 1 t/ha + 50% recommend dose of fertiliser are helpful.

Suitable cropping systems

- Advancing the time of sowing of *rabi* sorghum from September to October causes sustained increases in yield
- On medium black soils early sowing in second fortnight of September is better
- Sowing of *rabi* black soils

- Pigeonpea – first fortnight of July
- Cotton – second fortnight of July

Sequence cropping

- Greengram – *rabi* sorghum/ sunflower
- Cucumber – *rabi* sorghum/ sunflower
- Greengram – safflower

Intercropping

Kharif

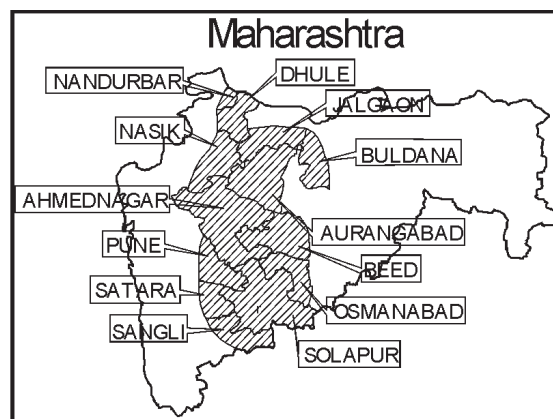
- Hybrid pearl millet + castor (3:1)
- Cotton + setaria (1:1)
- Groundnut + setaria (3:1)
- Pearl millet + pigeonpea (2:1)
- Sesame + pigeonpea (3:1)
- Bunch groundnut + pearl millet (4:2)
- Bunch groundnut + pigeonpea (3:1 or 4:2)
- Groundnut + cotton (2:1)
- Groundnut + sunflower (3:1)

Rabi

- Chickpea + safflower (4:2)
- Chickpea+ safflower (3:1)
- *Rabi* sorghum + pigeonpea (3:1)
- Safflower + chickpea (2:4 or 1:3)
- *Rabi* sorghum + chickpea (2:1)

5.1.3. Semi-Arid Shallow to Deep Vertic Inceptisols / Vertisols in Scarcity Zone of Western Maharashtra

Recommendation domain: Comprises Western parts of Beed, Osmanabad, Aurangabad, Some parts of Jalgaon and Buldana districts, Solapur, Ahmednagar districts and eastern parts of Nasik, Pune, Satara, Dhule, Nandurbar and Sangli districts in Maharashtra.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Pigeonpea (BSMR-736 & BSMR-853) Sunflower, Sorghum (Early sown)	Harvesting, Threshing	-
February	Sorghum, Safflower and Chickpea	Harvesting, Threshing	-
March		Ploughing of <i>rabi</i> soils	-
April		Ploughing of <i>rabi</i> soils	-
May	For <i>Kharif</i> cropping	Land preparation by harrowings, Preparation of soil for moisture conservation layouts like compartment bunds, ridges and furrows.	Very shallow and shallow soils up to 45 cm depth
June	All <i>Kharif</i> crops viz. Pearl millet (Shradha and Saburi), Pigeon pea (BDN-2, BSMR-736, BSMR-853), Castor (Aruna, VI-9, DCH 32) , Groundnut (JL 24, TAG 24, TG 26) Green gram (Phule M-2), Black gram (TPU-4), Moth bean (MBS-27), Horse gram (Sina and Man) Intercrops (Pearlmillet + Pigeonpea, Sunflower + Pigeonpea, Pigeonpea + Clusterbean)	Preparation of soil for moisture conservation layouts, Sowing of <i>kharif</i> crops and intercrops	For normal onset of monsoon
July	Sunflower (SS-56, Morden), Pigeon pea (BDN-2, BSMR-736, BSMR-853), Setaria (Arjun), Castor (Aruna, VI-9, DCH 32) Intercrops (Pearlmillet + Pigeonpea, Sunflower + Pigeonpea, Pigeonpea + Clusterbean) For mid late onset of monsoon	Sowing of <i>kharif</i> crops. Gap filling and inter-cultivation of early sown <i>Kharif</i> crops.	
August	All <i>Kharif</i> crops Sunflower, Pigeonpea, Horsegram,	Inter-cultivation i.e. weeding and hoeing Sowing of <i>kharif</i> crops.	For late onset of monsoon

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	Sunflower + Pigeonpea	Ridges and furrows for soil and water conservation for <i>rabi</i> crops	
September	Sunflower (SS-56, Morden) Sorghum (Maulee on shallow to medium soils, M-35 on medium deep, Yeshoda for deep soils) Safflower (Bhima, Phule Kusuma) Chickpea (PG 12, Vijay, Vishal)	Control of shoot fly Land preparation for <i>rabi</i> crops i.e. harrowing and stubble collection. Sowing of Sunflower, sorghum, Safflower, and Chickpea. Harvesting of early sown <i>Kharif</i> pulses.	Medium deep and deep soils depth > 45 cm. If <i>Kharif</i> is failure, shallow soils are also sown with <i>rabi</i> crops.
October	Sunflower (SS-56, Morden) Sorghum (Maulee on shallow to medium soils, M-35 on medium deep, Yeshoda for deep soils) Safflower (Bhima, Phule Kusuma) Chickpea (PG 12, Vijay, Vishal)	Control of shoot fly and stem borer, Harvesting of Pearl millet, Horsegram, Groundnut, Sunflower & Setaria Sowing of <i>rabi</i> sorghum 24 th September to 14 th of Oct. Sowing of sunflower and safflower up to end of 1 st fortnight of October. Sowing of gram 2 nd week of Oct. onwards.	-
November	<i>Kharif</i> crops : Mothbean, Castor, Pigeonpea <i>Rabi</i> crops : Sorghum, Safflower, Sunflower, Chickpea	Harvesting, Intercultivation, Plant protection Gap filling, Inter-cultivation, plant protection for sorghum stem borer. Complete the sowing of Chickpea by end of 1 st fortnight of November in waterlogged soils.	-
December	<i>Kharif</i> crops : Castor, Pigeonpea <i>Rabi</i> crops : Sorghum, Safflower, Sunflower, Chickpea	Harvesting Ploughing of <i>Kharif</i> soils. Inter-cultivation i.e. weeding & hoeing, plant protection etc. Adopt moisture conservation practices for <i>rabi</i> crops.	-

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	-	-	-
	II Fortnight	All <i>Kharif</i> Crops Pearl millet : Shradha (75-78), Saburi (75-80) Pigeon pea (BDN-2, BSMR-736, BSMR-853) Green gram: Phule M-2 (60-65) Black gram : TPU-4 (70-75), TPU-4(70-75) Sunflower : EC-68414 (100-110), SS-56(80-85) Castor: Aruna (115-120), VI-9(100-110) Kidney bean : MBS-27 (125-130) Groundnut : TG -26 (95-100), SB-11 (105-110), TAG 24 (100 - 110) Horse gram: Sina (115-120), Man (100-105)	Preparation of soil moisture conservation layouts, Sowing of <i>kharif</i> crops.	Normal sowing
July	I Fortnight	Pearl millet, Setaria, Groundnut, Castor, Horsegram, Intercropping of Pearl millet + Pigeonpea (2:1), Sunflower + Pigeonpea (2:1), Pigeonpea + Clusterbean (1:2), Castor + Clusterbean (1:2)	Sowing of <i>kharif</i> crops.	-
	II Fortnight	Sunflower, Pigeonpea, Setaria, Castor,	Sowing of <i>kharif</i> crops.	Weed free crop

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
August		Horsegram, Intercropping of Sunflower + Pigeonpea (2:1), Pigeonpea + Clusterbean (1:2)	Gap filling and inter-cultivation.	for 15 to 30 DAS
	I Fortnight	Sunflower, Pigeonpea, Castor, horse gram Intercropping of Sunflower + Pigeonpea (2:1) Sunflower + Ridge ground mix crop	Sowing of <i>kharif</i> crops and Intercultivation.	If the dry spell occurs adopt soil moisture conservation measures
	II Fortnight	Sunflower, castor	Sowing of <i>kharif</i> crops, Intercultivation	-
September	I Fortnight	<i>Rabi</i> Sorghum for fodder	Sowing, Plant protection in pigeonpea	-
	II Fortnight	-	Harvesting	-
October	I Fortnight	-	Harvesting	-
	II Fortnight	-	-	-

Note : Figures in parenthesis indicates the duration of crops. The cultural operations to be cudgeled accordingly to delayed sowing of *Kharif* crops as well as mid season corrections.

Recommended Contingency plans for delayed rains or failed *Kharif* (Soil depth more than 45 cm)

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
September	I Fortnight	-	-	-
	II Fortnight	<i>Rabi</i> sorghum : (Maui on shallow to medium soils, M-35 on medium deep, Yeshoda for deep soils as well as for protective irrigation) Safflower (Bhima, Kusuma), Sunflower (SS-56, Morden), Chickpea (PG 12, Vijay, Vishal)	Sowing and gap filling, Plant protection for Sorghum Shoot fly	-
October	I Fortnight	<i>Rabi</i> sorghum : (Maui on shallow to medium soils, M-35 on medium deep, Yeshoda for deep soils), Safflower (Bhima, Kusuma), Sunflower (SS-56, Morden), Chickpea (PG 12, Vijay, Vishal)	Sowing and gap filling, Plant protection for Sorghum Shoot fly and stem borer.	-
	II Fortnight	<i>Rabi</i> sorghum, sunflower, chickpea,	Sowing, Intercultivation, Plant protection	-
November	I Fortnight	Chickpea Sunflower	Intercultivation, Plant protection	-
	II Fortnight	Onwards no cultivation of crops is possible because of moisture stress.	-	-

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Pearlmillet	ICTP-8203 Hybrid	2.0-2.2	50-55	70-80	Resistant to <i>Gosavi</i>	Bold seed, ash colour
	Shradha	2.5-3.0	50-55	75-80	Resistant to <i>Gosavi</i>	Bold seeded, seed colour white gray
	RHRBH-8609	2.5-3.0	50-55			
Setaria	Arjun (variety)	1.7-1.8	50-52	103	—	Suitable for moisture stress
Pigeonpea	No.148	2.1-2.2	75-85	145-155	Tolerant to wilt	Suitable for intercropping
	BDN-2	1.6-1.8	85-90	155-165	Wilt resistant	Bold white seeded, better for intercropping
	T-Vishakha	1.5-1.6	80-85	120-125	—	—
	Maruti (ICP-8863)	1.5-1.6	80-85	185-190	—	—
	BSMR-736	1.5-1.6	80-85	185-190	—	Resistant to wilt
Sunflower	EC-68414	1.0-1.2	60-65	100-110	—	Recommended for <i>Kharif</i>
	Morden	0.7-0.8	54-58	80-85	—	Recommended for light to medium type of soil
	SS-56	0.8-1.0	52-55	80-85	—	Recommended for drought prone area
Groundnut	M-13	1.6-1.7	40-45	130-135	—	Erect
	SB-11	1.2-1.4	30-35	105-110	—	-do-
	ICGS-11	2.6-3.0	45-50	125-130	—	-do-
	JL-220	2.0-2.2	30-35	90-95	—	-do-
	TAG-24	1.2-1.4	100-105	—	—	
	TG-26	1.8-2.0	35-40	95-100	—	Erect, suitable for whole Maharashtra State
Horsegram	Sina (K-42)	0.8-0.9	55	115-120	Tolerant to mosaic	Pale white seeded, suitable for intercropping
	Man (D-40-1)	0.7-0.8	45	100-105	-do-	Dark brown seeded, suitable for intercropping
Greengram	S-8	0.9-1.0	35-40	75-80	—	Suitable for sequence cropping
	J-781	0.8-1.0	35	65-70	—	Bold, green shining seeds, suitable for sequence cropping
	Phule M-2	1.1-1.2	38-40	60-65	—	Pale green, suitable for both seasons
Blackgram	T-9	0.7-0.8	32-35	78-82	—	Suitable for sequence cropping
	TPU-4	1.1-1.2	35-40	70-75		Bold seeded, Medium
Mothbean	MBS-27	0.7-0.8	75-80	125-130	Resistant to mosaic	Recommended for western Maharashtra

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Castor	VI –9	1.1-1.5	90-95	100-110	—	Recommended for western Maharashtra
	Aruna	1.0-1.2	70-75	115-120	—	-do-
	Girija	1.0-1.4	80-85	110-120	—	-do-
Sorghum	M 35-1	1.5-1.8	70-75	120-125	Resistant to mosaic	Recommended for drought prone area and medium deep soils
	Phule Yashoda	3.0-3.2	75-80	120-125	Resistant to charcoal rot and shootfly	Recommended for deep soils
	Mauli	M-1.5-2.0* S-0.8-0.9**	70-75	105-110	-do-	Recommended for drought prone area and light soils
	Sel.-3	0.6-0.8	65-70	105-110	-do-	Recommended for light soils
Safflower	Bhima	1.4-1.6	65-70	130-135	—	Recommended throughout Maharashtra for late sowing
Chickpea	Vikas	1.1-1.2	40	115-120	Resistant to wilt	Recommended for Western Maharashtra
	N-59	1.0-1.1		105-110	-do-	Recommended for Vidharbha, Marathwada
	Chaffa	0.9-1.0	37	100-105	-do-	Recommended for drought prone area of Maharashtra
	Phule G-12	1.2-1.3	40-45	105-110	—	Recommended for rainfed and irrigated area
	Vijay Vishal	1.5-1.6 1.4-1.5	38 40	85-90 110-115	Resistant to wilt -do-	Recommended for rainfed and irrigated area

