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Compensatory Production Plan
Rabi 2014




ICAR - CRIDA

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4.0 Compensatory *Rabi* Production Plan

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

- Varieties suitable for early sowing under residual moisture conditions in Central India should be encouraged in wheat: HD 2987 (Pusa Bahar), HD 4672 (Malwa Ratna), HI1500 (Amrita), HI-1531 (Harshita), HI-7483 (Meghdoot), HI-8627, HW 2004 (Amar), JWS-17 (Swapnil)

- Adoption of early maturing wheat varieties of 100 - 10 days duration for zero tillage planting in eastern and north eastern states in problem soils (acidic soils) is recommended

- Basal application of $ZnSO_4$, $FeSO_4$, $MnSO_4$ @ 25kg/ha based on soil test values, and $CuSO_4$ and borax @ 10kg/ha and Ammonium molybdate @ 1kg/ha. In case of basal application is not possible in deficient soils, apply 0.5% micronutrients ($ZnSO_4$, $FeSO_4$, $MnSO_4$) along with 0.25% unslaked lime solution; 0.2% ($CuSO_4$ / borax) along with 0.25% unslaked lime solution; 0.05 – 0.1% Ammonium molybdate along with 0.05% unslaked lime solution. The micronutrients are to be applied 2-3 times at 10 - 15 days interval.

- Rapeseed- mustard responds to basal application of 20 - 40 kg sulphur as gypsum; zinc as Zinc Sulphate (25 kg/hectare) and Boron as borax (10 kg/hectare) in all types of deficient soils.

- In calcareous alkaline soils, basal application of 50 kg $FeSO_4$ per hectare is recommended to alleviate iron deficiency based on soil test values.

- Relay cropping of wheat by broadcasting in standing cotton at the time of last irrigation to cotton can improve wheat productivity in the cotton - wheat system in Punjab compared to delayed planting conditions

- To make best use of residual soil moisture, wheat can be planted with minimum tillage by using zero till drill or happy seeder which also eliminates paddy straw burning. Zero till drilling saves time (up to 10 days), cultivation cost (Rs 2000-3000/ha), diesel and energy and gives 5-10% higher yield. Importantly, it saves first irrigation water and permits effective weed control (*Phalaris minor*) in north-west India.

- Furrow-irrigated raised bed (FIRB) system in wheat saves water (25-40%), inputs (25% of seed and nitrogen fertilizer), promotes higher water productivity and energy efficiency (up to 25%). FIRB planted wheat increases resilience as the crop is less affected due to unseasonal rains in February/March associated with hailstorm due to vigorous plant growth and root system.

- Precision seeding and fertilizer application with roto till drill provides rotary tillage of top 10 cm with simultaneous placement of seed and fertilizer at desired depth can boost wheat productivity in Haryana

- Bionoculation of seed with biofertilizers (*Bacillus spp., Azotobacter, Azospririllum,* PSB, VAM, *Rhizobium* etc.) can promote plant growth and increase in yield of wheat, pulses and oilseed crops by about 15%.

- Seed treatment with fungicides (@ 2 to 3 g/kg seed) prevents seed borne diseases, promotes better germination and crop stand leading to higher productivity in all *rabi* crops.

- Adoption of micro-sprinkler /sprinkler/drip irrigation systems in wheat, maize, oilseed crops and vegetable crops results in water saving upto 50% and yield improvement on an average by about 25% in all *rabi* production zones wherever suitable quality water is available for irrigation through micro irrigation system (MIS).

- Special emphasis should be given for enhancing productivity of *rabi* pulses viz. chickpea, lentil and field pea in the North-eastern states. Measures recommended include adoption of high yielding varieties, seed priming in chickpea, and seed treatment with fungicides @ 3 g/kgseed, bactericides @ 1g /kgseed, and bio-inoculants (*Rhizobium* @ 200 g/10 kg seed, *Trichoderma* @ 6g/kg seed), efficient weed control and if available irrigation at flowering/pod filling stage.

- Special emphasis may be given to production technology of *rabi* pulses (chickpea, blackgram, greengram and lentil) in rice fallows for achieving higher land productivity per unit area. The additional interventions include higher seed rate

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

- In Central India, to achieve higher productivity in bold seeded chickpea (*kabuli*), a presowing irrigation may be given wherever possible. Additional interventions include seed priming with molybdenum @i g/kg seed in chickpea cultivated after soybean.

