

2019

PULSES – SUMMER CULTIVATION IN INDIA

Compiled and Edited by

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Year of Publication : 2019

Correct Citation

A.K. Tiwari and A.K. Shivhare 2019. *Pulses- Summer cultivation in India*. Directorate of Pulses Development, GoI, Bhopal – 462004 (M.P), India pp-1-12.

Published by

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Directorate of Pulses Development, Government of India

Ministry of Agriculture & Farmers Welfare

Department of Agriculture Cooperation & Farmers Welfare

Bhopal – 462004, Madhya Pradesh, India

Web : www.dpd.gov.in

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ISBN 978-81-949512-1-6

Printed by

Krishak Bharati Cooperative Limited

State Marketing Office, Block no. 2, Bhutal

Paryawas Bhawan, Arera Hills, Bhopal-462 011

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SUMMER PULSES CULTIVATION IN INDIA

POCKET GUIDE



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1.0 Introduction

India's economy has been dominated by agriculture. Indian farmers are most motivated to grow either rice or wheat or cash crops like cotton, sugarcane, soybean etc. Pulses have been a second choice for the farmers for cultivation. However, due to awareness about newer soil management techniques such as crop rotation, inter-cropping etc., pulse farming is gaining attention since 2014-15.

In a country where vegetarianism is promoted, pulses form an indispensable constituent of the daily dining palate of the poorest Indian. India is the largest producer and consumer of pulses in the world contributing around 26% of the global production (FAOSTAT,2017). About 72% of the global pigeonpea, 61% of gram and 16% of lentil area falls in India. The major pulse producing states are Madhya Pradesh (33%), Maharashtra (13%), Rajasthan (12%), Uttar Pradesh (9%), Karnataka (8%), Andhra Pradesh (5%) Gujarat (4%) and remaining 16% by all other state like Jharkhand, Tamil Nadu and Telangana etc.

Indian agriculture fiercely depends on monsoons to yield sufficient agricultural returns. Pulses, therefore, witness huge fluctuations in terms of production and prices depending upon rainfall scenario. The Govt. of India thus initiated to create a buffer stock of pulses since 2016-17 to reduce price fluctuations and ensuring availability. This also helped in providing remunerative prices to farmers. India is the highest producer of pulses in the world, its domestic production of 25.23 Mt in 2017-18 first time brought out self sufficiency in pulses. Long-term solution to meet demand for pulses lies in increasing productivity of pulses by bridging the yield gaps, intercropping of pulses and growing pulses during spring/ summer.

1.1 Seasonal Contribution of Pulses (2017-18)

Area	Total Pulses : >29 Mha (24 % total food-grains) Kharif : >14 Mha (20% Kharif food-grains) Rabi : >16 Mha (29% Rabi food-grains) ; <i>Summer : >1 Mha</i>				
Production	Total Pulses : > 25 MT (9% of total food-grains) Kharif : > 9 MT (7%) ; Rabi >15 MT (11%); <i>Spring/Summer (Approx: 01 MT)</i>				
Crop Sharing (%)					
Kharif	Area	Production	Rabi	Area	Production
Total Pulses	47	37	Total Pulses	53	63
Tur	31	46	Gram	66	71
Mung	23	15	Mung	06	04
Urd	32	30	Urd	06	05
Kulthi *	02	01	Kulthi	01	01
Summer Area: Total 1.25 Mha <i>Mungbean (69 %), Urdbean (29%), Cowpea/Avare/Kulthi (2%)</i>			Lentil	10	10
			Pea*	06	06
			Lathyrus*	03	02

*Source: DES, Govt. of India (2017-18, IVth Estimates); * Normal (2012-13 to 2016-17)*

2.0 Importance of growing Pulses in Zaid Season (Spring/ Summer)

Ensuring/sustain self-sufficiency in Pulses; maintaining soil health/production sustainability; increasing resource use efficiency; true alternative for green manuring; exploiting non-traditional niches (Spring/Summer/ rice-fallow); increasing cropping intensity and helping to double the farmers' income, etc., is the major importance to grow pulses during Spring/ Summer or Zaid seasons.

