Annual Report: Glimpses

2023-24

AICRP on Seed (Crops)

ICAR- Indian Institute of Seed Science
(Formerly ICAR-Directorate of Seed Research)
(Indian Council of Agricultural Research)
Kushmaur, Mau 275103 (UP)
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Preface

Quality seed is the *numero uno* input for sustained agriculture production. The pace of progress in food production is largely dependent upon the progress of seed programme with which a country is able to multiply and market good quality seed of high yielding varieties with superior genetics. Role of quality seed is documented and acknowledged across farming systems and ICAR duly acknowledged this fact by the launch of mile stone project *viz*. AICRP- NSP (Crops) during 1979-80 and ICAR Seed Project during 2005-06. As per the recommendations of 'Review Committee of AICRPs/AINPs', ICAR merged both the projects into single entity i.e., AICRP on Seed (Crop) during 2021-22. The AICRP on Seed (Crops) is mandated to produce breeder seed as per national requirement, to augment quality seed production among agricultural crops and to develop region specific seed technologies as per the contemporary needs of seed industry. Apart from above, technology dissemination, model deployment, seed infrastructure institution and capacity building has been the integral part of the project. In order to address issues such as Seed Replacement Rate (SRR) and Varietal Replacement Rate (VRR) and to develop need based technological interventions in seed domain, launching of network project viz. AICRP on Seed (Crops) has been a significant stride under ICAR.

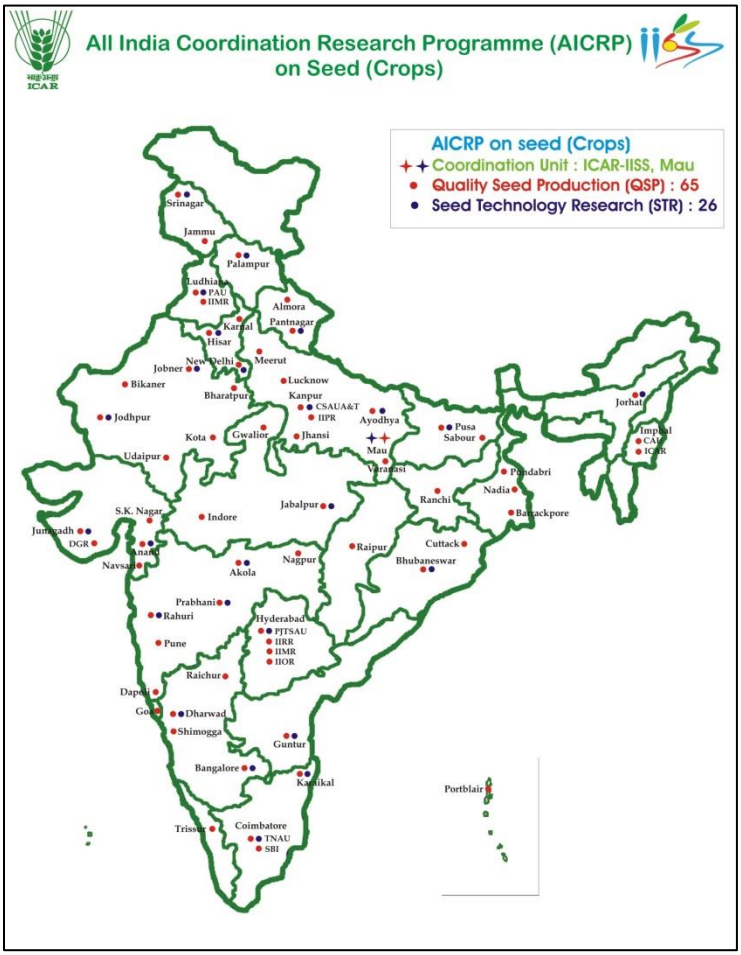
Annual Report 2023-24 is a compilation of progress made by varied co-operating centers under AICRP on Seed (crops) under its two components *viz*., Quality Seed Production and Seed Technology Research. It is my immense pleasure to gratefully acknowledge the dynamic leadership and path illuminating guidance received from Dr. Himanshu Pathak, Hon'ble Secretary, DARE & Director General, ICAR and I hope that under his able stewardship, Indian seed production and research fraternity would excel in the arena of quality seed production and research. I acknowledge gratefully Dr. T.R. Sharma, DDG (CS), who is the mission leader of this project, for his kind support, guidance and encouragement. I thank Dr. D.K. Yadava, ADG (Seed) for his tireless help and active co-operation rendered. I also thank Seed Section, DA&FW, MoA&FW for their cooperation in implementation of BSP programme. I also place on record my sincere thanks to all nodal officers and scientists from various co-operating centers, who did commendable job in successful implementation of the project. I gratefully acknowledge the immense support of Principal Investigators; Dr. Sandeep K. Lal, Dr. S.K. Yadav, Dr. Atul Kumar, Dr. Amit Bera and Dr. Ashwani Kumar and; Co-PIs, Dr. Bhojaraja Naik K., Dr. Udaya Bhaskar K., Dr. Anjitha George and Dr. P. Sivamma who have done meticulous compilation of various reports, technical programme and for providing technical guidance to scientists. I also take this opportunity to acknowledge all scientists and staff of IISS primarily Dr. Sripathy K.V., Dr. Udaya Bhaskar K. and Dr. Banoth Vinesh for their efforts in successful co-ordination of this massive project across the country. I firmly believe that this project, down the line would tread us towards attaining seed sufficiency with adept technological backup for quality seed driven agricultural growth.