- Effective integrated weed management through hoeing, hand weeding coupled with herbicide application (pre and postemergence) can boost crop yield in pulses and other *rabi* crops.

- Seed production of *rabi* fodder crops (lucerne, berseem and oats) may be encouraged along with adoption of better management practices.

- Special emphasis should be laid on adoption of pest and disease resistant/tolerant cultivars in *rabi* crops for higher productivity such as:

    - Wheat: Yellow rust tolerant varieties such as GW322, PBW502, DBW17, Raj 4037, PBW550, GW366, DBW621/50, HD2733, HD2864/2824, HUW510, NW2036, K0307

    - Blackgram: YMV resistant and short duration varieties for spring/summer season in UP and Bihar (WBU-109, Uttara, Azad Urd-1, Pant U 31) and for *rabi* / spring season in Odisha (IPU-7-3, BGG-04-008, LU-391, IPU-2-43, KU-301, TU-94-2)

    - Greengram: YMV resistant varieties for UP/ Bihar (HUM-16, Pant M5, IPM 2-3, Samrat); for Odisha (IPM 2-14, COGG 912, OUM 11-5, TARM-1)

4.1. Early *Rabi* Production Plan

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

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

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

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

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

4.2. Normal *Rabi* Production Plan

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

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

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

State	Crop	Suggested measures for *rabi* crops
	Chickpea	Sowing time: Up to second fortnight of October Varieties: Gujrat Chana-4, Pusa-256, KWR-108, Adhar, WCG-2, J.G.- 16, K- 850, Radhey, Avarodhi,Type-3, Type-6 Seed treatment: Thiram or Carbendanzim @ 3g/ kg seed and Rhizobium culture @ 200 g/ 10 kg seed Seed rate: 80 kg/ha Spacing: 30 x 15 cm Fertilizer dose: 20:60:20 kg NPK/ha Weed management: Spray Pendimethalin @ 0.75-1.0 kg /ha or Oxyfluorfen @ 200 g /ha as pre-emergence at 0-3 DAS, or two hand weedings at 20 and 45 DAS
	Mustard	Sowing time: Up to second fortnight of October Varieties: Narendra Ageti Rai-4, Kanti (RK-9807), Narendra Rai-1, Narendra Swarna Rai-8, Varuna,Vaibhav, Ragini, Maya, Pusa Bold, Urvashi, Kranti Seed treatment: 1.5g Metoloxyl or 2.5g Thiram/kg seed Seed rate: 4-5 kg/ha Spacing: 45 cm x 15 cm Fertilizer dose: 60: 40: 30 kg NPK/ ha as basal Weed managment: Spray Pendimethalin (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 to 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS
	Barley	Sowing time: Up to second fortnight of October Varieties: Narendra Jau-1, Narendra Jau-3, Azad (K-125), K-141, Haritma (K-560), Lakhan, (K-226) Seed treatment: Thiram or Carbendanzim @ 3g/ kg seed. Seed rate:100 kg/ ha Spacing: 30 x 10 cm Fertiliser dose: 60:40:30 NPK kg/ha as basal Weed management: To control broad- leaved weeds, spray 2,4-D @ 500 g/ha at 30 -35 DAS in 500 l water. Isoproturon @ 0.75 to1.0 kg/ ha in 500 L water at 30- 35 DAS
	Linseed	Sowing time: Up to second fortnight of October Varieties: Sweta, Garima, Shubhra, Laxmi-27, Padmini, Sharda, Nilam, Mau Azad-1, Type-397, Shekhar Seed treatment: 1.5g Metalzxyl or 2.5g Thiram/kg seed Seed rate: 25 kg/ha Spacing: 30 x 10 cm