*M=Medium deep soil; **S=Shallow soils

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Pearlmillet	03	45	15
Sunflower	10	45	30 (Heavy soils)
		45	22.5 (Light soils)
Groundnut	100		
Errect		30	10
Semi spreading		30	15
Spreading		45	15

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Pigeonpea	12	45 to 60	20
Horsegram	15	30	10
Mothbean	15	30	10
Blackgram	15	30	10
Greengram	15	30	10
Rabi sorghum	10	45	20
Safflower	12	45	20
Chickpea	75	30	10

Preparatory tillage

- Horsegram, mothbean, greengram, blackgram, chickpea – 2 to 3 harrowings
- Pearl millet, pigeonpea, sunflower, safflower – 3-4 harrowings
- Groundnut – one ploughing, 3-4 harrowings
- Sorghum – ploughing once in three years 3-4 harrowings every year

Nutrient management

Crop	Fertilizer (kg/ha)		FYM	Remarks
	N	P ₂ O ₅		
Pearl millet	50	25	—	<i>Leucaena</i> loppings 5 t/ha on shallow strips + 25 kg N
Sunflower	50	25	—	—
Groundnut	12.5	25	—	—
Pigeonpea				
Horsegram				
Mothbean				
Castor	25	12.5	—	—
Rabi Sorghum	50	25	12.5 Cart loads farm yard manure/ha once in three years, to the ploughed fields	Medium deep soils: 25 kg N/ha, Deep soils: 50 kg N/ha Mulching with 5 t/ha dry grass after crop emergence + protective irrigation cowpea (fodder) – rabi sorghum – leucaena loppings (5 t/ha) + 25 kg/ha P ₂ O ₅ to cowpea
Safflower	50	25	—	—
Chickpea	12.5	25	—	—
Summer Groundnut (JL-220/ TAG-24)	25	50	—	—
Greengram	12.5	25	—	—
Blackgram	12.5	25	—	—

- General Recommendation
 - Cereals – 50 kg N + 25 kg P₂O₅ /ha
 - Pulses – 12.5 kg N + 25 kg P₂O₅ /ha
- Seed treatment
 - Pearl millet, sunflower, sorghum, safflower – *azotobacter* culture 25 g/kg seed
 - Pigeonpea, greengram, blackgram, horsegram, mothbean, groundnut, chickpea – *Rhizobium* culture 25 g/kg seed

Suitable cropping systems

Sowing time

- Horsegram – upto mid of August
- Mothbean – upto end of July
- Groundnut, pearl millet – upto first fortnight of July
- Pigeonpea – upto second fortnight of August
- Greengram/ blackgram – upto end of June
- Sunflower – upto September, as contingency planning
- Sorghum, safflower – upto second fortnight of September
- Chickpea – upto end of October

Crop planning as per soil depth

- Soil depth – <7.5 cm (available moisture – 15-20 mm): grasses, agroforestry, dryland horticulture
- Soil depth – 7.5 – 22.5 cm (available moisture – 30-35 mm): grasses, horsegram, mothbean, castor, agroforestry, dryland horticulture, pearl millet + horsegram / mothbean (2:1)
- Soil depth – 22.5 – 45 cm (available moisture – 40-65 mm): sunflower, pearl millet, pigeonpea, pearl millet + pigeonpea (2:1), pigeonpea + clusterbean (1:2), castor + clusterbean (1:2), castor + ridgegourd, castor 90x45 cm line sowing of ridgegourd in the castor row at 100 cm spacing.
- Soil depth – 45 – 60 cm (available moisture – 60-150 mm): *rabi* sorghum, safflower, sunflower and chickpea
- Soil depth – > 60 cm (available moisture – > 150 mm): *rabi* sorghum, safflower, sunflower, chickpea and also double cropping

Sequence cropping

One year rotation

- Blackgram or greengram or cowpea for fodder followed by *rabi* sorghum, safflower, sunflower.
- Pearl millet or sunflower followed by chickpea
- Sorghum for fodder followed by chickpea or safflower

Two year rotation

- Safflower or chickpea - *rabi* sorghum • *Rabi* sorghum or chickpea - safflower *Medium deep (60-90 cm) soils*
• Normal onset of monsoon
- Greengram – *rabi* sorghum • Pearl millet – chickpea *Rabi to rabi rotation* • *Rabi* sorghum – chickpea • *Rabi* sorghum – safflower • *Rabi* sorghum – chickpea

Intercropping • Medium deep soils: *kharif* crops – first fortnight of July • Pearl millet + pigeonpea (2:1) • Sunflower + pigeonpea (2:1) • Pigeonpea + clusterbean (1:2) • Castor + clusterbean (1:2) • Castor + ridgegourd, castor 90x45 cm line sowing of ridgegourd in the castor row at 100 cm spacing. • Shallow soils • Pearl millet + pigeonpea (2:1) • Sunflower + pigeonpea – aberrant weather • Sunflower + maize (2:1) • Dry seeding of sunflower + pigeonpea (2:1) during 11 to 17 June • *Kharif* sorghum + pigeonpea (1:1) • Hybrid pearl millet (paired row at 30 cm spacing) + pigeonpea (2:1)

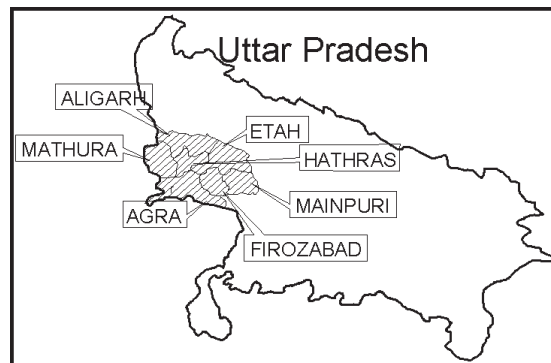
Recommended intercropping practices

Practices	Pearlmillet + pigeonpea (2:1) intercrop	Sunflower + pigeonpea (2:1) intercrop	Pearlmillet+ horsegram / mothbean (2:1) intercrop
Soil Preparatory tillage Sowing time N:P2O5 kg/ha at sowing Variety	Medium deep 3 to 4 harrowings Up to 1st fortnight of July 50:25 Pearlmillet - As per sole pearlmillet Pigeonpea - BDN-2, N - 148	Medium deep 3 to 4 harrowings Up to 2nd fortnight of August 50:25 Sunflower – SS-56, Morden Pigeonpea – N-148, BDN –2	Shallow 2 to 4 harrowings Pearlmillet + mothbean – up to 2nd fortnight of June Pearlmillet + horsegram – up to 2nd fortnight of July 50:25 Pearlmillet – As per sole pearlmillet Mothbean – MBS –27; Horsegram – Sina, Man
Seed rate (kg/ha)	Pearlmillet – 2.5 Pigeonpea - 8	Pearlmillet – 2.5 Pigeonpea – 8	Pearlmillet – 2.5; Mothbean -5; horsegram –5
Seed treatment (per kg seed)	Thiram /captan – 3 g and Azatobacter – 25 g for pearlmillet. Rhizobium – 25 g for pigeonpea	Thiram /captan – 3 g and Azatobacter 25 g for sunflower, Rhizobium – 25 g for pigeonpea	Thiram/captan – 3 g and Azatobacter – 25 g for pearlmillet, Rhizobium – 25 g for legumes
Sowing distance (cm)	Pearlmillet-30 x 15, Pigeonpea-90x20	Sunflower-45x30 cm, Pigeonpea-135x20 cm	Pearlmillet – 30 x 15; Mothbean/horsegram – 90 x 10
Intercultivation	Weeding (one) before 30 days followed by 2 – 3 hoeings	Weeding (one) before 30 days followed by two hoeings	Weeding (one) before 30 days followed by 2 hoeings
Plant protection	As suggested under sole pearl millet and pigeonpea	As suggested under sole sunflower and pigeonpea	As suggested under sole pearlmillet
Protective irrigation (if available)	At flowering of pearlmillet At pod filling of pigeonpea	At flowering of sunflower At seed filling of sunflower At pod filling of pigeonpea	At tillering of pearlmillet At flowering of pearlmillet
Yield (t/ha)	Pearlmillet 1.2 – 1.5 Pigeonpea 0.4 – 0.6	Sunflower 0.6 – 0.8 Pigeonpea 0.4 –0.5	Pearlmillet 1.0 – 1.2 Mothbean/ horsegram 0.3 –0.4

5.2. Pearlmillet based production system

5.2.1. *Kharif – Rabi* Semi Arid Inceptisols in South Western zone of Uttar Pradesh

Recommendation domain: Comprises the districts of Agra, Aligarh, Hathras, Etah, Mainpuri, Firozabad and Mathura districts in Uttar Pradesh.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	—	Plant protection measures of Rabi crops	If required
February	—	—	—
March	—	Harvesting of rabi crops	—
April	—	—	—
May	—	Deep ploughing	By disc plough
June	—	Harrowing	By harrow
July	PM pure, CB pure, PP, Pure PM+CB(2:1), PM+PP (2:1) PM+GG (2:1) PM+Ses (2:1)	Land preparation and sowing By seed drill	By cultivator
August	—	Thinning and weeding + Top dressing of N fert.	Manual weeding
September	—	Harvesting of kharif crops. Field preparation for Rabi crops	By cultivator
October	Mustard, Cowpea, Barley, Barley+ Cowpea (3:2) (Pea+mustard) (4:1)	(i) One irrigation to PP and (ii) sowing of rabi crops	By harvested water in the end of October
November	—	Harvesting of PP and thinning weeding of rabi crops	Manual weeding
December	—	—	—

PM – Pearlmillet, PP- Pigeonpea, GG- Greengram, Ses – Sesbania, CB- Clusterbean

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight		Deep tillage	
	II Fortnight			
July	I Fortnight	PM (pure) NBH-63, pro agro-9330 short duration PP pure – UPAS-120; PM + Sesame PP, (2:1) PM+CB (HGS-870) PM+ Sesame (RT 120)PM+GG (Pant-2)PM+BG (Pant 0-19)	Land preparation, sowing inter culture, tillage for <i>in-situ</i> moisture conservation	Normal sowing
	II Fortnight	do	Land preparation inter culture compartmental bunding for in situ moisture conservation nursery of PM	15% higher seed rate may be planted. Nursery may be kept ready for transplanting
August	I Fortnight	(i) Transplanting of PM (ii) Sowing of legumes like GG,BG, and clusterbean	Transplanting, inter culture, construction of compartmental bunding and conservation furrow for <i>in-situ</i> moisture	Due to short duration crops legume are more suitable in late seeding condition than PM.
	II Fortnight	(i) PM+cowpea for green fodder (WCC-75, local) (ii) Clusterbean (HGS – 870)	Sowing of fodder and clusterbean, inter culture in clusterbean, construction of conservation furrow for <i>in-situ</i> moisture conservation rains received after mid of Aug may be conserved for <i>rabi</i> sowing	(i) Clusterbean can be grown without suffering much reduction (ii) PM+Cowpea fodder can easily be grown in this situation only
September	I Fortnight		Application of life saving irrigation from harvested water. As a mid - season correction, toria can be sown. Rains conserved for <i>rabi</i> season	
	II Fortnight		Reduction in plant population in <i>kharif</i> up to 50%, sowing of taramira (T – 27), and lentil in <i>rabi</i> season. Rains conserved for <i>rabi</i> season	Used as fodder Compaction through roller.
October	I Fortnight		Sowing of mustard and chickpea; Use of harvested water for pre sowing irrigation, life saving irrigation in high value crops	Wider spacing
	II Fortnight		Re-seeding and inter culture in <i>rabi</i> crops (mustard, chickpea, barley)	

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Mustard (Bio – 902), Chickpea (Gaurav) , Taramira (T – 27)	Land preparation and sowing	Wider spacing
	II Fortnight		Interculture, use of mulch and compaction	
November	I Fortnight		Interculture	
	II Fortnight			
December	I Fortnight		Plant protection measures	
	II Fortnight			
January	I Fortnight			
	II Fortnight			