2.1 State-wise sowing schedule for Zaid Pulses

S.No.	States	Time of Sowing
1	Assam	March (B) – March (E)
2	Andhra Pradesh	March (B)-April (M)
3	Bihar	March (E) – April (M)
4	Chhattisgarh	March(M)-April (B)
5	Gujarat	March(M)-April (B)
6	Haryana	March(M)-April (B)
7	Jharkhand	March (B)-April(M)
8	Karnataka	February (E)- April (B)
9	Madhya Pradesh	March (M)-April (B)
10	Maharashtra	March (B)-April (B)
11	Odisha	March (B)-April (M)
12	Punjab	March (M)-April(M)
13	Rajasthan	March (B)-April (B)
14	Tamilnadu	March (B)-April (M)
15	Telangana	March(M)-April(M)
16	Uttar Pradesh	March(M)-April (B)
17	West Bengal	March (B) – April (B)

B: Beginning, M: Middle, E: End

3.0 State-wise Potential Cropping Systems

States	Cropping System
MP, Punjab, Haryana,	Rice-Wheat-Mung/Urd/Cowpea
Odisha, TN, AP, Karnataka, Kerela	Rice-Mung/Urd
Bihar	Rice-Maize+Potato-Mung/Urd/Cowpea
U.P, M.P.	Rice-Potato-Mung/Urd/Cowpea
Rajasthan, M.P, U.P, C.G.	Rice-Mustard-Mung/Urd/Cowpea
M.P, UP, Raj., Bihar	Maize-Wheat-Mung/Urd/Cowpea
A.P, T.N, Gujarat	Fallow-Tobacco-Mung/Urd/Cowpea

3.1 State-wise potential Spring/ Summer Area for Pulses

S.No	Potential summer crop	Preceding crop / intercrop crop	Potential area
1	Mung: sole crop spring/ summer as catch crop (Irrigated)	Wheat, Mustard, Potato, Veg. fieldpea	U.P. , Haryana, Punjab, Bihar, West Bengal, M.P. (Area 11.11 Lha)
2	Summer mung (Irrigated)	Rice	New delta Tamil Nadu ,Odisha (Area 2.00 Lha)
3	Summer mung/Urd (Rice Fallow)	Intercrop with Rabi Rice	East –West Godawari , Krishna, AP, Kaveri delta Tamil Nadu (Area 0.80 Lha)
4	Rainfed summer mung	Wheat, Mustard, Potato, Tobacco, Late rice (Aman)	T.N., Gujarat, North Bihar, Odisha (Area 2.22 Lha)
5	Urd (Irrigated)	Wheat, Gram., Potato, Peas	M.P., U.P. (Area 0.95 Lha)
6	Cowpea (Irrigated)	Wheat, rice, potato , mustard	Odisha, Tamil Nadu, Karnataka (Area 0.47 Lha)

(Source : Pulses in India : Retrospect & Prospects-2018)

4.0 Major Zaid Pulse Crops and States in India

In India, major 11 states viz. Madhya Pradesh, Uttar Pradesh, Karnataka, Bihar, Odisha, T.N., West Bengal, Chhattisgarh, Andhra Pradesh, Jharkhand, Gujarat are growing spring/ summer/ zaid pulses. The crops which are being taken are mungbean (69 per cent) and urdbean (29 per cent) followed by Cowpea/Avare or Kulthi in remaining 2% area. Mung, Urd and Cowpea are basically short duration crops and are used in a variety of value added cuisine/items and fetch good market value.

Combining all 03 seasons producing states are :

Crop	Contributing states
Mung	Rajasthan (38%), MP (13%), MS (8%), Karnataka (6%), Bihar (5%), AP (5%), Odisha , Gujarat & TN (each 4%), Telangana
Urd	MP (37%), Raj. (15%), AP (11%), UP (9%), TN (8%), Jharkhand (3%), MS (4%), Gujarat (2%)+

4.1 Crop sharing – Summer Pulses

(Area : Lakh ha)

States	2017			2018			% Share 2017		
	Mung	Urd	Total	Mung	Urd	Total	Mung	Urd	Other
Bihar	2.95	-	2.95	1.47	-	1.47	100	-	-
Odisha	1.57	0.47	2.14	0.99	-	1.02	73	22	5
TN	0.67	1.64	2.31	0.98	1.33	2.39	29	71	0
UP	0.76	0.59	1.36	0.76	0.64	1.40	56	43	1
MP	1.19	0.32	1.51	0.76	0.16	0.92	79	21	0
WB	0.59	0.03	0.62	0.73	0.13	0.86	95	5	0
Gujarat	0.31	0.08	0.40	0.30	0.08	0.38	78	20	3

Contd.....