State	Crop	Suggested measures for *rabi* crops
		Fertilizer dose: 40:20:20 kg NPK/ ha as basal Weed management: Spray Pendimethalin (Stomp 30 EC or Stomp Xtra 38.7% CS) @ 0.5 - 0.75 kg /ha in 400-500 l water within 2-3 days of sowing, or two hand weedings at 20 and 45 DAS
Uttar Pradesh (Eastern Plain and Vindhyan Zone	Chickpea	Sowing time: Second fortnight of October to first fortnight of November Varieties: Avarodhi, Pusa -256, T-6, KWR-108 Seed treatment: 2g Thiram /kg seed and *Rhizobium* culture @ 200g/ 10 kg seed Seed rate: 80 kg/ha Spacing: 45 x 10 cm Fertilizer dose: NPK: 20:40:20 kg/ha as basal Weed management: Pre-emergence application of pendimethalin @ 0.5 - 0.75 kg /ha or oxyfluorfen @ 200 g /ha, or mechanical weeding by weeder at 20 to 25 DAS
	Barley	Sowing time: Second fortnight of October to first fortnight of November Varieties: K-125, K-141, K-560, K-226, K-603 Seed treatment: 2.5 g Thiram /kg seed Seed rate:100 kg/ha Fertilizer dose: 40:20:20 NPK kg/ha as basal Weed management: Mechanical weeding by dryland weeder at 45 DAS. To control broad- leaved weeds, spray 2,4-D @ 500 g/ha at 30 -35 DAS in 500 L water. Isoproturon @ 0.75 to1.0 kg/ ha in 500 L water at 30- 35 DAS
	Lentil	Sowing time: Second fortnight of October to first fortnight of November Varieties: Pant L 406, 639, Narendra masoor -1, HUL-57, K-75 ,L-4076,KLS-218 Seed rate: 30 kg/ha Spacing: 30 cm x 10 cm Fertilizer dose: 20:40:20 kg/ha of NPK as basal Weed management: Mechanical weeding by dryland weeder at 20-25 DAS or Spray Pendimethalin @ 0.5 - 0.75 kg /ha (Pre emergence)

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

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

State	Crop	Suggested measures for *rabi* crops
	Chickpea	Sowing time: First week of October Varieties: Vijay, Digvijay Seed treatment: 2 g Thiram + 2 g Carbendazim/kg seed or 5 g Trichoderma/ kg seed followed by *Rhizobium* culture @ 25 g/ kg seed Seed rate: 65-70 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 25:50 kg N and P_2O_5/ha as basal Interculture: Two hoeings i.e. 3 weeks and 4 weeks after sowing
Andhra Pradesh	Chickpea	Sowing time: First fortnight of October to first fortnight of November Varieties: JG-11, KAK-2 JAKI 9218 Vihar, LBeG 7, JG-130 , ICCV-2 Seed treatment: Captan or Thiram @ 2.5 g/kg seed and *Trichoderma viridi* @ 4-5 g/kg seed Seed rate: 70-80 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 20:50 NP kg/ha Weed management : Pre-emergence application of Pendimethalin @ 0.5 - 0.75 kg /ha within 2-3 days of sowing or one hand weeding at 20-25 DAS
	Coriander	Sowing time: October to November Varieties: Sadhana (CS-4), Sindhu (CS-2),Sudha (LCC-128) and Swathi (CS-6) Seed treatment: *Azospirillum* @ 1.5 kg/ha Seed rate :15 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 30 : 40 : 20 NPK kgha as basal application
	Rabi maize	Sowing time: Last week of October to second week of November Varieties: Kaveri 2288, 50, CP818, NMH 731 & 666 Seed treatment: Bavistin + Captan (1:1 ratio) @ 2 g/kg seed; Apron 35 SD @ 4 g/kg seed Seed rate: 20 kg/ha Spacing: 60 x 20 cm or 75 x 20 cm Fertilizer dose: 90:45 (N & P) kg/ha for rainfed condition; 120:60 (N&P) kg/ha for irrigated condition. N in 3 splits i.e. 1/4 as basal, 1/2 at 30 DAS, 1/4th at pre-flowering. In Zn deficient soils, apply 50 kg $ZnSO_4$/ha. If Zn deficiency symptoms are observed in plants, spray 0.2% $ZnSO_4$ solution 2-3 times at weekly intervals