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Pearlmillet	MBH-110	2.2-2.3	55-60	85-90	Resistant to diseases and pests	Suitable for pure/ intercropping
	MBH-163	2.3-2.4			-do-	-do-
	Proagro –9402	2.5-2.6	60-65	105-110	-do-	-do-
	WCC-75	1.6-1.8			-do-	-do-
Pigeonpea	T – 21	2.5-3.0	95-100	160-170	Resistant to diseases and pests	Suitable for pure/ inter cropping
	UPAS-120	2.0-2.5	90-95	130-140		
	ICPL-87	2.5-3.0		140-150		
Clusterbean	Durgapura	1.3-1.4	65-70	115-120	Resistant to diseases and pests	Suitable for pure/ intercropping
	Safed					
	RGC-197	1.0-1.2	65-70	110-120		
Greengram	Pant Moong-1	0.8-1.0	40-45	70-75	Resistant to yellow mosaic and pests	Suitable for pure/ inter sequence
	Pant Moong-2	0.8-1.0	40-45	65-70		(with mustard) crop systems
	T – 44	0.8-1.0	40-45	65-70		
	K – 851	1.0-1.2	40-45	60-65		
Blackgram	T – 9	1.0-1.2	50-55	80-90	Resistant to yellow mosaic and pests	Suitable for pure/ intercropping
	Pant - U - 19	1.2-1.5	50-55	80-85		
	Pant – U – 30	1.0-1.2	50-55	80-85		
Groundnut	Chandra	1.2-1.5	65-70	145-150	Susceptible to Tikka disease	Suitable for pure cropping
	T – 64	1.0-1.2	65-70	145-150		
Cowpea	C 152	1.2-1.5	55-60	95-100	Resistant to diseases and pests	Suitable for pure/ intercropping
	RC 19	1.0-1.2	55-60	95-100		
Sesame	T – 4	0.6-0.8	55-60	95-100	Resistant to diseases and pests	Suitable for pure/ intercropping
	T – 12	0.6-0.8	45-50	90-100		
	Pratap	0.6-0.8	45-50	85-100		
Mustard	Varuna (T59)	2.0-2.5	45-50	135-140	Susceptible to	Suitable for pure /

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Chickpea	RH 30	2.0-2.2	45-50	135-140	aphids	inter (chickpea)/ sequence (after greengram) crop systems
	Pusa Jaikisan	2.0-2.5	45-50	135-140		
	BG 256	2.5-2.8	80-90	140-150	Susceptible to blight	Suitable for pure / inter (mustard) cropping
Barley	Gaurav	2.5-2.8	80-90			
	K 850	2.6-3.0	80-90			
	RS 6	2.2-2.5	60-65	145-150	Resistant to diseases and pests	Suitable for pure cropping
Oats	Ratna	2.5-2.8	60-65	145-150		
	DL 70	2.2-2.5	60-65	145-150		
	TMH 1	1.6-1.7	50-55	160-165	Susceptible to <i>Alternaria</i> blight	Suitable for pure cropping
	M 630	1.8-2.0	50-55	160-165		

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Pearlmillet	5-6	45	15
Pigeonpea	12-15	60	15
Blackgram/ greengram	12-15	30	10
Mustard	5-6	45	15
Clusterbean	25	45	15
Chickpea	70-75	30	15
Barley	80-85	25	10
Safflower	6-7	45	15
Linseed	10-12	30	10

Nutrient management

Crop	Nutrients (kg/ha)			Mode of application
	N	P ₂ O ₅	K ₂ O	
Pearlmillet	60	40	—	P ₂ O ₅ basal and N in two equal splits at sowing and tiller initiation
Pigeonpea / blackgram / greengram	10-15	40	—	Placement at 10 cm depth
Clusterbean	10-15	40	—	Placement at 10 cm depth
Mustard	60	40	30 (gypsum)	N and P ₂ O ₅ as basal at 10 cm depth
Safflower	60	40	—	N and P ₂ O ₅ as basal at 10 cm depth
Chickpea	10-15	60	—	Treat seed with rhizobium culture. Full dose of N and P ₂ O ₅ as basal at 10 cm depth
Barley	60	40	—	N and P ₂ O ₅ as basal at 10 cm depth

Crop	Nutrients (kg/ha)			Mode of application
	N	P ₂ O ₅	K ₂ O	
Linseed	45	30	—	N and P ₂ O ₅ as basal at 10 cm depth
Pearlmillet + greengram(2:1)	45	30	—	N and P ₂ O ₅ as basal at 10 cm depth
Chickpea + mustard (4:1)	15-20	45	—	
Barley + chickpea (3:2)	45	30	—	
Fallow – mustard	60	40	—	
Half of recommended dose of N should be substituted by farm yard manure for reducing cost and for increasing productivity				
In greengram – mustard sequence: In case of incorporation greengram stover after first picking of pods followed by mustard and green manuring saves 15 and 30 kg N/ha				

Suitable cropping systems

Monocropping

- Pearlmillet at 45 cm row spacing
- Pigeonpea at 60 cm row spacing
- Mustard at 45 cm row spacing
- Chickpea at 30 cm row spacing
- Barley at 30 cm row spacing

Sequence cropping

- Greengram (green manuring after first picking) – mustard
- Pearlmillet + cowpea (fodder) – chickpea + mustard
- Sow *kharif* crops early with the onset of monsoon

Intercropping

- Pearlmillet + pigeonpea (2:1) – One row of pigeonpea or greengram or blackgram is intercropped in 75 cm space between paired rows of pearlmillet
- Pearlmillet + greengram (2:1)
- Pearlmillet + blackgram (2:1)
- Pearlmillet + clusterbean (2:1)
- Pigeonpea + greengram (2:2) – Two rows of greengram are intercropped in 90 cm space between paired rows of pigeonpea
- Chickpea + lentil (4:1)
- Chickpea + barley (2:3)
- Chickpea + mustard (4:1)
- Chickpea + linseed (6:1)

Fodder based cropping system

- Pearlmillet (grain) + cowpea (2:1) is grown for fodder and harvested after 45-50 days/ up to end of August or early September followed by chickpea + mustard (4:1)

Contingent crop planning

Kharif

Under normal rainfall (first fortnight of July)

- Pearl millet (Proagro 9402), pigeonpea (UPAS 120), greengram (K 851), clusterbean (RGC 197); pearl millet (WCC-75; BK –560) + greengram (T-44, K –851, Pant-2 and PS-8) in 2:1 ratio

Monsoon at end of July

- Pearl millet (Proagro 9402) intercropped with pigeonpea (UPAS 120, IPCL 87), blackgram (T-9) and greengram (K 851).
- Pure crop of clusterbean, blackgram and greengram
- Groundnut (Chandra) and sesame (Pratap) upto the end of third week of July

Monsoon at third week of August

- Cereals and pulses: Clusterbean (RGC 197) and transplanting of pearl millet (MBH 163)

Monsoon at end of August

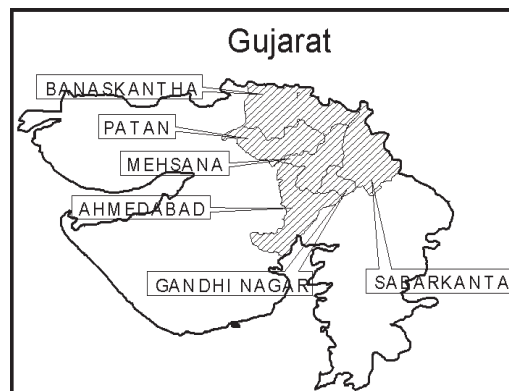
- Clusterbean as pure crop (RGC 197)
- Castor with a seed rate of 15 kg/ha

Rabi (first fortnight of October)

- Mustard (Pusa Jaikisan), barley (Ratna), chickpea (K 850), lentil (L 9-12) and taramira

5.2.2. *Kharif* Arid Deep Aridisols in North Gujarat Zone of Gujarat

Recommendation Domain: Comprises Sabarkantha, Gandhinagar, Mehsana, parts of Pathan, Ahmedabad and Banaskanta districts in Gujarat.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
June	Pearlmillet: GHB-558, GHB-538, Maize: Guj. Maize-1, 2, Ganga 11 Desi Cotton: V-797, G.Cot-13,21, DCH-7, MDH-11 Cowpea: Guj. Cowpea-4 Greengram: GM-4, K-851	Basal dose of fertilizer/ Sowing	
July	Pearlmillet: GHB-558, GHB-538, Maize: Guj. Maize-1, 2, Ganga 11 Castor: GCH-5 ,6 Greengram: GM-4, K-851 Clusterbean: GC-2 Desi Cotton: V-797, G.Cot-13,21, DCH-7, Sesame : Guj.Til-2 Cowpea: Guj. Cowpea-4 Sorghum: GJ-37, 39, 41, GFS-4,5	Sowing / Gap filling / Interculturing / weeding sowing	
August	Maize: Guj. Maize-1, 2, Ganga 11 Castor: GCH-5 ,6 Clusterbean: GC-2 Sorghum: GJ-37, 39, 41, GFS-4,5	Sowing / Interculturing / weeding / Top dressing except pulses	
September	Castor: GCH-5 ,6 Sorghum: GJ-37, 39, 41, GFS-4,5	Harvesting/threshing Interculturing/weeding/ Top dressing/plant protection measure	
October	Chickpea: GC-2 Mustard: GM-2,3, , Bio-902 Durum Wheat: Arnej-206,28, GW-1 Dilseed: GD-1 Ajwah: GA-1	Harvesting/threshing Sowing	
November	Chickpea: GC-2 Mustard: GM-2,3, , Bio-902 Wheat: Arnej-206,28, GW-1 Dilseed: GD-1, Ajwah: GA-1	Plant protection measure. Picking/ harvesting/threshing	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
December		Picking/ threshing	
January		Picking/threshing	
February		Picking/threshing	
March			
April			
May		Land Preparation	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	Pearlmillet: GHB-558, GHB-538, Maize: Guj. Maize-1, 2, Ganga 11	Sowing/Gap filling/ Interculturing/weeding sowing	
	II Fortnight	Maize: Guj. Maize-1, 2, Ganga 11 Desi Cotton: V-797, G.Cot-13,21,DCH-7, MDH-11 Cowpea: Guj. Cowpea-4 Greengram: GM-4, K-851	Sowing/Gap filling/ Interculturing/weeding sowing	
July	I Fortnight	Maize: Guj. Maize-1, 2, Ganga 11 Desi Cotton: V-797, G.Cot-13,21,DCH-7, MDH-11 Cowpea: Guj. Cowpea-4 Greengram: GM-4, K-851	Sowing/Gap filling/ Interculturing/weeding sowing	
	II Fortnight	Maize: Guj. Maize-1, 2, Ganga 11 Castor: GCH-5 ,6 Clusterbean: GC-2 Desi Cotton: V-797, G.Cot-13,21,DCH-7 Cowpea: Guj. Cowpea-4 Sorghum: GJ-37, 39, 41, GFS-4,5	Sowing/Gap filling/ Interculturing/weeding sowing	
August	I Fortnight	Maize: Guj. Maize-1, 2, Ganga 11 Castor: GCH-5 ,6 Clusterbean: GC-2 Sorghum: GJ-37, 39, 41, GFS-4,5	Sowing/Gap filling/ Interculturing/weeding sowing	
	II Fortnight	Castor: GCH-5 ,6 Clusterbean: GC-2 Sorghum: GJ-37, 39, 41, GFS-4,5	Sowing/Gap filling/ Interculturing/weeding sowing	
September	I Fortnight	Castor: GCH-5 ,6 Sorghum: GJ-37, 39, 41, GFS-4,5	Harvesting/threshing Interculturing/ weeding/Top dressing/ plant protection measure	
	II Fortnight	Castor: GCH-5 ,6 Sorghum: GJ-37, 39, 41, GFS-4,5	Harvesting/threshing Sowing	
October	I Fortnight	Chickpea: GC-2 Mustard: GM-2,3, , Bio-902 Wheat: Arnej-206,28, GW-1 Dilseed: GD-1 Ajwaha: GA-1	Harvesting/threshing Interculturing/weeding/ Top dressing/ plant protection measure	
	II Fortnight	Chickpea: GC-2 Mustard: GM-2,3, , Bio-902 Durum Wheat: Arnej-206,28, GW-1 Dilseed: GD-1 Ajwaha: GA-1	Harvesting/threshing Sowing	

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I Fortnight	Castor	Sowing	
	II Fortnight	Mustard and Gram	Sowing/Interculturing/weeding	
November	I Fortnight	Wheat	Sowing/ Interculturing/weeding	
	II Fortnight	Dilseed and ajma	Sowing /Interculturing/weeding	
December	I Fortnight		Interculturing/weeding	
	II Fortnight		Interculturing/weeding	
January	I Fortnight			
	II Fortnight			