(Area : Lakh ha)

States	2017			2018			% Share 2017		
	Mung	Urd	Total	Mung	Urd	Total	Mung	Urd	Other
CG	0.10	0.08	0.18	0.12	0.10	0.22	56	44	0
AP	0.25	0.38	0.74	0.03	0.04	0.15	34	51	15
Jharkhand	0.04	-	0.04	0.03	-	0.03	-	-	-
Karnataka	0.01	0.01	0.09	0.01	0.01	0.09	11	11	78
Assam	-	-	0.00	0.001	0.002	0.003	-	-	-
Other	0.19	0.01	0.22	-	-	0.02	86	5	9
Total	8.63	3.61	12.52	6.17	2.48	8.94	69	29	2

Note: Mung 69%, Urd-29% and Other 2% (Avare, Kulthi, in Odisha, Guj, AP , Karnataka)
Mung States -Bihar, Odisha, MP, UP, WB, Gujarat, CG; Urd States – TN, UP, MP, Odisha
(Source: WWWR-Summer, DPD, Govt. of India, Bhopal)

4.2 Summer Potential Area Harnessed

(Area : Lakh ha)

S. No	States	Spring/Summer Pulse Area			Area covered*		
		Potential Area	Potential Utilized 2016-2018	Normal*	2017	2018	2019 Anticipated
1	Bihar	6.35	2.95	1.57	2.95	1.47	2.50
2	Madhya Pradesh	4.00	1.67	1.78	1.51	0.92	3.67
3	Uttar Pradesh	4.00	1.56	1.53	1.36	1.40	3.00
4	Tamil Nadu	3.00	2.39	2.06	2.31	2.39	2.66
5	Odisha	2.75	2.14	1.58	2.14	1.02	2.50
6	West Bengal	1.25	0.86	0.48	0.61	0.86	0.81
7	Andhra Pradesh	1.25	0.74	0.74	0.74	0.15	2.00
8	Haryana	1.00	0.18	0.18	0.00	0.00	0.16
9	Gujarat	0.75	0.43	0.48	0.40	0.38	0.49
10	Jharkhand	0.75	0.40	0.058	0.04	0.03	0.05
11	Chhattisgarh	0.50	0.22	0.18	0.18	0.22	0.25
12	Punjab	0.50	0.39	0.39	0.14	0.00	0.50
13	Karnataka	0.25	0.19	0.14	0.09	0.09	0.21
14	Assam	0.05	0.002	0.002	0.00	0.00	-
15	Maharashtra	0.05	0.02	0.019	0.02	0.02	0.04
16	Others	3.35	-	0.68	0.09	0.05	1.66
	Total	29.80	14.14	10.1	12.58	8.94	20.50

>30 Lha vacated by Wheat/Peas/Potato/Sugarcane/lentil/lathyrus may be brought under spring/summer pulses
Source: DPD, Govt. of India, Bhopal; *WWWR-Summer, *Normal: (Avg. 2013 to 2016).

5.0 Selection of varieties

Based on the prevalent cropping system, sowing time & source of irrigation, short duration varieties ensure that succeeding crops not only saving the crop damage in the event of early summer monsoon showers but also save deterioration of seed quality and pre harvest sprouting of the grains. Therefore, the summer varieties should be chosen having good initial vigour and grow profusely in the first 25–35 days so that, they are well established before the onset of flowering.