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

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

State	Crop	Suggested measures for *rabi* crops
	Mustard	Sowing time: Second fortnight of October to first fortnight of November Varieties: TM-2, TM-4, Varuna Seed rate: 4-5 kg/ha Spacing : 30 - 45 x 15 cm Fertilizer dose: 40:35:15 kg/ha NPK Weeding: Spray Pendimethalin 0.5-0.75 kg/ha as pre-emergence or one hand weeding at 25-30 DAS
	Potato	Sowing time: First fortnight of October to first fortnight of November Varieties: Kufri Jyoti, Kufri Megha, Kufri Sinduri Seed treatment: Mancozeb@5g/lit for 10 minutes and dried in shade for 48 hours Seed rate: 25 q/ha Spacing: 50 cm x15 cm Fertilizer dose: For Ranifed: 60:50:50 kg/ha NPK Interculture: Earthing up at stolon and tuber formation Weed management: Pre-emergence application of Metribuzin @ 500-700 g/ha at within 3-4 DAP or early post-emergence application of Metribuzin @ 500 g/ha at 15-20 DAP or one or two hand weedings as required
	Pea	Sowing time: First fortnight of October to first fortnight of November Varieties: T-163,Boneville, HUP-2 and *Rhizobium culture* Seed treatment: Bavistin @2g/kg of seed Seed rate: T-163: 50kg/ha; Boneville: 60 kg/ha;HUP-2: 65 kg/ha Fertilizer dose: 10:46:0 kg/ha NPK as basal Weed management: Application of Pendimethalin 0.5- 0.75 kg/ha as pre-emergence (0-3 DAS) or application of Metribuzin @ 250 g/ha at 25-30 DAS
Punjab (Kandi region)	Wheat	Sowing time: Last week of October to first week of November Varieties: PBW 175, PBW 527, PBW 644 Seed treatment: Dursban (Chlorpyriphos) 20 EC @ 12.5 ml/kg seed followed by Bavistan/ Deroal/Agrozim @ 2.5 g /kg seed or Raxil @ 1g /kg seed Seed rate: 100 kg/ha Spacing: Interrow 22.5 cm Fertilizer dose: 40:40:30 kg/ha NPK as basal and 40 kg N /ha about 30-60 DAS with winter rain Interculture: One hoeing with kurpa 4-6 weeks after sowing Weed management : Spray of 2,4-D @ 500-750 g/ha in 500 L of water 30-35 DAS in sole wheat crop or post-emergence application of metsulfuron @ 4g/ha at 30 DAS

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

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

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

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

State	Crop	Suggested measures for *rabi* crops
	Wheat	Sowing time: First week of October to second week of November Varieties: Sujatha, C -306, HW 2004 (Amar), Swapnil, HI 1500 (Amrata), HI 1531 (Harshita), JW 3020, Lok-1, Malav Kranti (HI 8638), Malav Ratna (HD 4672), JW 17, JW3020,Narmada 4 Seed treatment: Thiram 2 g/kg seed and *Azaotobacter* + PSM 5 g/kg of seed Seed rate:100 kg/ha Spacing: 30 x 5 cm Fertilizer dose: 40:20:10 kg/ ha NPK as basal. 20 kg N/ha with winter rains Weed management: Application of Atlantis (Mesosulfuron+ Iodosulfuron) or Vesta (clodinafop+metsulfuron) @ 400 g/ha as POE at 25-30 DAS. Application of 2,4-D 0.5 kg/ha in 500 L of water at 30-35 DAS
	Chickpea	Sowing time: First fortnight of October Varieties: *Desi:* JG-16,JG-412,JG-322,JG-218,JG-11,RVG-201,JG-6, JAKI – 9218 *Kabuli*: RVKG-101, RVKG-102, JGK-1, JGK-3, KAK-2 Seed treatment: Bavistin 1.5 g/kg seed and *Rhizobium* culture+ PSM 5 g/kg of seed Seed rate: 80 kg/ha (Desi), Kabuli: 100 kg/ha Spacing: 30 x 10 cm Fertilizer dose: 20:40 kg/ha NP as basal Interculture: One hoeing at 20 DAS
Tamil Nadu (Southern plateau and hills and East coast plains and hills regions)	Cotton	Sowing time: Up to second fortnight of October Varieties: KC-2, KC-3 and hybrids Seed rate: 20 kg/ha, hybrids – 1.5 kg/ha Spacing : 45 x 30 cm Fertilizer dose: 20:20:40:10 kg/ha NPKS as basal. 20 kg/ha N at square formation. Foliar spray of 1% $MgSO_4$ at 50 and 80 DAS Foliar spray of 0.5% $ZnSO_4$ at 45 and 60 DAS Interculture: One intercultural operation with blade harrow at 60 DAS Weed management: Spray Pendimethalin @ 1.0 kg /ha or Oxyfluorfen 200 g/ha followed by one hand weeding at 25-30 DAS and one mechanical weeding with power weeder at 45 DAS