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Castor	GCH-4, Seed: 1.20 –1.50		55-60	150-170	Tolerant to wilt	
	GCH-5, Straw: 2.00		-do-	-do-	-do-	
	GCH-6		-do-	-do-	-do-	-do-
	GAUCH-1					
	GAUCH-4					
	GAUCH-7					
Pearlmillet	GHB-235 Grain-1.80		40-45	85-90	Slightly susceptible to	
	GHB-316 Straw-8.50		-do-	-do-	downy mildew	
	BJ-104					
	CJ-104					
	GHB-77					
	GHB-30					
Cowpea	Guj.Cowpea-4 Seed-1.00		30-35	75-80	Susceptible to yellow vein	
	Straw-2.60		-do-	-do-	mosaic Virus upto some extent	
Clusterbean	Guj. Seed-0.80		55-60	110-115	Susceptible to bacterial	
	Clusterbean-1 Straw-2.90		-do-	-do-	blight	
Greengram	Guj. Seed- 0.70		30-35	75-80	Slightly susceptible to	
	Greengram-4 Straw-3.90				yellow vein mosaic virus	
Sorghum	GSF-4	Fodder-	45-50	90-100	Susceptible to shoot fly	
	GJ-36	13.00				
	CSH-6					
	CSH-5					
	GJ-37					
	GFS-5					
	S-1049					
Mothbean	Guj.1	Seed- 0.80	50-55	95-100	Slightly susceptible to	
		Straw-7.00			yellow vein mosaic Virus	
Karingado	Guj.	Seed- 0.50	50-55	115-125	Susceptible to aphids	

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
		Karingado-1	-do-	-do-		
Pigeonpea	T-15-15 BDN-2 ICPH-8 ICPL-87 Gujarat-1					
Sesame	GS-1 Patern 64					

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Pearlmillet	3.75	45	10-15
Sorghum	60	45	10
Cowpea	16	45	10
Cluster bean	16	45	10
Greengram	16	45	10
Moth bean	16	45	10
Castor	4-6	30, 45 or 60	30 or 45
Karingado	1-1.5	180	60

Nutrient management

Crop	Nutrients (kg/ha)			Mode of application
	N	P ₂ O ₅	K ₂ O	
Greengram	20	40	—	Apply both N and P ₂ O ₅ as basal
Pearlmillet	80	40	—	Apply + recommended dose of N and whole dose of P ₂ O ₅ as basal and remaining + dose of N at tillering stage depending on soil moisture content.
Castor	60	30	20	Apply + recommended dose of N whole dose of P ₂ O ₅ and K ₂ O as basal and remaining dose of N in two splits at 30 and 45 days after sowing depending on soil moisture content
Cowpea	20	40	—	Apply both N and P ₂ O ₅ as basal
Mothbean	20	40	—	Apply both N and P ₂ O ₅ as basal
Sorghum	80	40	—	Apply + recommended dose of N and whole dose of P ₂ O ₅ as basal and remaining + dose of N at tillering stage depending on soil moisture content.
Clusterbean	20	40	—	Apply both N and P ₂ O ₅ as basal

Suitable cropping systems

- Greengram + pearlmillet (3:1)
- Cowpea + castor (2:1)
- Sorghum + karingdo (6:1)
- Pearlmillet + clusterbean (2:1)

- Ber + sorghum/ greengram were grown between two rows of ber

Contingent crop planning:

Normal sowing (Early July)

Castor - GCH-4, GCH-5, GCH-6

Pearlmillet - GHB-235, GHB-316

Cowpea - Guj. Cowpea - 4

Clusterbean - Guj. Clusterbean - 1

Greengram- Guj. Greengram - 4

Sorghum - GSF- 4

Mothbean - Guj.1

Karingado - Guj. Karingado-1

Delayed sowing (15th July to early August)

Castor - GSF-4

Sorghum - GCH-4

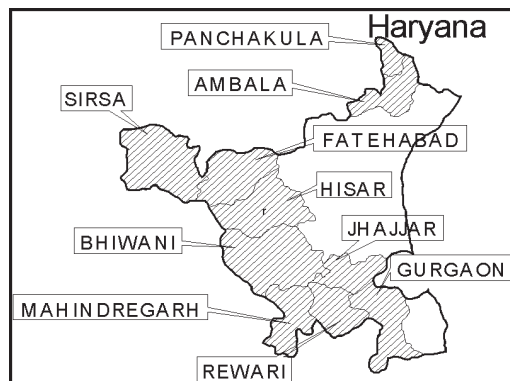
Clusterbean - Guj. Clusterbean-1

Very delayed sowing (mid August)

Castor - GCH-4

5.2.3. *Kharif* Arid Deep Aridisols in Western Zone of Haryana

Recommendation domain: Comprises the districts of Hisar, Sirsa, Fatehabad, Bhiwani, Jhajjar, Mahendergarh, Rewari, Gurgaon, Kandi area of Panchkula and Ambala in Haryana.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January	Chickpea, Barley, Chickpea + Mustard	Hoeing/weeding with wheel hand hoe and kasola	Moisture conservation
	Barley	Apply protective irrigation. If deficiency symptoms of nitrogen and zinc occur then spray of urea (2.5%) and zinc sulphate 0.5% should be done.	To increase the yield and better grain filling
	Mustard	If possible apply life saving irrigation	To avoid frost injury
	Taramira T-27	If winter rains go for sowing	
February	Mustard	For aphid control repeat spray of recommended insecticides if required.	
	Chickpea	For blight control uproot and burn affected plants Spray 200 ml Monocrotophos 36 SL for control of caterpillar. Spray of Endosulphan 400 ml, 35 EC to control pod borer. If it rains, go for hand weeding.	To reduce multiplication of weed seeds.
March	Barley	Apply irrigation if possible	For better grain filling.
	Mustard	Do timely harvesting	To avoid shattering losses
April	Chickpea	Repeat spray for control of pod borer	
	Mustard	Threshing of harvested crop	
May	Chickpea, Barley and Taramira	Harvesting and threshing	
	Chickpea	Safe storage of produce in sand Summer ploughing and pruning of <i>ber</i> trees	To avoid storage pest losses Deep ploughing after 3 years
June	<i>Dhaincha</i>	Opening of field with disc harrow followed by field bunding. If rain received then go for sowing of <i>Dhaincha</i> for green manuring of field to be sown with <i>rabi</i> crops.	To increase the fertility of soil.
	Pearlmillet	In 2 nd fortnight if rains are > 25 mm go for sowing of Pearlmillet	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
July	Pearl millet (HHB 67-2, HHB 67, HHB 94, HHB 117, HC 10) Clusterbean (HG 365, HG 563, RGC 936) Greengram (Asha, Muskan) Moth RMO 40, RMO 257 Cowpea Charodi, CS 88 (for green fodder) Castor CH 1, Til, HT 1	Apply fertilizer (20 kg N+ 20 kg P ₂ O ₅ /ha) and treat seed with biofertilizers and fungicides Apply organic manures in fallow field for <i>rabi</i> crops.	To improve the physical properties of soil
		Complete sowing of all these crops with recommended dose of fertilizer and seed treatment with fungicides and biofertilizers. Keep row spacing 45 cm for all crops except castor (75 cm)	
August	Pearlmillet, Greengram, Clusterbean, Cowpea, Til	Sow Pearl millet crop on ridge shoulders with ridger seeder Thinning/gap filling and hoeing with wheel hand hoe and Kasola after 3 weeks of sowing Do harrowing after each effective rainfall in the field kept for <i>rabi</i> crops for moisture conservation.	To reduce crusting problem and better germination.
		Maintain plant population and do interculture operation in July sown <i>kharif</i> crops. Remove and destroy the downy mildew infected plants in Pearlmillet For control of Jassid and whitefly in <i>kharif</i> pulses and oil seeds spray with Rogor 30 EC/ Metasystox 25 EC @ 250 ml in 250 litres of water/acre Apply remaining dose of nitrogen (20 kg/ha) in Pearl millet Ploughing after each effective rainfall for moisture conservation in fields kept for <i>rabi</i> crops. For control of hairy caterpillar and seme looper in castor spray Endosulphan @ 500 ml in 250 litres of water/acre.	
September	Arid Hort.	Apply recommended fertilizer in arid horticulture.	
	<i>Dhaincha</i>	Incorporate <i>Dhaincha</i> for green manuring.	
October	Castor and Pulses	Interculture/weeding in castor and pulses if required.	
	<i>Rabi</i> Crops	At the withdrawal of monsoon soil moisture may be conserved through harrowing followed by planking in fields kept for <i>rabi</i> crops. Use blade harrow/randa to check evaporation losses for better soil moisture conservation	
October	Pearlmillet, <i>kharif</i> pulses	Complete harvesting of Pearl millet and <i>kharif</i> pulses.	
	Arid fruits	Go for budding of arid fruits.	
	<i>Khari</i> crops and castor	Harvesting and threshing of <i>kharif</i> crops and picking of castor.	
	<i>Rabi</i> Crops	Field preparation by cultivator and planking for <i>rabi</i> crops.	
	Mustard (RH 30, Laxmi, RH 819), (RH 781)	Apply recommended dose of fertilizer in mustard (40 kg N and 20 kg P ₂ O ₅ /ha)	
	Chickpea (C 235, H 208, HC 1)	20 kg N and 40 kg P ₂ O ₅ /ha	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
November	Barley (BH 393, BG 25, BH 75)	Apply 30 kg N and 15 kg P ₂ O ₅ /ha	
	Mustard and chickpea	Treat seeds of chickpea with Rhizobium, oil seeds and barley with <i>Azotobactor</i> and fungicides/insecticide for control of termite and seed born diseases.	
	Barley	Sow the crop with ridger seeder in furrows at 30:60 cm paired row system. For other methods of sowing keep 45 cm row spacing.	
	Mustard	Keep 30 cm row spacing.	
	Chickpea (chickpea + mustard in 8:1 row ratio) and Barley	10-25 Oct., is optimum sowing time.	
	Chickpea, Barley, <i>Rabi</i> Crops	Last week of Oct. to 1 st week of Nov.	
	Castor	Complete sowing	
	<i>Ber</i>	Weeding and Interculture with Kasola and wheel hand hoe in Oct. planted crops.	
	Mustard	2 nd picking of castor	
	Mustard	Spray <i>ber</i> trees with 0.25% sulfex.	
December	Mustard	Thinning of mustard . If painted bug appears spray Melathion 50 EC @ 200 ml in 200 litres water/acre.	
	Castor	Remove and burry aphid infested twigs. If infestation exceeds ETL go for spray of Rogor 30 EC/ Metasystox 25 EC @ 250 ml in 250 litres of water/acre.	Spray in the evening hours to avoid mortality of honey bee.
	Chickpea and barley	Final picking and harvesting of castor.	For moisture conservation.
		Interculture/weeding in chickpea and barley with wheel hand hoe/Kasola.	

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I		Ploughing and bunding of field boundary	To absorb maximum rain water.
	II	<i>Dhaincha</i>	Dry seeding , if mid season drought the <i>dhaincha</i> can be kept for seed purpose, avoid green manuring	To reduce the risk of failure of sowing due to continuous rain.
		Pearlmillet	Raising of pearlmillet nursery if irrigation water available. Go for sowing with ridger seeder if rains are 40 to 50 mm.	To reduce risk of crusting due to rains after sowing.
July	I	Pearlmillet	Sowing with ridger seeder on the shoulder of ridges.	To save the crops from excess rain
	II	Pearlmillet	Transplanting of 3 weeks old nursery	in case of continuous rains
		Pulses	Do sowing of pulses.	
		Pearlmillet	Sow short duration varieties (HNB 67-2 and HNB 68)	To overcome delayed onset of monsoon.
		Castor	Sowing at 75 to 90 cm row spacing.	

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
August	I	Pearlmillet	Thinning	To reduce extra plant population to over come the drought.
			Soil mulching by wheel hand hoe	To reduce evaporation losses.
		Pearlmillet	Harvest every 3 rd row for fodder, life saving irrigation if possible. Straw mulching after Interculture	To manage drought situation.
	II	Pulses, clusterbean and castor	Hoeing and interculture.	To conserve soil moisture.
		Pulses, clusterbean and castor	Hoeing and Interculture.	To conserve soil moisture.
September	I		Field preparation for <i>rabi</i> crops and moisture conservation through harrowing followed by planking. Advance application of fertilizer for mustard	Better solubilization of nutrients.
	II		Blade harrowing for moisture conservation	
October	I	-	-	-
	II	-	-	-

Recommended *rabi* Contingency plans for absence or delayed rains or failed *kharif*

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
October	I		Use roller if moisture is less in surface layer	To enhance the upward movement of soil moisture.
	II	Mustard (RH-30, RH -819, RH- 781 and Varuna	Sow both crops in furrows at 30:60 cm paired system with ridger seeder	If moisture is low in surface layer with profile moisture around 150 mm/m
November		Chickpea (C-235, H-208 and HC-1)	Sow single row of both crops in furrows with ridger seeder	If moisture is low in surface layer with profile moisture around 125 mm/m
	I	Chickpea	Complete sowing.	
	II	<i>Rabi</i> crops	Hoeing and weeding with wheel hand hoe.	To control the weeds and conserve soil moisture.
December		Taramira	Do sowing	If moisture is < 125 mm/m
	I	Taramira	Go for sowing in case of winter showers	
		Mustard	Hoeing and weeding with hand hoe/Kasola	To control weeds and conserve moisture
	II	Taramira	Go for sowing	
January		Chickpea	Hoeing and weeding	To control weeds and conserve moisture
	I	Mustard	If possible apply life saving irrigation	To protect the crop from frost.
		Chickpea	Do weeding if needed.	To reduce crop weed competition