Sanjay Kumar
Director, ICAR-IISS, Mau

Contents

Introduction

Seed provides foundation to productive agriculture, be it crop husbandry, horticulture or fisheries. It is cheapest input among all and plays seminal role in enhancing agricultural productivity. The seed sector plays a major role in the dissemination of latest agricultural technologies to farmers through high quality seeds of high yielding varieties as exemplified by consistent increase and record production of field crops. AICRP on Seed (Crops) played its part in augmenting quality seed production (breeder seed & other classes), research back up on various aspects of seed science and technology, infrastructure establishment to support seed activities, seed related technology dissemination, capacity building and more importantly making seeds available at right place and time by innovative model deployment (participatory seed production and seed village programme etc.). The development of high yielding varieties/ hybrids of wheat, rice, maize, pearlmillet and sorghum in early sixties were the landmark beginning for development of the seed programme in the country. The World Bank assisted considerably for strengthening of Indian seed programme by launching NSP I in 1977-78 and subsequently NSP II in the following year. The ICAR along with its partner *i.e.* SAUs shouldered the responsibility of producing the breeder seed through launch of All India Coordinated Research Project on seed called 'National Seed Project (Crops)' in 1979-80 with two components *viz*. Breeder Seed Production (BSP) and Seed Technology Research (STR). The seed programme of the country was further strengthened with NSP III through World Bank assistance in 1989-90, which not only supported the ICAR and SAUs but also Department of Agriculture Corporation and Farmers Welfare (DAC&FW), Seeds Corporations, Seed Certification Agencies and Private Seed Industry to a great extent in production, processing and in providing quality seeds to the farmers. Similarly, in a bid to foster seed multiplication chain and for strengthening seed production infrastructure facilities in the country, ICAR launched ICAR Seed Project-'Seed Production in Agricultural Crops' during 2005-06. As per the recommendations of 'Review Committee on AICRPs/AINPs of ICAR', the two flagship seed programmes of ICAR were merged into single entity and rechristened as AICRP on Seed (Crops) during 2021-22 with two components viz. Quality Seed Production (QSP) and Seed Technology Research (STR).



The AICRP on Seed (Crops) is mandated to produce breeder seed as per national requirement, to augment quality seed production among agricultural crops and to develop region specific seed technologies as per the contemporary needs of seed industry under five broad theme areas of seed science *viz*. seed production and certification; seed physiology, storage and testing; seed pathology, seed entomology and seed processing. During 2023-24, Quality Seed Production and Seed Technology Research components were operational at 64 centres and 24 centres respectively, under AICRP on Seed (Crops) at various SAUs and ICAR institutes across the country.

Mission of AICRP-NSP (Crops)

To ameliorate Seed Replacement Rate (SRR) and Varietal Replacement Rate (VRR) through production of adequate quantity of quality seed and to develop region specific seed technologies for improved yield and production.

Mandates of AICRP-NSP (Crops)

- To produce breeder seed as per national requirement and augment quality seed production among agricultural crops in the country.
- To conduct, coordinate and monitor research on different aspects of seed science and technology.
- Qualitative and quantitative enhancement in seed production capabilities of institutions under NARES
- Capacity building among various stake holders on seed production, processing, storage & packaging, quality control and seed health.
- To establish linkages with Crop Improvement Projects, Seed Industry, Seed Regulatory Agencies, NGOs, KVKs etc.

Cooperating centres& location

During 2023-24, 64 quality seed production and 24 seed technology research centres are in existence under AICRP on Seed (Crops).