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

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

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

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

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

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

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

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

4.3. Fodder Production Plan

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

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

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

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

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

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

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

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

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

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

State	Suggested fodder production measures in *rabi*
Maharashtra	• Promote sowing and establishment of fodder species like *Cenchrus ciliaris, Stylo hamata, Stylo scrabra* etc in inter row spaces in existing orchards • Promotion of horse gram (CRHG-19;CRHG-4,CRHG 18 R) as contingent crop and harvesting it at vegetative stage as fodder in all crop failed areas • Encourage progressive farmers to grow fodder crops of sorghum/pearl millet/maize (UP chari, MP chari, HC-136, HD-2, Gaint bajra, L-74, K-677, Ananad/African Tall, Kisan composite, Moti, Manjari, B1-7 on their own lands with input subsidy in case of some rains in the coming weeks • Sowing of berseem varieties like Mescavi, Wardan, BB-2, BB- 3 and oat varieties like JHO-822, Kent, JHO-851, UPO-212 & UPO-94 till the second fortnight of October, where as lucerne varieties like Chetak, Sirsa-9, Anand-2 can be sown from September to October will boost fodder production • Supply of quality seeds of COFS 29, Stylo and fodder slips of Marvel, Yaswant, Jaywant, Napier, guinea grass well before monsoon will strengthen feed and fodder base at village level .
Madhya Pradesh	• Sowing of maize varieties like african tall and Sorghum single cut varieties like MP Chari, Pusa Chari –6, Jawahar Chari-6, irrigated- HC-136, Pusa Chari-23, UP Chari-2, Proagro Chari (SSG-988), HC-308; multi cut varieties like Jawahar Chari-69, Proagro Chari (SSG-988), Pant Chari-5 (UPFS- 32); dual purpose (grain and fodder) varieties like CSH 13 as *rabi* crop for fodder production • Berseem varieties like Jawahar Berseem-1 (JB-1), JB-5, Bundel Berseem-2 (JHB-146), Mescavi; lucerne varieties like GAUL-1 (Anand-2), Anand Lucerne-3 (AL-3) and where ever irrigation source is there, RL-88 can be cultivated as *rabi* crop for fodder production • Guar varieties like Bundel Guar- 1, 2 and 3, HG-75, HFG-119, FS-277 etc from mid October to early November and sometimes till late December can be cultivated • Encourage growing oats varieties like JO-1,Bundel Jai-822, OS-6, UPO–212, OL-125, Bundel Jai- 851 for fodder production in *rabi* • Cowpea varieties like Crop- UPC – 287, Bundel Lobia-1 (IFC - 8401), UPC- 9202, UPC – 618, UPC- 625 can be grown in October and or late monsoon.

State	Suggested fodder production measures in *rabi*
Rajasthan	• Harvest the top fodder (Khejari, Neem, Subabul, Acasia, Pipol etc) and create fodder banks at village level • Establishment of silvi-pastoral system in CPRs with *Stylosanthus hamata* and *Cenchrus ciliaris*, Dinanath, Dhaman and Sewan grass etc., as grass with *Leucaena leucocephala*, Khejari, Neem, Subabul, Acasia, Pipol etc., as tree component • Sowing of improved varieties of pearlmillet (Giant, Bajra, Raj Bajra Chari 2, AVKB 19), Guar (Bundel Guar 1, Bundel Guar 3, Guara 80, HFG 356), sorghum (Harasona 855, Safed Moti, GFS 4, CSH 20), lucerne (RL 88, Anand 2, Anand 1, Anand 3), Cowpea (UPC 5287, UPC 5286, UPC 618, UPC 622, CL367), oats (Bundel Jai 851, OL 125, UPO 212, UPO 94, Kent), guinea grass (PGG 14, PGG 616, PGG 101, Bundel G. grass 1), Dinanath grass in *rabi* season for fodder production • In winter, maize cultivation may be carried in areas with assured irrigated conditions with the varieties like PEHM 1, PEHM 2, Prakash, HM 2, Pratap Makka Hybrid 1, Mahi Kanchan, Mahi Dhawal, Navjot, GM-6 and GM-138, Aravali • Mothbean varieties like RMG-40, RMO-257, G-8 can also be cultivated for fodder purpose • Under irrigated conditions, pearlmillet cultivars like RHB 121, RHB 127, HHB 67, GHB 558, ICMH 356, JBV-3, Raj-171, CZP-9802 for green fodder production
Karnataka	• Short duration Pearlmillet (AVKB-19, Giant Bajra, CO 8 varieties) crop which is hardy and requires less moisture may be cultivated if there are small rains. Short duration dual (grain and fodder) varieties like GPU 26, GPU 45 and GPU 48 for late sown conditions from second fortnight of August to September can be cultivated for fodder production • Perennial sorghum (CSV -216R) cultivation may be cultivated canal command areas. Farmers growing this crop may be adequately compensated and green fodder after harvest may be transported to areas of deficit. Short duration varieties like CSH 14 and CSV 17 for crops in red soils, and CSH 16, CSH 18 and CSH 21 may be grown in black soils and in transitional belt in *rabi* season • Cowpea (Bundel Lobia -2, KBC 2, RBL-6, COFC 8) as fodder crop may also be cultivated and fed to cattle and buffaloes as protein source. If adequate moisture level is available, farmers may be advised for cultivating maize crop (African Tall & Pratap Makka varieties). • Sampoorna (DHN 6), CO-3, CO-4, APBN-1 etc., hybrid napier fodder varieties can be grown where ever assured irrigation facility exists.