Crops and varieties

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Pearlmillet	HHB 50	3.2-3.6	40-42	70-80	Resistant to downy mildew	High input conditions
	HHB 60	3.2-3.5	38-40	74-76		High input conditions, drought and salt stress tolerant
	HHB 67	3.0-3.5	30-32	60-62	-do-	Drought tolerant, suitable for early to late sowing and inter and multiple cropping and first extra early wonder hybrid in the world
	HHB 68	3.0-3.2	30-32	60-62	-do-	Tolerant to drought and salt stress, suitable for early sowing and extra early hybrid
	HHB 94	3.2-3.5	38-40	74-76	-do-	Suitable for high input conditions, and maturity
	HHB 117	3.0-3.5	38-40	72	-do-	Suitable for high input conditions, good tillering and stays green at maturity
Greengram	S 9	1.0-1.1	40-46	70-75		Tolerant to yellow mosaic suitable for mixed cropping with clusterbean and as sole crop
	Asha (MH 83-20)	1.3-1.6	45-48	75-80		Resistant to yellow For <i>kharif</i> season, mosaic virus w suitable for mixed cropping with clusterbean and as sole crop
	MH 85-111	1.2-1.4	42-45	74-76		Tolerant to yellow mosaic virus suitable for mixed cropping with clusterbean and as sole crop
Cowpea	Charodi	1.0-1.2	30-35	60-65		— Normal sowing, suitable for mixed cropping with clusterbean paired rows
	CS 88	35.0	50-52	80-85		Resistant to yellow For summer and mosaic virus, aphids rainy season, erect and jassids. growth and early vigour, long and broad leaves, good for mixed cropping
Mothbean	RMO 40	0.7-0.8	30-32	62-65		Tolerant Wide adaptability, to yellow mosaic erect, dark green virus, aphids and foliage, suitable for jassids mixed cropping
	RMO 257	0.7-0.8	30-32	62-65		
Clusterbean	FS 277	0.7-0.8	50-55	90-100		— Timely sown, erect, unbranched
Sesame	HG 75	1.0-1.2	55-60	110-115	—	Timely sown bushy
	HG 365	1.1-1.3	50-52	85-100	Tolerant to leaf spot and jassids	Tolerant to drought, dwarf, serrated leaves, early and cropping
	HT 1	0.7-0.8	40-42	75-78	Resistant leaf curl and phyllody	White and bold seeds, contains 49 percent oil

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Castor	CH 1	1.8-2.2	50-55	130-140	Tolerant to leaf spot and semilooper	Recommended for all kinds of soils, dwarf, seed small and dark brown in colour, contains 49 percent oil
Chickpea	C 235	2.2-2.3	80-100	140-165	Tolerant to Aschochyta blight	North east of Haryana
	C 214	1.8-2.0	80-100	150-170	Tolerant to Fusarium wilt	—
	H 208	2.0-2.2	80-100	145-175	Resistant to Fusarium wilt	For irrigated conditions also
	HC 1	2.0-2.5	78-80	135-145	-do-	For late sown irrigated conditions also
Barley	C 138	1.8-2.3	80-95	125-150	Resistant to Fusarium wilt	Tall, long ears with long yellow grains
	BH 393	3.5-4.5	75-80	115-125	-do-	Dwarf plant type with long ears. Seeds bold thin husk, high malt, early in maturity, tolerant to lodging
Mustard	Varuna (T59)	2.0-2.5	58-60	142-145	Susceptible	Wide adaptability and to <i>Alternaria</i> , white bold seeded rust and aphids
	RH 30	2.2-2.6	55-60	136-140	-do-	Suitable for mixed cropping, medium plant height, bold seeded, non-shatter-ing and contains 40 percent oil
	RH 819	1.8-2.0	58-62	145-148	Susceptible to <i>Alternaria</i> , white rust	Medium bold seeds, contains 40 percent oil
	RH 781	1.8-2.0	58-62	140-145	Susceptible to <i>Alternaria</i> , white rust and aphids	Suitable for frost affected areas medium bold seeds, contains 40 percent oil
Taramira	T 27	0.6-0.8	60-65	145-150	—	Seeds are yellowish green and contain 32 percent oil

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra row
Pearlmillet	5	45	15
Clusterbean	20	45	20
Greengram	20	45	10
Mothbean	20	45	10
Cowpea	25	45	15
Sesame	5	45	15
Castor	12	60	30
Chickpea	40-45	45	—
Mustard	5	45	15
Barley	75-80	30	—
Taramira	5	45	15

Nutrient management

Crop	Nutrients (kg/ha)		Mode of application		Remarks
	N	P ₂ O ₅	Basal	Topdressing	
Pearlmillet	40	20	All P ₂ O ₅ and 50% N	50% N at knee-high stage	Based on soil test
Clusterbean	20	40	All P ₂ O ₅ drilled	—	
Greengram	0	30	All N and P ₂ O ₅ drilled	—	
Mothbean	20	40	-do-	—	

Crop	Nutrients (kg/ha)		Mode of application		Remarks
	N	P ₂ O ₅	Basal	Topdressing	
Cowpea	20	40	All N and P ₂ O ₅ drilled	—	
Sesame	20	40	-do-	—	
Castor	40	—	All N drilled	—	
Chickpea	20	40	-do-	—	
Mustard	20	40	All N and P ₂ O ₅ drilled	—	
Barley	40	20	-do-	—	
Taramira	30	15	-do-	—	

Suitable cropping systems

Sequence cropping

- Pearlmillet – chickpea
- Pearlmillet – raya
- Pearlmillet – fallow
- Fallow – raya
- Fallow – chickpea
- Greengram/ cowpea/ mothbean – raya

Contingent crop planning

Normal rainfall

Soil and water conservation practices

- Bunding in Mahendergarh district (rainfall 550 mm) where storm intensity is high. In Hisar region compartmental bunding and leveling of land within the compartments (0.08 ha)
- Runoff collection is possible in Mahendergarh district. In the Hisar region planting with a ridger-seeder which facilitates inter-row water harvesting
- In areas adjoining Rajasthan, stabilization of sand dunes and in areas adjoining Aravali ranges waer harvesting from hills

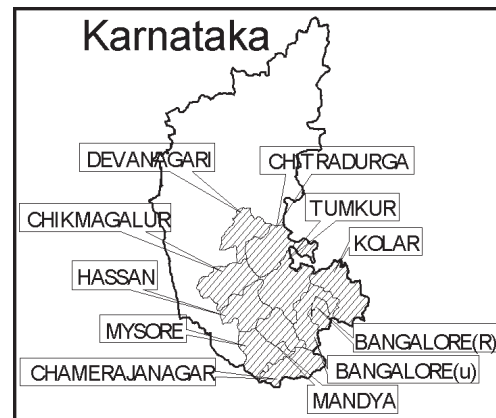
Suitable

- *Cropping systems* for risk minimization by allotting areas in proportion to the probability of the length of season worked out on the basis of long term rainfall records: pearlmillet 45 percent area; greengram 10 percent; forages 10 percent
- Selection of *rabi* crops is dependent upon the amount of *kharif* rainfall

5.3. Fingermillet based Production System

5.3.1. *Kharif* Semi – Arid Deep Alfisols in Eastern Dry Zone of Karnataka

Recommendation domain : Comprises Kolar, Tumkur, Mandya, Hassan, Chamaryanagar, Chitradurga, Chikmagalur, Devanegere and Mysore districts in Karnataka.



Recommended Crop(s) and Cultural Calendar for a normal season

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
January			
February			
March			
April			
May	Pigeon pea, Fodder maize + cowpea 3:1, Niger/cowpea/Sesame for double cropping	Land preparation, FYM application and sowing across the slope	Taking double crop depends upon the receipt of good pre-monsoon showers.
June	Maize, Maize + Pigeon pea 1:1 Pigeon pea + Cowpea 1:1 Groundnut + Pigeon pea 8:2 Fingermillet long duration varieties Fingermillet + pigeon pea 10:2 Cowpea/Greengram/Blackgram for double cropping Fodder maize + cowpea 3:1	Land preparation application of FYM and sowing across the slope. Thinning Interculturing and weeding May sown crops.	
July	Pigeon pea, Long and medium duration Fingermillet, sunflower, castor Fingermillet + Pigeon pea 10:2 Groundnut + Pigeon pea 8:2	Land preparation, application of FYM and sowing across the slope. Interculturing and Earthing up in may sown pigeon pea Thinning, gap filling inter culturing for June sown crops. Opening of moisture conservation furrow in pigeon pea paired row system	
August	Short duration Fingermillet sowing /	Land preparation, application of FYM	

Month	Crop/ Intercropping system (Varieties)	Cultural operations	Remarks
	transplanting medium duration finger millet, after the harvest of May sown crops–short duration finger millet, sunflower	and sowing across the slope. Harvesting of May sown crops Top dressing to June sown Fingermillet. Thinning, gap filling Interculturing for July sown crops. Opening of moisture conservation furrow in pigeon pea paired row system, plant protection measures.	
September/ October	Cowpea, Horsegram, Sunflower	Land preparation and sowing. Plant protection measures, Top dressing to July – August sown Fingermillet. After the harvest of June sown crops – Transplanting short duration Fingermillet.	
October			
November			
December			

Recommended *kharif* Contingency plans for delayed monsoon or other aberrations

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
June	I Fortnight	Pigeonpea (Hyd3C, TTB-7, ICP 7035) castor (NPH-1, GCH-4, DCS-9) Fodder maize (South African tall) Fodder Sorghum (Pusachari, J-set-3,SSV-74) Fodder Pearl millet ((Giant bajra) Sorghum (CSH-5, CSH-9, CSV-4, DSV-2) Maize (Deccan 103, Ganga-11, NAC-6004, NAC-6002) Pearlmillet-(WCC-75) Fingermillet (L-5,MR-1, MR-6) Groundnut (TMV-2, JL-24&PDB-4) Sunflower (KBSH-1, KBSH-41, KBSH-42 & KBSH-44) Chilli (Nursery sowing) (Samruddhi, Arka Lohit, G-4, Gowribidnur)	Soon after the land preparation, it is very important to open conservation furrows across the slope at about 5 M interval. Crust breaking if there is heavy rain after the sowing. If there is a dry spell, thinning operation to be carried out.	For the late onset of monsoon measure to be taken for selecting suitable crop cultivars. Dry sowing of Fingermillet
	II Fortnight	Pearlmillet (WCC-75 Zone 4 & 6) Fingermillet (L-5, MR-1, MR-6) Groundnut (TMV-2, JL-24, K-134 and VRI-2 for zone 5) Chilli nursery sowing (Samruddhi, Arka Lohit G-4, Gowribidanur)	Soon after the land preparation, it is very important to open conservation furrows across the slope at about 5 M interval. Crust breaking if there is heavy rain after the sowing. If there is a dry spell, thinning operation to be carried out.	For the late onset of monsoon measure to be taken for selecting suitable crop cultivars. Dry sowing of Fingermillet
July	I Fortnight	Pigeonpea (Hyd 3C, TTB-7,BRG-1 BRG-2, ICP=7035) Maize (NAC 6004, NAC 6002)	Resowing in the event of very poor plant population Thinning/gap filling	Diversifying the cropping system is useful even in the event of poor

Month	Fortnight	Crop/ Intercropping system (Varieties)	Cultural operations including mid-season corrections	Remarks
August		Pearlmillet (WCC-75 Zones 4 & 6) Fingermillet (L-5, MR-1, MR-6) Groundnut (TMV-2, JL-24, K-134 and VRI-2 (Zone-5) Cotton (CPD-1 (Zone-4) Sunflower (KBSH-1, KBSH-41, KBSH-42) Pigeonpea (BRG-1, BRG-2) Maize (NAC-6004, NAC-6002) Fingermillet (GPU-28, HR-911, PR-202 for Direct sowing, L-5, MR-1, MR-6 for transplanting) Groundnut (TMV-2, JL-24, K-134 and VRI-2 (Zone-5)	Interculturing Sowing only the short duration varieties. Giving protective irrigation	distribution of rain fall.
		Cotton (CPD-1 (Zone-4) Sunflower (KBSH-1, KBSH-41, KBSH-42, KBSH-44) Cowpea (TVX-944-02E, KBC-1, KBC-2) Horsegram (PHG-9, KBH-1) Soybean (Hardee, KHSb-2, KB-79) Field bean (HA-3)	Resowing in the event of very poor plant population Thinning/gap filling Interculturing Sowing only the short duration varieties. Giving protective irrigation	Diversifying the cropping system is useful even in the event of poor distribution of rain
	I Fortnight	Fingermillet (GPU-28, HR-911, PR-202 -Transplanting) (GPU-26, Indaf-5, Indaf-9 - Direct sowing) Sunflower (KBSH-1, KBSH-41, KBSH-42 and KBSH-44) Cowpea (TVX-944-02E, KBC-1, KBC-2) Horsegram (PHG-9, KBH-1) Field bean (HA-3) Soybean (Hardee, KHSb-2, KB-79) Blackgram (LBG-625)	Interculturing operations Giving protective irrigation If there is a prolonged drought harvest the crop for fodder	Prolonged drought at the crop critical growth stages detrimental to crop growth and yield.
	II Fortnight	Field bean (HA-3) Blackgram (LBG-625, Fodder Maize: (South African Tall) Fodder jowar (Pusa chari, J-set-3, SSV-74) Fodder Pearlmillet (Gaint bajra, Deenabandhu)	Interculturing operations Giving protective irrigation If there is a prolonged drought harvest the crop for fodder	Prolonged drought at the crop critical growth stages detrimental to crop growth and yield.
	I Fortnight	Horsegram (PHG-9, KBH-1)	Intercultural operations If there is dry spell thinning should be done	Harvest the crop for fodder if there is a continuous drought for the crops sown during July/August
	II Fortnight			
October	I Fortnight			
	II Fortnight			