5.1 Mungbean Varieties for Summer

Variety	Release Year	Area of Adoption	Maturity days	Yield (q/ha)	Specific Traits
Pusa Vishal	2000	NWPZ	62-65	11-12	Resistant to MYMV
HUM 2 (Malviya Jagriti)	2000	UP, UK	67-69	10-11	Mod. Resistant to MYMV
PDM 139 (Samrat)	2001	UP	60-65	10-12	Resistant to YMV
Gujarat Mung 4	2001	Gujarat	65-68	10-14	Partial resistant to YMV
SML 668	2002	Punjab	60-62	11-13	Tolerant to MYMV
Pant Mung 5	2002	UP, UK	60-65	14-15	Resistant to MYMV
HUM 12 (Malviya Janchetna)	2003	NEPZ	60-62	11-12	Mod. Resistant to MYMV, CLS
IPM 02-3	2003	NWPZ	62-68	11-12	Resistant to MYMV
Meha (IPM 99-125)	2004	NEPZ	66-68	9-10	Resistant to MYMV
TMB 37	2005	NEPZ	65-67	11-12	Mod. Resistant to MYMV
HUM 16 (Malviya Jankalyani)	2006	NEPZ	55-58	10-11	Resistant to MYMV
TJM 3	2007		65-70	9-10	Resistant to PM, YMV and CLS
IPM 2-14	2010	SZ	60-65	11-13	Resistant to MYMV
SML 832	2010	Punjab	60-65	10-11	Tolerant to MYMV & Thrips
MH 421	2012	NWPZ	60-62	12-13	Resistant to MYMV
IPM 410-3 (Shikha)	2016	NWPZ and CZ	60-65	11-13	Resistant to MYMV
IPM 205-7 (Virat)	2016	MP, CG & SZ	50-55	12-14	Resistant to YMV
LBG 787	2016	SZ	70-75	13-14	Resistant to Powdery Mildew
MH 318	2016	Haryana	60-65	10-14	Resistant to MYMV, well under rice wheat rotation
WGG 42 (Yadadri)	2016	Telangana	55-60	10-12	Resistant to MYMV
MGG-351(Sri Rama)	2016	Telangana	60-65	12-14	Moderately tolerant to MYMV
VBN 8	2017	SZ	65-75	13-14	Resistant to YMV
SGC 16	2018	Assam	65-70	13-14	Resistant to CLS and YMV , Moderately resistant to WB
GAM 5	2018	Gujarat	60-65	18-19	Highly resistant against YMV

5.2 Urdbean Varieties for Summer

Variety	Release Year	Area of Adoption	Maturity days	Yield (q/ha)	Specific Traits
ADT-4	1991	Tamil Nadu	65-70	8-9	Tolerant to YMV
ADT-5	1991	Tamil Nadu	65-70	8.0	Tolerant to YMV
NDU-88-8 Narendra Urd 1	1993	UP	60-70	10-11	Resistant to YMV
LBG 611	1995	Andhra Pradesh	85-90	14-15	Resistant to Wilt
Mash 338	1996	Punjab	85-90	9-10	Tolerant to YMV
Vamban 2	1997	Tamil Nadu	60-70	10-11	Tolerant to YMV & drought.
TU 94-2	1999	SZ		9-10	Resistant to YMV
KU 91-2 (Azad Urd 1)	1999	UP, Bihar, WB.	80-85	10-11	Resistant to YMV
Vamban 3	2000	Tamil Nadu	65-70	8-9	Mod. Resistant to YMV
KU 300 (Shekhar 2)	2001	Punjab, Haryana, West UP, Rajasthan	70-75	11-12	Resistant to YMV

Variety	Release Year	Area of Adoption	Maturity days	Yield (q/ha)	Specific Traits
KU 309 Shekhar -3	2004	UP	66-84	10-11	Resistant to YMV, Leaf crinkle, CLS
Gujarat-1	2004	Gujarat	85-90	12-13	Mod. resistant to PM & CLS
LBG 709	2006	Andhra Pradesh	70-75	14-15	Tolerant to YMV
Vamban 5	2007	Tamil Nadu	65-70	8-9	Resistant to YMV
Pant Urd 31	2008	UP, Raj. AP, Odisha, CG, Bihar,	75-80	15-16	Resistant to YMV
WBU-109	2008	West Bengal	75-80	12-13	Resistant to YMV
DU-1	2008	SZ	80-85	14-15	Mod. resistant to PM & CLS
KU 91(Azad U. 2)	2009	UP	75-80	8-9	Resistant to YMV
KUG 479	2010	Punjab, Haryana, West UP, UK	82-85	12-13	Resistant to YMV and PM
Indira U. Pratham	2016	Chhattisgarh	70-75	12-13	Resistant to PM
KKM 1	2017	Tamil Nadu	65-70	7-8	Resistant to LCV, PM
ADT 6	2017	Tamil Nadu	65-70	7-8	Resistant to LCV, PM
LBG 623		Andhra Pradesh	75-80	15-17	Tolerant to PM & YMV
OBG 17 (Ujala)		Odisha	70-75	7-6	Resistant to PM, YMV, CLS