State	Suggested fodder production measures in *rabi*
	• Wherever feasible, cultivation of fodder grasses like *Bothriochloa intermedia,Cenchrus setigerus, Dichanthium annulatum, Pennisetum pedicellatum, Panicum maximum* and fodder legumes like *Arachis hagenbackii, Stylosanthes hamata, S. Scabra* may be promoted.
Gujarat	• Sowing of sorghum (HC- 106, AS-16, SSG-988, Harasona 855, Safed Moti, Pant Chari-5, UPMCH-1101, CSH-13, GFS 4), lucerne (Chetak, GAUL-2, RL 88, Anand 2, Anand 1, LL 3, Anand 3), cowpea (Kohinoor, GFC-1/2/3/4,UPC 5287, UPC 5286), pearlmillet (Giant Bajra, Raj Bajra Chari 2, AVKB 19), guar (T-8, Bundel Guar 1, Bundel Guar 3, Guara 80, HFG 356), oats (Bundel Jai 851, OL 125, UPO 212, UPO 94) in *rabi* season for fodder production • Promote sowing and establishment of fodder species like *C. ciliaris, S. hamata, S. scrabra* etc in inter row spaces in existing orchards • Round the year forage production in irrigated areas with Napier- Pearl millet hybrid + cowpea / lucerne and maize + cowpea / oat or maize + cowpea may be promoted • The silvipastoral systems involving *Acacia nilotica + Cenchrus setigerus and Leucaena leucacephala + Panicum maximum/ Dichanthium annulatum* can be developed in waste lands • Wherever feasible, cultivation of fodder grasses like *guinea grass (PGG 14, PGG 616, PGG 101), dinanath grass (Bundel 2, CO 1) Cenchrus ciliaris, Chloris gayana, Dichanthium, Stylosanthes, Clitori* and legumes grasses like *Stylosanthes hamata, S. Scabra* may be promoted in grazing lands.
Chhattisgarh	• Sowing of sorghum single cut varieties like MP Chari, Pusa Chari –6, Jawahar Chari-6, irrigated- HC-136, Pusa Chari-23, UP Chari-2, Proagro Chari (SSG-988), HC-308; multi cut varieties like Jawahar Chari-69, Proagro Chari (SSG-988), Pant Chari-5 (UPFS- 32); dual purpose (grain and fodder) varieties like CSH 13 as *rabi* crop for fodder production • Berseem varieties like Jawahar Berseem-1 (JB-1), JB-5, Bundel Berseem-2 (JHB-146), Mescavi; lucerne varieties like GAUL-1 (Anand-2), Anand Lucerne-3 (AL-3) and where ever irrigation source is there, RL-88 can be cultivated as *rabi* crop for fodder production • Guar varieties like Bundel Guar- 1, 2 and 3, HG-75, HFG-119, FS-277 etc from mid October to early November and sometimes till late December can be cultivated