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Single, Double and Inter / Mixed cropping system for zone-V
(Red laterite soils - **medium rainfall** 750 - 900 mm)

Crops and varieties*Central dry zone:* Sorghum, finger millet, groundnut and cotton*Eastern dry zone:* Finger millet, groundnut, pigeonpea and horsegram*Southern dry zone:* Sorghum, finger millet, groundnut and potato

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Finger millet	L-5	3.0-3.5	72	120-130	resistant to finger Long duration blast and neck blast	
	Indaf-8	3.0-3.5	75	130-135	Susceptible to finger Long duration blast and neck blast	
MR-1	3.0-3.5	70	120-130		Long duration	
GPU-28	2.5-3.0	67	110-120	Resistant to finger blast and neck blast	Medium duration	
PR-202	2.5-3.0	64	110-115			
HR-911	2.5-3.0	68	115-120		Medium duration, susceptible to lodging	
GPU-26	2.0-2.5	60	90-105	Resistant to finger blast and neck blast	Medium duration	
Indaf-5	2.5-3.0	65	105-110		Short duration	
Indaf-9	2.5-3.0	68	105-115		Short duration cold tolerant	
Maize Ganga-11	3.5	74	110-115	Susceptible to downy mildew	—	
Deccan-103	3.5	70		-do-	—	
Vijay composite	3.5	72	115-120	-do-	—	
NAC-6004 (Composite)	4.5	70		Resistant to downy mildew		
NAC 6002 (Composite)	4.0	57	85-90	-do-		
Little millet CO2	1.25	62	90-100	—		
PRC-3	1.25	60				
Foxtail millet	1.0-1.5	65	95-100	—		
RS-118						
K-221-1	1.0-1.5	63				
Pigeonpea Hyd-3C	1.2-1.5	98	150-200	Susceptible to wilt and sterility mosaic	Suitable for vegetable purpose also	
TTB-7	1.2-1.5	104	160-210			
Greengram PS-16	0.6	37	65-70	Susceptible to leaf spot and mosaic	—	
PDM-84-178	0.6	35				
Blackgram K-7	0.6	48	85-90	Susceptible to leaf spot and mosaic	—	
T-9	0.6	45	75-80			
Cowpea C-152	1.0-1.25	58	90-95	Susceptible to leaf spot and rust	—	
TVX-944-02E	1.0-1.25	56		Moderately resistant to rust and leaf spot		
KBC-1	1.0-1.25	60		—	Suitable for late <i>kharif</i>	
KBC-2	1.2-1.4	62	95-105	Resistant to leaf spot and rust	—	
Fieldbean Hebbal-3	57	90-100			Short duration, photoperiod insensitive, suitable for double cropping	

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Soybean Hardy	1.0-1.5		53	100-110	Susceptible to rust	—
KHSb-2	1.0-1.5		60	110-120	and yellow mosaic	
Monetta	1.0-1.5		45	80-85	-do-	
KB-79	1.0-1.5		50	90-92	-do-	
Horsegram KBH-1	0.7-0.9		58	90-100	Susceptible to	—
PHG-9	0.8-1.0		56		powdery mildew	
Groundnut TMV-2	0.8-1.0		42	100-120	Susceptible to Tikka and rust	—
JL-24	0.8-1.0		37	90-120		
K-134	0.8-1.0		39	95-105		
VRI-2	0.8-1.0		41	100-110	—	Suitable for low rainfall situations
Sunflower Morden	1.0-1.5		40	75-80	Susceptible to leaf	
BSH-1	1.5-2.0		58	88-90	spot, rust and bud rot	
KBSH-1	1.5-2.0		62	90-95	-do-	
KBSH-41	1.5-2.0		60		-do-	
KBSH-42	1.5-2.0		60		-do-	
KBSH-44	1.5-2.0		59		-do-	
Niger No.71	0.4-0.5			46	70-80	
Sesame TMV-3	0.4-0.5		49	85-90	Susceptible to rust and powdery mildew	
Castor NPH-1 (Aruna)	1.0-1.2		60	125-130		
Chillies Byadagi	0.75-1.0		55	160-170	Susceptible to leaf spot, powdery mildew and fruit rot	Recommended for Southern Zone
						Preferred for green chillies
Mysore	0.75-1.0		52		-do-	Recommended for Southern Zone
Gauribidnur (green chillies)	0.8-1.0		60		-do-	Recommended for Southern Zone
						Preferred for green chillies
NP-46-A	0.75-1.0		56		-do-	All dry zones
Arka Lohit			59		-do-	
Ceylon Selection (Samruddhi) (green chillies)	10-12		57	140-150	—	For green chillies
Fodder Crops						
Hybrid NB-21	45-50				—	
Napier BH-18	45-50					
Guinea Kambu Napier	45-50		—	—	—	
grass DH-4	45-50					
Green panic	— 35-40		—	—	—	
Rhodes grass	30-35					
Congo signal	25-30					
Anjan grass	25-30				—	

Crop	Varieties hybrids	Yield potential (t/ha)	Days to 50% flowering	Duration from seed to seed(days)	Reaction to disease and pest	Remarks
Fodder Sorghum	J-set-3	25-32.5 (Green)	—	70	—	—
	MP-Chari	25-32.5		60		
	GS-20	25-32.5		70		
	Pusa chari	25-32.5		80		
	S-1049	25-32.5		70		
	Salabani	25-32.5		60		
	Pioneer x 988 (Hybrid)	25-32.5		70		
	SSG-59-3	30-35 (Green)				
Fodder Maize	Yellow	40-45 (Green)	—	70	—	—
Fodder Pearl millet	White					
	Giant	45-50		65-70		
	Pearlmillet					

Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)		
		Inter row	Intra row	
Finger millet	10	30	10	Spacing is same for drilling and transplanting
Sorghum	7.5	37.5	10	—
Pearl millet	5	45	15	
Groundnut	100 kg kernel	30	10	
Maize	15	60 or 75	20	No variation in yield between 60 or 75 cm spacing
Sunflower	5-7.5	60 or 45	30 or 30	Closer spacing for varieties Wider spacing for hybrids
Pigeonpea	15	60	22.5	Wider spacing of 75, 90, 120 cm is recommended in case of May sowing
Blackgram	20	30	10	Suitable for double cropping
Greengram	15-20	30	10	Suitable for double cropping
Chickpea	62.5	30	7.5	Suitable for late <i>kharif</i>
Fieldbean	30	45	15	Suitable for inter cropping
Cowpea	20	45	10	Suitable for double cropping and late <i>kharif</i> sowing
Foxtail millet				
Little millet	4	30	10	Suitable for contingent crop
(Haraka)	7-10.0	30	10	planning for late <i>kharif</i>
	10-12.5	30	10	
Fodder Maize	100	30	10	Suitable for double cropping in
Fodder Pearl millet	15	30	10	areas with bi-modal rainfall
Sweet Sorghum	15	30	10	distribution.
Sesame	4	30	5	Mix the seeds with sand before sowing
Castor	6 and 12	45, 60, 90	45	Spacing to be adopted depending on the duration of the crop
Chillies	1200 g	45	30	

Nutrient management

Crop	Nutrients (kg/ha)			Farm yard manure (t/ha)	Mode of application	Remarks
	N	P ₂ O ₅	K ₂ O			
Fingermillet	50	50	25	1.00	N in 2 equal splits, 1/3 at sowing or drill; 1/3 at tillering initiation; P and K basal placement	—
Maize	75	50	25	1.00	N in 2 splits, + at sowing and + at knee high stage. Place P 5 cm deep from the seed	Apply 10 kg zinc sulphate also
Sorghum	65	40	40	1.00	N in 2 splits + at sowing and + at 30 days after sowing	—
Pearlmillet	50	25	0	0.75	All basal	—
Groundnut	25	50	25	0.75	All basal	Apply 1.0 t/ha lime and also 10 kg/ha sulphur into the soil
Foxtail millet	50	15	0	0.625	All basal	
Little millet and Haraka	20	20	0	0.625	All basal	

Suitable cropping systems

Central dry zone	Eastern dry zone	Southern dry zone
Monocropping system		
Fingermillet	Fingermillet	Fingermillet
Groundnut	Groundnut	Groundnut
	Maize	
Horsegram	Horsegram	Horsegram
Sunflower	Sunflower	Sunflower
Sorghum		Sorghum
Pearlmillet		
Cotton		Cotton
	Chilli	
Minor millets	Minor millets	Minor millets
Field bean	Field bean	Field bean
Soybean	Soybean	Soybean
Cowpea	Cowpea	Cowpea
		Tobacco
Double cropping system		
Fodder crops – fingermillet		Sesame – fingermillet
Fodder crops – chilli		Fodder crops – fingermillet
		Fodder crops – chillies
	Fodder crops – tomato	
	Cowpea – fingermillet	Cowpea – fingermillet
	Greengram bean – fingermillet	Greengram bean – fingermillet

Central dry zone	Eastern dry zone	Southern dry zone
	Blackgram bean – fingermillet	
	Sorghum – horsegram	Sorghum – horsegram
	Sorghum – transplanted fingermillet	Sorghum – transplanted fingermillet
Potato – maize/ horsegram/ cowpea		Potato – maize/ horsegram/ cowpea
Pearlmillet – horsegram		
Sunflower – sorghum		
Intercropping system		
Pigeonpea + maize (1:1)	Pigeonpea + maize (1:1)	Pigeonpea + maize (1:1)
Pigeonpea paired row + finger millet (10:2)	Pigeonpea paired row + finger millet (10:2)	Pigeonpea paired row + finger millet (10:2)
Pigeonpea paired row + groundnut (10:2)	Pigeonpea paired row + groundnut (10:2)	Pigeonpea paired row + groundnut (10:2)
Groundnut + castor (8:1)	Groundnut + castor (8:1)	Groundnut + castor (8:1)
Finger millet + fieldbean	Finger millet + field bean	Finger millet + fieldbean
Finger millet + soybean	Finger millet + soybean	Finger millet + soybean
Sorghum + pigeonpea		
		Sesame + pigeonpea(10:2or3:1)
		Castor + niger (8:2)
Horsegram + niger	Horsegram + niger	Horsegram + niger

6. Basic Concepts and Practices for Crop Production in Rainfed Regions

In addition to the region-specific recommendations made earlier, some basic concepts and practices are of universal application for raising crops in the rainfed regions. These are :

- i. **Conserve the basic resources of soil and water;**
- ii. **Make the best use of the conserved resources for crop production;**
- iii. **Evolve contingency plans to meet seasonal aberrations.**

A. Soil and Water Management

1. **Soil and water conservation:** Prevention of soil erosion and retention of more rain water where it falls are utmost importance in dryland agriculture. Basic practices of soil and water conservation like graded bunds, land leveling and floor smoothing must be adopted.
2. **Management of deep black soils:** In the low rainfall region (Deccan), advancing sowing date and choice of short duration crops are important to mature rabi crops by mid January.
3. **Management of red soils:** Soil crusting is a serious problem in these soils leading to considerable runoff. Off-season tillage should be taken up to work the soil with a blade harrow to keep the soils open for increasing infiltration and reducing run-off.
4. **Management of sloppy lands:** In Bhubaneswar and Chotanagar regions toposequences are common with gravelly skeletal soils at the highest level of topography followed by loamy sand and sandy loams at intermediate level and sandy clays at the lowest element. The crop choice should vary with toposequence. Crops with low water requirement (sorghum and finger millet) alone can grow well in higher elements of topography while rice will be the successful crop at the lowest regions. In between, crops like maize will be suitable.
5. **Soil amendments:** In the lateritic red soils of Bangalore, Bhubaneswar and Ranchi, 2-4 quintal/ha of lime need be added for neutralizing exchange acidity. Further, in those soils, the phosphatic fertilizers, when used, need be band placed. In these soils gypsum application @ 4-5 quintal/ha would be beneficial for increasing yields of groundnut.

B. Crop Management

1. **Seed:** Good quality seed and choice of suitable varieties is essential for obtaining higher yields. Uniform seed size is also important, particularly for bold seeded crops like groundnut.

Certified seed from recognized agencies alone need be used for obtaining good plant stands.

For a given area (village) it is necessary to use one kind of seed (hybrid or variety) of a crop to reduce bird damage, incidence of pests and diseases and also to preserve purity of cross pollinated crops like red gram and castor.