5.3 Cowpea Varieties for Summer

Variety	Release Year	Area of Adoption	Maturity days	Yield (q/ha)	Specific Traits
Pant Lobia 1	2009	Uttarakhand	60-70	15-20	Resistant to YMV and drought tolerant
Pant Lobia 2	2010	Uttarakhand, UP	75-80	20-21	Moderately resi.to Aphids, Thrips, Bruchids
Hidrudaya	2010	Kerala	50-55	10-11	Tol. to leaf rust, Aphids, Pod borer
Hisar Cowpea 46	2010	Haryana	65-70	10-12	Drought tol., resistant to YMV.
PKB 6	2012	Karnataka	80-85	10-12	Res. to Bacterial leaf blight, Rust & Pod borer
Pant Lobia-4	2015	All cowpea growing regions	60-65	14-15	Res. to YMV & drought tolerant
TPTC-29 (I)	2016	SZ	80-82	11	Mod.res.to dry root rot and YMV
Pant Lobia-5	2017	Uttarakhand	65-70	16-20	Tolerant to aphid thrips bruchids and resistant to CYMV
TPTC-29 (Tirupati cowpea-1)	2017	AP, Karnataka, Tamilnadu, odisha	80-90	10-11	Moderately resistant to dry root rot and YMV

5.4 Guar Varieties for Summer

Variety	Release Year	Area of Adoption	Maturity days	Yield (q/ha)	Specific Traits
RGC-1066	2006	Rajasthan	97-100	10-14	Resistant to Bacterial blight and Root rot.
Guar Kunjal (RGC 1033)	2010	Rajasthan	95-100	15-20	Mod. resistant to Alternaria leaf blight, Tol. to BLB and root rot,

5.5 Horsegram Varieties for Summer

Variety	Release Year	Area of Adoption	Maturity days	Yield (q/ha)	Specific Traits
Pratap Kulthi-2 (AK 53)	2016	Raj., CG, MH, Gujarat & UK	80-85	6-7	Extra early maturing,
CG kulthi-3 (BHG-03)	2017	Chhattisgarh	85-90	5-6	Res. to collar rot, powdery mildew leaf spot disease.

CZ- Central Zone (MP & CG), NWPZ- North Western Plain Zone (Punjab, Haryana, Rajasthan, Western U.P. J&K, H.P. and UK, MH, Goa), NEPZ-North Eastern Plain Zone (Eastern U.P., Bihar, Jharkhand, Orissa, West Bengal, Assam and plains of North Eastern States), SZ-South Zone (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, Odisha).

PM-Powdery Mildew, MYMV-Mungbean Yellow Mosaic Virus, YMV- Yellow Mosaic Virus, CLS- Cercospora leaf spot, WB-Web Blight.

(Source:-Project Coordinator's Report, AICRP on MULLaRP, ICAR, IIPR, Kanpur.2017-18.)

6.0 Development Programme under NFSM

Under NFSM, since 2012-13, a programme on Additional Area coverage for increasing pulses production during Rabi/Summer to increase production of rabi/summer pulses through area expansion of Rabi Pigeonpea, Gram, Pea, Lentil (in rice fallow) during Rabi and Greengram and Blackgram during summer is operational.