State	Suggested fodder production measures in *rabi*
	• Encourage growing oats varieties like JO-1,Bundel Jai-822, OS-6, UPO–212, OL-125, Bundel Jai- 851 for fodder production in *rabi* • Cowpea varieties like Crop- UPC – 287, Bundel Lobia-1 (IFC - 8401), UPC- 9202, UPC – 618, UPC- 625 can be cultivated in October and or late monsoon • The silvipastoral systems involving *Acacia nilotica + Cenchrus setigerus and Leucaena leucacephala + Panicum maximum/ Dichanthium annulatum* can be developed in waste lands • Wherever feasible, cultivation of fodder grasses like *guinea grass (PGG 14, PGG 616, PGG 101), dinanath grass (Bundel 2, CO 1) Cenchrus ciliaris, Chloris gayana, Dichanthium, Stylosanthes, Clitori* and legumes grasses like *Stylosanthes hamata, S. Scabra* may be promoted in grazing lands. • Irrigated fodder with the varieties like CO-3, CO-4, APBN-1 etc., may be promoted.
Southern Tamil Nadu	• Short duration Pearlmillet (CO-8, TNSC-1) crop which is hardy and requires less moisture may be cultivated if there are small rains. Short duration sorghum varieties like CO-27, COFS-29, K-11 can be cultivated for fodder production in *rabi* season • Legume fodder crops like Rice bean-RBL-6, Lucerne-CO-1, Cowpea-CO-1/5, CO(FC)-8 may also be cultivated and fed to cattle and buffaloes as protein source. If adequate moisture level is available, farmers may be advised for cultivating maize crop (African Tall & DHM varieties) in winter • CO-1/2/3/4, KKM-1, APBN-1 etc., hybrid napier fodder varieties can be grown where ever assured irrigation facility exists. • Wherever feasible, cultivation of fodder grasses like hedge lucerne-*Desmanthus virgatus*; subabul CO-1 (P), FD 1423; Dinanath grass-COD-1; Guinea grass-CO-1/2; Anjan grass-CO-1; *Stylosanthes hamata, S. Scabra* may be promoted • Creation of tree fodder models with subabul, glyricidia, Agathi, prosopis etc. at village level.
Andhra Pradesh	• In all rice field bunds, para grass may be grown for green fodder production • If adequate moisture level is available, farmers may be advised for cultivating sorghum (Proagro Chari (SSG-988), APFB-2, Pant Chari-5 (UPFS- 32) and maize crop (African tall, APFM-8) for fodder production in *rabi* season

State	Suggested fodder production measures in *rabi*
	• Berseem varieties like Mescavi, Vardhan (S99-1), JB-1, JB-2, JB-3 and UPB-103; Cowpea varieties like Vardan or Mescavi for; lucerne varieties like T-9, Anand-2, S-244, CO-1, RLS-88 can be cultivated in *rabi* season for leguminous fodder production • In assured irrigation having areas, cultivation of perennial Napier varieties like APBN -1, Co-1, Co-2, Co-3, NB-21, BH-18, Guinea gross, Paragrass etc may be taken up • Top dressing of N in 2-3 split doses @ 20-25 kg N/ha in common property resources (CPRs) like temple lands, panchyat lands or private property resources (PPRs) like waste and degraded lands with the monsoon pattern for higher biomass production • Promote tree fodder (Neem, Subabul, Acasia, Pipal etc) in degraded lands.
Telangana State	• If adequate moisture is available, farmers may be advised for cultivating sorghum (PC-6, MP Chari, HC-136, Hara Sona, Proagro Chari (SSG-988), APFB-2, Pant Chari-5 (UPFS- 32), maize (African tall, Vijay, Jawahar Moti Composite, APFM-8, HGT-3), Pearlmillet (Rajko, K599, T-55AP, L-72, L-74) and oats (Kent, UPO-94, OS-6, S-2688, OL-9, UPO-212, HFO-114, OS-7, JHO-822) for fodder production in *rabi* season • Berseem varieties like Mescavi, Vardhan (S99-1), JB-1, JB-2, JB-3 and UPB-103; cowpea varieties like Vardan or Mescavi for; lucerne varieties like T-9, Anand-2, S-244, CO-1, RLS-88 can be cultivated in *rabi* season for leguminous fodder production • In assured irrigation having areas, cultivation of perennial Napier varieties like APBN -1, Co-1, Co-2, Co-3, Co-4, NB-21, BH-18, guinea grass, Para grass etc may be taken up • Top dressing of N in 2-3 split doses @ 20-25 kg N/ha in common property resources (CPRs) like temple lands, panchyat lands or private property resources (PPRs) like waste and degraded lands with the monsoon pattern for higher biomass production • The grasses like buffalo grass (Molopo, S-3108, S-3106, CAZRI-75), Dinanth grass (IGFRI-43-1, IGFRI-4-22-1, Bundel-1), Rhodes grass (Callide Kotambore, Pioneer), Urochloa (Nixon) etc., and shrubs like Hedge Lucerne may be grown in waste lands for fodder production • Promote tree fodder (neem, subabul, Acacia, Pipal etc) in degraded land.