2. **Sowing time:** Early sowing of kharif crops is important to obtain vigorous seedlings, avoid incidence of pests and diseases like shootfly on sorghum and downy mildew/ergot on pearl millet and to vacate land early for a second crop in regions like Indore and Akola.

This can be achieved by preparing seed bed during the off-season, widening of row distances but maintaining full population and by resorting to dry seeding in some areas where rains can be expected with some certainty

(cotton in Indore; rice in Ranchi and pearl millet in Hisar).

3. **Population:** The new high yielding varieties of crops, as also the hybrids, yield better with higher population levels than local varieties. To obtain good plant stands, higher seed rate, quality seed and method of seeding become important. Normally seed drills give better stands.
4. **Fertilizer use:** The two main constraints in crop production in drylands are the moisture and nutrient supply. Fertilizer use at low to medium level pays in these lands. Fertilizer use pays best when other inputs are also well managed. Perse its efficiency can be enhanced by deep drilling. While phosphates need be basally applied, nitrogen should be applied in 2-3 splits in kharif. However, in rabi it has also to be deep placed along with phosphates.
5. **Weed control:** The importance of weeding cannot be over emphasized. Timely weed control is important for kharif crops. By 3-4 weeks the first weeding by whatever means possible manually, culturally or chemically must be attempted. Year-round tillage minimizes weed population. Widening the inter-row distance helps in quicker and timely weeding by interculture using bullock drawn blade harrows or sweeps.

Explanatory Notes

The practices recommended for different regions in this publication are not exhaustive. They mention only what has been recently found to be beneficial for increasing and stabilizing crop yields in rainfed regions. More information is assumed to be available from the Department of Agriculture, State Agricultural Universities, Private sector, etc., for respective areas. This information should be used wherever available.

1. **Varieties:** Varieties or hybrids of crops listed in this bulletin are not necessarily those released by the concerned Department of Agriculture. The hybrids and varieties enlisted are those which have consistently performed well at the respective locations.
2. **Fertilizers:** in some cases fertilizer use has been recommended only for a few crops. For other crops the recommendations of the Department of Agriculture/Agricultural University hold good.
3. **Weeding:** Specific recommendations have been made for only a few crops. These are based on recent findings of research at respective centers. For all crops weeds have to be effectively controlled using one method or the other. Hand weeding and interculture of crops should not slow down only because some chemical herbicide has been recommended for a particular crop.
4. **Crop sequence:** Some of the crop sequences are only of contingent nature depending on weather conditions. In areas of low rainfall with deep retentive soils two crops are feasible if the monsoon rains continue beyond the normal data of withdrawal. In other seasons only one crop a year is possible, wither a kharif crop or a rabi crop, with soil moisture conserved from the preceding rains.
5. **Water harvesting:** Water should be harvested in farm ponds wherever there is runoff. Asphalt coating of the sides and bottom of ponds has been found effective in reducing seepage losses and storing water for 30-45 days.

7. Livestock Management in Rainfed Agriculture

Livestock becomes an integral part of the traditional farming systems in rainfed agriculture. This component as a part of the traditional farming system will act as buffer to stabilize and enhance the income of rainfed farming community for different aberrant weather situations. Among livestock enterprises, the cattle, buffalo and small ruminants (sheep and Goat) are important source for income and livelihood improvement in rainfed farming community of our country. There is a need to take care of hygiene, health and nutritional management to improve the productivity of the livestock. In this context, efforts were made to document the important care to be taken for different seasons. The details are as follows:

Metrological week: 1st– 4th (1st to 28th January)

Hygiene maintenance: Protect the livestock from cold waves by providing proper shelter and in severe conditions some sort of heat source may be arranged in the shed. Prevent dampness in the animal shed as it aggravates the respiratory problems because of cold environment conditions. Ensure cleanliness in milking area to prevent mastitis attack in newly calved animals. Sprinkle limestone/chalk power (Calcium carbonate) in the shed to prevent the ammonia formation and control of coccidiosis and E.coli problem. Mosquito repellents should be sprayed in the shed to control mosquitoes.

Nutrition management: The quality of available fodder from grazing lands get deteriorates day by day, hence supplementation of concentrate mixture/top fodder like subabul or sesbania could sustain production and maintain optimum reproductive cycle in livestock.

Offer lush green fodder to the young calves it helps in early rumen development.

Some of the ewes (female sheep) may come to heat between January-March, hence flushing (Supplementation of concentrate mixture @ 250g/ewe for a month in order to increase number of ova to be released from the ovary and also enhance conception rate) should be adopted.

After paddy harvest grow Sun hemp in the same field for use as green fodder

Disease control:

Coccidiosis: Blood tinged loose diarrhoea could be seen in coccidiosis affected lambs and kids. Give anti-coccidial drug after consultation of local Veterinarian.

E.coli infection: Dark yellow tinged diarrhoea could be seen in E.coli affected calves. Give antibiotic drug after consultation of local Veterinarian.

The new born calves should be dewormed with piperzine adepate

All the small ruminants should be dewormed with broad spectrum deworming medicine.

A week after deworming, vaccinate small ruminants against Pesti des petits ruminants (PPR) disease.

Symptoms of PPR: Sudden high fever remaining high for 5-8 days; will return to normal before recovery or drop below normal before death. Serous nasal discharge, becoming mucopurulent; can crust over and occlude nostrils. Purulent occur discharge with congested conjunctiva; can encrust, cementing eyelids together. Necrosis and ulceration of mucous membrane and inflammation of gastrointestinal tract leading to severe, nonhemorrhagic diarrhoea. Abortion in pregnant animals. Mortality rate can reach 100%.

Prevention: Regular and timely vaccination

Metrological week: 5th- 8th (29th January-25th February)

Hygiene maintenance: Ectoparasite repellents should be sprayed in the shed especially in small ruminant shed, as the environment is most suitable for proliferation of ectoparasites.

Nutrition management: Concentrate supplement should be given to the milch animals as per their milk production. Provide mineral blocks in the shed so that animal licks and get more calcium and other minerals. Sprinkle some concentrate mixture on chopped Sorghum stover in order to increase the intake and meet the nutrient requirement of the animal.

The farmers who have irrigation facility should go for fodder crops like Maize (African tall variety), Sweet sudan grass (SSG) etc., for green fodder production. Start offering dry fodder to the young calves.

Disease control: Give one more dose of deworming medicine to the calves.

Metrological week: 9th-12th (26th February-25th March)

Hygiene maintenance: Maintain strict hygienic conditions in the animal shed and surroundings so that there may not be much problem of ectoparasites and mosquitoes

Nutrition management: Increase the quantity of top feed /concentrate mixture supplementation to the livestock as the availability of green fodder and quality forage get decreases. Feed silage if available to meet the nutrient requirements and maintain production at optimum level. If no greens are feeding, add vitamin supplement in the concentrate mixture to over come vitamin deficiency in lactating animals.

Disease control: Vaccinate the small and large ruminants against Foot and Mouth (FMD) disease.

Symptoms of FMD: The disease affected animals will have fever, formation of vesicles and blisters in the mouth, udder, teats and on the skin between the toes and above the hoofs. Profuse salivation, ropes of stringy saliva hangs from mouth, vesicles appear in mouth and in the inter digital space and lameness observed in affected animals.

Prevention: Regular and timely vaccination

Metrological week: 13th-16th (26th March-22nd April)

Hygiene maintenance: Keep the shed clean and neat with good ventilation. Don't allow the livestock to drink stagnated water. Provide always clean and fresh water.

Nutrition management: Prepare the concentrate mixture with locally available feed ingredients to supplement the livestock during summer along with dry roughages. The following different combinations can be used to

Feed Ingredients	Concentrate mixture					
	1	2	3	4	5	6
Cereal grains (maize/bajra/jowar) (kg)	30	20	20	30	40	30
Conventional bran (Wheat Bran/ Rice Bran) (kg)	32	50	40	47	10	-
GNC /coconut cake (kg)	25	20	20	20	20	25
Unconventional bran (Bengal gram/ green gram / black gram bran) (kg)	-	-	17	-	27	25
Cotton seed meal (kg)	-	-	-	-	-	17
Molasses (kg)	10	7	-	-	-	-
Mineral mixture (kg)	1	1	1	1	1	1
Salt (kg)	2	2	2	2	2	2

prepare concentrate mixture depending upon the availability and cost of feed ingredients.

Disease control: Deworm all the adult cattle and buffaloes and calves

Metrological week: 17th-20th (23rd April-20th May)

Hygiene maintenance: Protect the livestock from heat waves by providing proper shelter to the livestock. Provide foggers/sprinklers in the shed during peak summer to prevent heat stress and production losses from the livestock

Nutrition management: Make available plenty of cold clean drinking water throughout the day. Allow the animals early in the morning and late evening only for grazing. Feed green fodder/silage and concentrates during day time. Feed roughages during early morning and late evening only. Stored roughages like paddy straw/jowar stover etc., should be chopped and soaked in water after addition of little salt and jaggery/molasses and feed the livestock. Under irrigated areas Lucerne, African tall etc., annual fodder crops can be grown for feeding the livestock.

Small ruminants should be supplemented either with top feed/concentrate mixture in the evening (after coming back from grazing)

Observe the shebuffaloes for heat symptoms during the night time and early in the morning as silent heat will be the common problem during summer

Disease control: All the small ruminants should be dewormed. A week after deworming, vaccinate small ruminants against Entero toxemia (ET) disease.

Impaction: Due to excess feeding of only dry coarse fodder during summer, there is every possibility of development of impaction of rumen.

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Disease control: All the small ruminants should be dewormed. A week after deworming, vaccinate small ruminants against Entero toxemia (ET) disease.

Impaction: Due to excess feeding of only dry coarse fodder during summer, there is every possibility of development impaction of rumen.

Symptoms: Important symptoms of impaction of rumen include stoppage of rumination, dry and hard flakes of dung and severe abdominal pain.

Treatment: Stop feeding the animal with any kind of diet. 250 ml of castor oil can be given as a drench. If it is not subsided in two days then consult the local veterinarian.

Metrological week: 21st-22nd (21st May-3rd June)

Hygiene maintenance: Maintain proper drainage in the shed and prevent dampness. Sprinkle some detergent solution in the shed.

Nutrition management: If green fodder is available reduce the concentrate supplementation accordingly. The pregnant animals should be given more supplement.

Should be sown Stylo and Cenchrus ciliaris seed in CRRs and on tank beds and bunds as a fodder production initiative.

Disease control: Vaccinate the cattle and buffalo against Haemorrhagic septicemia, and Black quarter.

Black-quarter (Black-leg)

This disease is widespread amongst cattle in certain parts of India, particularly in Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra. Sporadic cases occur in the northern and eastern states of the country. The disease is common in areas with moderate rainfall and where dry-crop cultivation is common. Young animals in the prime of condition and six months to three years old are affected more than others. Buffaloes usually suffer from a milder form of the disease. Outbreaks generally occur with the onset of rains. True black-quarter is caused by *Clostridium chauvoei*.

It affects mostly start and sturdy animals.

Symptoms: High fever with redness of eyes. Hot painful swelling in the affected leg more often a hind-quarter. Crepitating sound on pressing the affected part of muscle. Death may occur in severe cases in 1 or 2 days

Treatment: Administration of broad spectrum antibiotics in repeated doses may be effective if injected before muscle damage has been caused with the advise of local veterinarian.

Prevention: Animals should be vaccinated one month before the onset of monsoon rains.

Haemorrhagic septicaemia

This acute septicaemic disease of cattle and buffaloes is widely prevalent in India. It occurs generally in low-lying areas periodically inundated by rainwater and in areas where irrigation facilities have developed.

Symptoms: The disease generally runs an acute course. Cattle and buffaloes often develop a highly septicaemic condition and die within the course of about 24 hours of infection.

Affected animals show a high rise in body temperature. Redness of eyes and lacrimation. Severe dyspnoea. Hot painful swelling at head, jowl region or brisket region. In severe cases sudden death may occur due to high fever and severe dyspnoea

Treatment: Early cases of the disease are amenable to treatment with broad spectrum antibiotics.

Prevention: Vaccination with the improved type of adjuvant vaccine, carried out about a month before the onset of monsoon rains, will protect animals against the attack of the disease for about one year.

Metrological week: 23rd-26th (4th June-1st July)

Hygiene maintenance: Protect the livestock from rains and prevent water logging conditions in the animal shed.

Nutrition management: Most of the Ewes (female sheep) would come to heat after first rains i.e., between June-August, hence flushing (Supplementation of concentrate mixture @ 250g/doe for a month in order to increase number of ova to be released from the ovary and also enhance conception rate) should be adopted.

Disease control:

Entero toxemia: The small ruminants get develop bloat and die suddenly after grazing on lands with newly grown lush green grass. It happens immediately after first rains due to Entero toxemia (ET) disease attack. Hence, booster dose of ET vaccine should be given after 15days of first ET vaccination in May month every year.

There is every possibility of development of bloat and non-specific diarrhea during rainy season due to over eating of available green legume fodder alone from grazing lands or excessive sole feeding of legumes like *Stylo* etc.,

Bloat

Symptoms: Symptoms of bloat include bulging abdomen due to accumulation of frothy gas, which in turn creates pressure on lungs and results in difficulty in respiration (Dyspnoea).