6.1 Year-wise programme implemented states' as given below:

Year	States
2014-15 (15 states)	Assam, AP, Bihar, Haryana, Jharkhand, Karnataka, MP, MH, Odisha, Punjab, Rajasthan, TN, Telangana, UP and WB.
2015-16 (24 states)	Assam, AP, Aru. Pradesh, Bihar, CG, Haryana, HP, J& K, Jharkhand, Karnataka, Manipur, MP, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, TN, Telangana, Tripura, UP, UK and WB.
2016-17 & 2017-18 (17 states)	Assam, AP, Bihar, CG, Gujarat, Haryana, Jharkhand, Karnataka, MP, MS, Odisha, Punjab, Rajasthan, TN, Telangana, UP, WB.
2018-19 (15 states)	Assam, AP, Bihar, CG, Gujarat, Jharkhand, Karnataka, MP, MS, Odisha, Rajasthan, TN, Telangana, UP, WB.

6.2 NFSM Budgetary Allocation : (Additional Allocation - Rabi/Summer)

(Rs. in Lakh)

States	2016-17			2017-18			2018-19 Alloc.
	Alloc.	Ach.	% UC	Alloc.	Ach.	% UC	
Andhra Pradesh	2500	1500	60	3670	2800	76	3300
Bihar	1200	833	69	1679	901	54	1650
Chhattisgarh	1600	1469	92	2575	1902	74	2750
Gujarat	300	0	0	300	64	21	287
Haryana	700	229	33	160	140	87	-
Jharkhand	600	508	85	1301	930	71	1375
Karnataka	2900	1405	48	4208	4150	99	4100
Madhya Pradesh	10100	2103	21	17300	3321	19	16500
Maharashtra	3700		0	2187	2006	92	1200
Odisha	852	779	91	1198	1198	100	1375
Punjab	100	0	0	103	60	58	-
Rajasthan	1975	1099	56	6260	5005	80	6050
Tamil Nadu	600	597	100	2270	2182	96	2200
Telangana	300	17	6	484	61	13	652
Uttar Pradesh	1875	520	28	3435	1222	36	5500
West Bengal	500	472	94	969	842	87	900
Assam	900	630	70	1100	0	0	1000
Grand Total	30702	12161	40	49199	26782	54	48839

Interventions: Demo, Seed Distri., INM/IPM, RCT, MIS.

Source: Crops Division, Min. of Agri. & FW (DAC&FW), N. Delhi ; Addl. Programme Since 2014-15

6.3 Other Existing Developmental Support from DAC&FW (2018-19)

- i. Ongoing Targeting Rice Fallow Area (TRFA) program in 6 Eastern States to promote zaid / summer in selected areas (NFSM-Pulses and Oilseeds)

Allocation- Rs.163 Cr.

- ii. Additional area program under NFSM-Pulses encourages to grow pulses in summer.

Allocation- Rs.296 cr. in 15 states

- iii. Intercropping in Oilpalm (NFSM- Oil Seed & Oil Palm)

Allocation- Rs. 13.50 cr. (Oilpalm)in 13 States

- iv. Intercropping in Sugarcane (NFSM- Pulses)

Allocation- Rs. 5.24 crore in 12 states

- v. Sub-mission on Nutri-cereals to promote millets (NFSM- Nutri-cereals)

Allocation- Rs. 93.08 crore, 22 states: 10% for summer

7.0 Technology Demonstrations/ Plan : (Rabi/Summer 2018-19)

(Area - ha, Rs.- Lakh)

State	Financial Allocation		Total Additional Area Planned (Rabi/S)	Proposed Area for Summer			
	Demons. (Rabi/Summ. Pulses)	Inter-cropping with Sugarcane		Sole	CSBD	Intercrop -ping	Total
Chhattisgarh	1534.95	-	17055	-	-	-	-
Rajasthan	5580.00	-	62000	-	-	-	-
West Bengal	580.50	-	7500	-	-	-	-
Uttar Pradesh	4032.00	540.45	44800	14000	-	15000	29000
Jharkhand	1224.00	-	13600	3000	-	-	3000
Tamil Nadu	1460.00	26.87	17400	-	4400	1000	5400
Bihar	1072.80	53.50	11920	2400	-	-	2400
Odisha	1287.00	3.40	14300	-	-	-	-
MP	11520.00	22.95	118000	-	15000	-	15000
Gujarat	96.57	16.57	1073	-	-	-	-
Karnataka	1650.00	90.10	19000	-	-	-	-
Telangana	279.54	9.29	3106	-	-	-	-
AP	2040.00	22.95	40800	-	-	-	-
Assam	630.00	-	7000	7000	-	-	7000
Maharashtra	90.00	-	1000	-	-	-	-
All India	33077.36	862.82	378554	26400	19400	16000	61800