State	Suggested fodder production measures in *rabi*
Jharkhand	• The sufficiently available forest grass during rainy season would be harvested at its flowering period and preserved as hay or silage or may be turned into feed blocks. • Encouragement for cultivation of lucerne (RL-88), hybrid napier (BNH-10, Co-3), maize (African Tall, Pratap Makka Chari 6), sorghum (CSH-20MF (UPMCH- 1101), CSH-20-MF (UPMCH-1101), pearlmillet (BAIF Pearlmillet-1), berseem (Bundel Berseem-3) in *rabi* season • Wherever possible, other legumes like ricebean (RBL-6Bidhan-1&2), cowpea (UPC 5286, EC-4216) will be encouraged for leguminous fodder production • Fodder tree species like subabul, sesbania species, gliricidia, mulberry, Ficus species, shivan, jackfruit etc. would be planted on field bunds and grasslands. • Maximum rice field bunds will be planted with hybrid napier (NH-10) and guinea grass for green fodder production • In water logged areas, Coix (KCA-3, KCA-4, Bidhan Coix 1) and Paragrass may be cultivated • Whereever assured irrigation facilities are available, cultivate hybrid napier (Jawahar Pennisetum-12) and guinea grass (Hamil).
Western Uttar Pradesh	• Harvesting potato leaves as fodder in potato growing areas • If adequate moisture level is available, farmers may be advised for cultivating sorghum (MP Chari, UP Chari-1 (IS 4776), UP Chari-2, Pant Chari- 3, Proagro Chari (SSG-988), Harasona 855, Safed Moti (FSH-92079), UPFS- 32, CSH-13), Pearlmillet (Raj Bajra Chari-2, CO-8, TNSC-1, FMH-3, AVKB-19) and maize (African tall, Pratap Makka Chari 6) for fodder production • Oats (Bundel Jai-822, Bundel Jai- 851, Bundel Jai 992 (JHO 99-2)Haryana Javi – 114, FOS-1/29, Kent, UPO-94) can be cultivated as forage crop in *rabi* season • Berseem (Bundel Berseem-2 (JHB-146), Bundel Berseem-3, JB-5, Pusa Giant, Wardan, UPB-10) and lucerne (Chetak (S-244), Sirsa Type 9) may be promoted for cultivation of leguminous fodder crops in winter • If assured irrigation facilities are available, recommend for cultivation of hybrid napier (Hybrid Napier-3 (Swetika), NB-21)

State	Suggested fodder production measures in *rabi*
	• Silvo-pastoral systems with *Dichrostachys-Cenchrus/Chrysopogon, Leucaena-Cenchrus/Chrysopogon, Albizia lebbek-Cenchrus-Sehima, Albizia procera-Cenchrus, Acacia/Prosopis-Cenchrus-Chrysopogon, Albizia-Leucaena, Bauhinia and Leucaena, Hardwickia binata Cenchrus/ Chrysopogon* and *Stylosanthes* may be developed in waste lands for enhancing fodder availability • Wherever feasible, cultivation of fodder grasses like *guinea grass (PGG 14, PGG 616, PGG 101), dinanath grass (Bundel 2, CO 1) Cenchrus ciliaris, Chloris gayana, Dichanthium, Clitori* and legumes grasses like *Stylosanthes hamata, S. Scabra* may be promoted in grazing lands.
North -Eastern Region	• *Rabi* fodder with berseem (Pusa Giant, Wardan, Hisar Berseem-1 (HFB-600)), Cowpea (UPC-622, UPC – 618) and rice bean (Bidhan Rice Bean 2 (KRB 4)) may be promoted in suitable areas • Farmers may be advised for cultivating oats (OS-7, OL-9, Bundel Jai 991 (JHO 99-1), Bundel Jai 2004 (JHO 2000-4) and maize (African tall, Pratap Makka Chari 6) for fodder production in *rabi* season • Encourage cultivation of fodder grasses like napier, guniea (Hamil) and Coix (KCA-3, KCA-4, Bidhan Coix 1) in areas with assured irrigation • Promote cultivation of Azolla at back yard and in paddy fields • Grassland/grazing land can be improved with forage grasses (*Brachiaria decumbens, B. mutica, Paspalum notatum*), legumes (*Desmodium uncinatum, D. heterophyllum*), shrubs and trees (*Artocarpus heterophyllus, A. lakoocha, Ficus hookeri, F. nermoralis, Parkia roxburghii, Morus alba*) for better fodder availability for the livestock • Promote growing of hybrid napier alone or maize + cowpea - maize -sorghum- oats or guinea (Hamil) alone for fodder production in assured irrigation areas.

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

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