Treatment: A mixture of 50 ml of camphor oil and 500 ml of good quality edible oil should be drenched. Stop feeding the animal till the bloat subsides. Small quantities of gruel made from jowar/wheat can be offered to the animal.

Metrological week: 27th–30th (2nd July-29th July)

Hygiene maintenance: Protect the livestock from heavy rains and thunderstorms. Prevent water logging conditions by providing proper drainage in the shed. Sprinkle limestone/chalk powder (Calcium carbonate) in the shed to prevent ammonia formation and control coccidiosis problem. Keep premises clean and neat to prevent disease outbreaks and attack of mastitis problem in milch animals.

Nutrition management: Most of the Does (female goats) would come to heat between July-September, hence flushing (Supplementation of concentrate mixture @ 250g/doe for a month in order to increase number of ova to be released from the ovary and also enhance conception rate) should be adopted.

Cut the green grass available in the fields/bunds/CPRs etc., and store it as heap after dry for use in summer. Protect the stored dry fodder from wetting and spoilage. Don't feed only green fodder as it may lead diarrhea. Mix some dry fodder along with green fodder and feed the livestock.

Disease control: All the small ruminants should be dewormed once during this month to reduce worm load in animals.

If any wounds/injuries are there on the body of animal, they should be thoroughly cleaned in potassium permanganate solution. Septic wounds should be cleaned with hot saline water. There is every chance of infestation of these wounds with maggots in rainy season, hence treat the wounds by removing the maggots initially with a forceps and then camphor oil, turmeric powder or custard leaf can also be applied. Neem oil can be used as fly repellent to control the spread of maggot infestation. Finally apply antibiotic powder, if necessary antibiotic medicines with the consultation of local veterinarian.

Theileriasis:

Crossbred cattle may get infected with Theileriasis disease during this month. Primarily ticks cause this disease, as they are the carriers of the infective protozoan.

Symptoms: High fever, swelling of lymph glands, blood tinged urine are the common symptoms of the disease.

Prevention: By regular and timely vaccination, hence vaccinate all the crossbred cattle during August against Theileriasis.

Metrological week: 31st –34th (30th July-26th August)

Hygiene maintenance: Flies and mosquitoes population will be more during this month, hence some repellent should be sprayed in the shed to control spread of diseases like Blue tongue in small ruminants and Theileriasis in crossbred cattle.

Nutrition management: Concentrate mixture should be fed to the pregnant sheep and goat @ 150-250g/day depending upon availability of feed from grazing lands for the last 60-75 days of pregnancy in order to get optimum birth weights in lambs and kids. And also helps in higher milk production from the dams.

Harvest all the available surplus fodder at 15 days interval from CPRs, bunds etc., and preserve either as hay or silage for use in summer.

Surplus Fodder preservation

- Fodder is cut before maturity ensuring optimum availability of nutrients.
- Fodder could be preserved by sun drying in artificial driers or under sun as HAY and / or in airtight chambers/pits as SILAGE

Hay Making

- Good quality herbage at the flowering stage is cut early in the morning and left in the field.
- After 4-5 hrs the cut fodder is turned and repeated till the moisture content comes down to 10-15%
- The dried hay is stored as heap or baled it
- Natural grass including legume and non-legume forage crops can be used for HAY making.

Silage Making

- Silage is a fermented green forage product prepared under anaerobic conditions and preservation of fodder without much loss of nutrients is the main aim of this method.
- Jowar and maize are the best crops suitable for silage making.
- Hybrid Napier, Sudan grass, Berseem, Oats cow pia, millets are also suitable crops.
- Legumes can also be made silage by addition of 8-12 kgs of molasses mixed in water for each one ton of green forage
- The crop is chaffed 2-4 cm in length and packed air tight in silo pit.
- The air tight pit stacked with fodder would be ready in 90 days with a PH of 5.8 and a lactic acid % of 0.1.
- Good silage is yellow-brown color, with a characteristic acid fruity smell and just exudes moisture when squeezed
- Excess of butyric acid formation would lead to more proteolysis there by reducing the digestibility and intake of silage by cattle.

Disease control: Vaccinate small ruminants in endemic areas against Anthrax disease.

Blue tongue: Small ruminants may get infected with Blue tongue disease during this month.

Symptoms: The affected animals will have high fever, swollen tongue, lips with pustules on gums.

Treatment: The pustules should be cleaned with luke warm potassium permanganate solution (1%). Apply Boroglycerine paste along with neem oil on the pustules. Feed the animals with easily digestible lush green fodder and also gruel made with ground wheat/jowar by adding little salt and jaggery.

Should be given broad spectrum antibiotics in order to prevent secondary bacterial infection with the consultation of local veterinarian.

Metrological week: 35th –38th (27th August-23rd September)

Hygiene maintenance: As calvings start from October month onwards, one has to have strict vigil on hygiene maintenance in the animal shed and surrounding premises. Maintenance of clean condition in the milking barn results both in better udder health and production of milk that remains wholesome for longer time. The floor should be impervious, non-slippery and reveled. The milking barn should be thoroughly washed and sobbed after each milking so that the barn will be clean and dry before the subsequent milking is commenced

Cleanliness of cows: The health condition of cows should be regularly examined. Milking should be carried

out first to healthy cows followed by diseased ones. The hind quarters and thighs of cows should be brushed and washed as lot of filth is accumulating on them. Just before milking the udder should be wiped with a cloth dipped and squeezed in some weak antiseptic solution.

Cleanliness of milkers: Milkers nails should be well trimmed and their hands cleaned and disinfected between each milking by washing in antiseptic solution. Milkers obviously ill and having filthy habits like spitting, blowing nose etc. should not be allowed. After each milking the milking pails should first be washed with warm water, scrubbed well using suitable dairy sanitizer and then rinsed well with clean cold water. The first few strips of milk from each teat should be let on to a strip-cup to see clues in milk for possible incidence of mastitis.

Nutrition management: Proper nutritional management and mastitis control measures should be taken as utmost priority especially during calving season. Milch animals should be fed with *ad libitum* green forages. An extra allowance of 1.5-2.0kg of concentrates should be provided during first 30-45 days of calving.

Instead of green fodder, 1-2 kg of good quality hay can be fed to the young calves during this period, beginning with 0.5 kg at 15 days of age, which may be raised to 1.5 kg at 3 months of age.

Disease control: There is every chance of recently calved cow or buffalo getting infected with mastitis due to unhygienic premises

Bovine mastitis:

This disease is more common in early lactation and most commonly in high yielders. This results from infection with one or more of the many organisms associated with cattle and the disease is of great economic importance to the milk producer. The disease is primarily caused due to improper milking practices and unhygienic premises.

Symptoms: It includes rise in body temperature along with swollen udder and teats. The milk is affected both in quality and in quantity, and as a result of permanent impairment of the function of one or more quarters milk production may cease altogether.

Treatment: Success depends on the nature of the etiological agent involved, the severity of the disease and the extent of fibrosis. Complete recovery with freedom from bacterial infection can be obtained in cases of recent infection and in those where fibrosis has taken place only to a small extent. Broad spectrum intra mammary infusions can help in amelioration of problem.

Metrological week: 39th –42nd (24th September-21st October)

Hygiene maintenance: Maintain strict hygienic conditions in the animal shed in order to check the mastitis

Nutrition management: Animals in 1st and 2nd lactation will still be growing and need to provide 20 and 10% extra feed, respectively. Concentrates should be fed at the rate of 1kg for every 2.5 kg of cow milk or 2kg of buffalo milk production. High energy density diet should be provided during early lactation.

All the cow/buffalo approaches parturition, should be housed in a clean shed covered with paddy straw on the floor. A period of 10-12 hr may elapse from the commencement of restlessness until the calf is born. If some trouble is suspected it is better for the unskilled farmer to seek veterinary assistance. The placenta is discharged within 8-12 hrs after calving. If it is delayed by 24 hrs then consult the nearest veterinarian. Give luke warm drinking water after calving.

Disease control: All the small ruminants should be dewormed

Metrological week: 43rd –46th (22nd October-18th November)

Hygiene maintenance: Maintain clean and neat conditions in the shed and control the external parasites

Nutrition management: Milch animals should be fed with *ad libitum* green forages. An extra allowance of 1.5-

2.0kg of concentrates should be provided during first 30-45 days of calving. When the animal is giving more than 10 kg of milk, 10% extra feed should be provided. Animals giving more than 8kg of milk should be fed with concentrate mixture containing ingredients rich in rumen protected protein like cotton seed cake etc.,. The cows in early lactation should be fed with high density energy diet (having more grain in concentrate mixture) in order to ensure optimum dry matter and nutrient intake to meet the production requirements.

Disease control: Vaccinate small ruminants against Sheep pox disease.

Sheep pox: The disease affects mostly young ones under 1 year age.

Symptoms: The chief symptoms are those of fever and paralysis. An eruption in the form of red spots appears on the membranes of the eyes and nose, and on the wool-free parts of the skin. In older sheep the disease begins by signs of serious ill-health, notably a high temperature and suppressed appetite. An eruption appears on the mucous membranes of the nose, eyes and mouth, and as noted above on the wool-free parts of the skin - inside the thighs and elbows, under the belly, on the scrotum or the udder. On the wool-free regions it shows itself first in the form of small pimples, which may grow in size until their bases are 10mm or more in diameter. The larger pimples are flattened on the surface, and the skin around the base is reddened. A thick reddish- yellow discharge oozes from the pimples, and forms a yellow crust on the surface. Affected pregnant ewes often abort.

Treatment: The pustules should be cleaned with luke warm potassium permanganate solution (1%). Apply Boro-glycerine paste along with neem oil on the pustules. Feed the animals with easily digestible lush green fodder or gruel made with ground wheat/jowar by adding little salt and jaggery.

Metrological week: 47th -50th (19th November-16th December)

Hygiene maintenance: Protect the livestock from cold waves. Maintain strict hygienic conditions in the animal shed. Prevent dampness and sprinkle limestone/chalk powder (Calcium carbonate) to prevent ammonia gas formation in the shed

Nutrition management: Milch animals should be fed with *ad libitum* silages/green fodder. An extra allowance of 1.5-2.0kg of concentrates should be provided during first 30-45 days of calving. When the animal is giving more than 10 kg of milk, 10% extra feed should be provided.

Reproductive management: It is an important prerequisite for the sustainability of dairy production. All the cows/shebuffaloes must have efficient reproductive performance i.e timely onset of heat, conceive to a fertile mating and normal delivery with viable calf at the end of gestation period in order to get milk continuously for 305 days from the animal. During the lifetime of a cow/shebuffalo, higher reproductive efficiency yields more lactations and therefore more milk as well as more calves for use as replacement stock or for sale. The main factors which contribute to economic losses are delayed puberty, long calving intervals, repeat breeding, short productive life and high calf mortality. Generally, cattle and buffalo heifers attain puberty when they reach 55-60% of their adult body weight. However, the age at which they attain puberty can be highly variable, ranging from 12-40 months in cattle and 18-46 months in buffalo. Thus growth rate and body weight are more important determinants of puberty than age in animals, which depends mostly upon the feeding management.

Synchronization of oestrus is the act of making a number of cows/buffaloes come into heat at the same time. This allows better planning of breeding activities and wider use of artificial insemination (AI). Animals usually come into heat 2-3 days after the treatment regime. Two inseminations are necessary per animal, at 48 and 72 hrs after withdrawal of the progesterone treatment or 72 and 96 hours after the end of prostaglandin's treatment.

Disease control: Cracks on udder and teats should be taken care by application of boro-glycerine paste during winter, other wise the bacteria might invade the udder and results in mastitis

Metrological week: 51st -52nd (17th –31st December)

Hygiene maintenance: Maintain strict hygienic conditions and prevent dampness in the animal shed

Nutrition management: Feed dry fodder during day time and green and concentrate mixture during night time. Provide high energy diet to the lactating animals.

Fine stemmed leafy leguminous hay is the best roughage for the young calf. Hay can be offered from two weeks of age onwards. A legume plus grass mixed hay is also valuable. At 6 months of age, a calf eats 1.5 to 2.25 kg hay, hence always make available sufficient quantity. The quantity increases with age. Silage can be given additionally in small quantities at 6 to 8 weeks onwards to the young calves.

Disease control: Small ruminants may get infected with Contagious ecthyma disease during winter.

Contagious ecthyma: The affected animals will have small pustules on lips, gums and around the nostrils. In severe cases the affected animals will not graze or take any feed and die in long run if untreated.

Treatment: The pustules should be cleaned with luke warm potassium permanganate solution (1%). Apply Boro-glycerine paste along with neem oil on the pustules. Feed the animals with easily digestible lush green fodder or gruel made with ground wheat/jowar by adding little salt and jaggery.

2.25 kg hay, hence always make available sufficient quantity. The quantity increases with age. Silage can be given additionally in small quantities at 6 to 8 weeks onwards.

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