New Delhi; Intercropping with Sugarcane since 2018-19

Source: Crop Division, Min. of Agri. & FW (DAC&FW)

8.0 Suggestive Policy Strategy for State Deptt. of Agri./ ICAR

- Effective MIS network for critical irrigation at reproductive phase.
- Opening canals to establish/exploit potential area to combat consecutive drought.
- Adoption/popularization of early varieties (rice, potato, wheat, sugarcane) to stop/tackle pre-harvest sprouting in the event of early onset of rains/pre-monsoon.
- Community farming/fencing under convergence with CSR/DMF, MGNREGAs etc., to protect/ward-off wild animal menace.
- Mandatory seed treatment with FIR and IPM to avoid infestation of Yellow Mosaic Virus in beans.
- To ensure the availability of quality seed/recommended varieties, enter into MoU with NFSM seed-hubs (150 Nos.)/NFSM-EBSP centers (12 nos).
- IIPR-AICRPs, SAUs to concentrate on breeding of location specific varieties to address limited varietal summer pulses cafeteria.
- Ensure supply of electricity for irrigation.

9.0 Suggestive Extension Strategy for Enhancing Productivity

- Use synchronous/climate resilient mung var.-PDM-139, Virat (IPM 205-7), MH-421, Shikha (IPM 410-3); urd- PU-31, Pratap Urd 1.
- **Critical Irrigation:** 02 nos. due to high temperature and low RH during summer
Ist at 20-25 DAS ; IInd at pod filling stage (critical stage)
- **Timely sowing:** **Spring-** Feb (Early)-March (Mid.); **Summer-** March (Mid)-April (Mid) (As per AES)
- **Spacing:** March (M) -April (M)- 25-30 cm x 10 cm (Mung/Urd)
March (End) to April (1st Week) - 30 cm x 10 cm (Cowpea)
- **Plant Density** 3.3 to 4.0 lakh /ha (Mung/Urd)
- Good tillage practices/crop establishment practices-Laser land leveling, use seed drills/zero tillage sowing in proper moisture, residue retention of previous crop.
- Use pre-emergence herbicides (Pendimethalin @ 0.75-1.50 kg ai/ ha) followed by one need based hand weeding.
- Intercropping of pulses with commercial crops-sugarcane.
- Efficient utilization of moisture available in rice fallow for pulses and optimizing utilization by efficient irrigation system.
- Use Phosphorus @40-50 kg/ha and Sulphur @15-20 kg/ha, particularly after wheat and intercropping with sugarcane.
- To control sucking pest in mung bean at pre-flowering use Dimethoate 30 EC @ 500 ml/ha or Imidacloprid @ 100-125 ml/ha.
- Adopt INM/foiar spray of liquid fertilizers (19:19:19) at flowering/pod formation stage for nourishment of plants.

10.0 Recommendation for higher yield during Summer

- State-wise field monitoring of summer pulses by DPD, Bhopal has found that use of NPK liquid bio-fertilizers were instrumental in increasing the productivity of summer mung and urd. It reduces the leaching of Potassium & Nitrogen and the phosphorus fixation in soils.
- It is recommended to use NPK liquid bio-fertilizer @ 500 ml/acre in 50-100 kg FYM/Compost to be mixed in soil before sowing.
- Another liquid bio-fertilizers *i.e.* i) Liquid Rhizobium ii) Phosphate Solubilising Bacteria (PSB) iii) NPK-3 (Rhizobium +PSB+KMB) @ 500 ml + 50-100 kg FYM/compost before sowing helps in making the fixed phosphorus in available form for the crops.
- Seed treatment with liquid PSB fertilizer @ 500 ml in 1-2 lit. water by soaking the seed for 15-20 minutes followed by drying (30 minutes) in shade and sowing thereafter is also recommended.
- The liquid bio-fertilizer helps in fixation of atmospheric nitrogen in tur, gram, mung, urd, fieldpea, berseem and dencha.

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