S. No.	Quality Seed Production (QSP)	S. No.	Seed Technology Research (STR)
A	**State Agricultural University (SAUs)**	**A**	**State Agricultural University (SAUs)**
1	CSKHPKV, Palampur	1	AAU, Anand
2	PAU, Ludhiana	2	CCSHAU, Hisar
3	CCSHAU, Hisar	3	CSAUAT, Kanpur
4	GBPUAT, Pantnagar	4	GBPUAT, Pantnagar
5	NDUAT, Faizabad	5	CSKHPAU, Palampur
6	CSAUAT, Kanpur	6	JAU, Junagadh
7	OUAT, Bhubaneswar	7	JNKVV, Jabalpur
8	JNKVV, Jabalpur	8	MPKV, Rahuri
9	VNMKV, Parbhani	9	NDUAT, Faizabad
10	MPKV, Rahuri	10	OUAT, Bhubaneswar
11	PDKV, Akola	11	PAJANCOARI, Karaikal
12	UAS, Bangalore	12	PAU, Ludhiana
13	UAS, Dharwad	13	PDKV, Akola
14	PJTSAU, Hyderabad	14	PJTSAU, Hyderabad

S. No.	Quality Seed Production (QSP)	S. No.	Seed Technology Research (STR)
15	TNAU, Coimbatore	15	SKNAU, Jobner
16	SKUAST, Srinagar	16	SKUAST, Srinagar
17	AAU, Anand	17	TNAU, Coimbatore
18	PAJANCOA&RI, Karaikal	18	UAS, Bangalore
19	VSI, Pune	19	UAS, Dharwad
20	AU, Kota	20	VNMKV, Parbhani
21	BAU, Ranchi	**B**	**SAUs – NEH Region**
22	BCKV, Nadia	21	AAU, Jorhat
23	SKRAU, Bikaner	**C**	**Central Agricultural University (CAUs)**
24	SDAU, SK Nagar	22	RPCAU, Pusa
25	IGKV, Raipur	**D**	**ICAR Institutes**
26	KKV, Dapoli	23	ICAR-CAZRI, Jodhpur
27	KAU, Trissur	24	ICAR-IARI, New Delhi
28	UAS, Raichur		
29	SKUAST, Jammu		
30	SVPUAT, Meerut		
31	UBKV, Pundibari		
32	NAU, Navsari		
33	BAU, Sabour		
34	UAHS, Shimogga		
35	ANGRAU, Guntur		
36	RVSKVV, Gwalior		
37	MPUAT, Udaipur		
38	JAU, Junagadh		
B	**ICAR Institutes**		
39	ICAR-CRIJAF, Barackpore		
40	ICAR-NRRI, Cuttack		
41	ICAR-IGFRI, Jhansi		
42	ICAR-CICR, Nagpur		
43	ICAR-IIRR, Hyderabad		
44	ICAR-IIMR, Hyderabad		
45	ICAR-IIOR, Hyderabad		
46	ICAR-IIWBR, Karnal		
47	ICAR-DRMR, Bharatpur		
48	ICAR-IISR, Indore		
49	ICAR-DGR, Junagadh		
50	ICAR-IISR, Lucknow		
51	ICAR-SBI, Coimbatore		
52	ICAR-IISS, Mau		
53	ICAR-IIMR, Ludhiana		
54	ICAR-CCARI, Goa		
55	ICAR-CIARI, Port Blair		
56	ICAR- VPKAS, Almora		
57	ICAR-IIPR, Kanpur		

S. No.	Quality Seed Production (QSP)	S. No.	Seed Technology Research (STR)
58	ICAR-CAZRI, Jodhpur		
59	ICAR-IARI, New Delhi		
C	**SAUs – NEH Region**		
60	AAU, Jorhat		
D	**Central Agricultural University (CAUs)**		
61	BHU, Varanasi		
62	RPCAU, Pusa		
63	CAU, Imphal		
E	**ICAR Institutes – NEH Region**		
64	ICAR RC for NEH, Manipur		

Thrust areas in Quality Seed Production

- Production of adequate quantities of breeder seed as per national requirement.
- Augmenting the availability of foundation, certified and truthfully labelled seed in the country.
- Production of disease-free planting material in vegetatively propagated field crops.
- Quality maintenance of nucleus and breeder seeds by employing dynamic maintenance breeding and rapid genetic purity testing tools.
- Identification of suitable seed provenance for institution of 'National Seed Reserves', with special emphasis on pulses & oilseeds in states of Maharashtra, Madhya Pradesh, Rajasthan, Karnataka, Andhra Pradesh and Telangana.
- Strengthening of seed infrastructure facilities and seed production capabilities of cooperating centers.
- Human resource development and technology dissemination pertinent to seed realm.

Thrust areas in Seed Technology Research

a. Seed production and certification

- Identification of suitable alternative areas/ provenances for seed production in a bid to counter the effects of climate change.
- Development and optimization of climate resilient seed production technology.
- Harmonization of seed standards in tune to the needs of global seed certification standards.
- Optimization of micro-nutrients and growth regulators in relation to reproductive behaviour to augment the seed yield.
- Development of seed production packages and seed certification standards for underutilized crops.
- To explore upon new planting methodologies/ geometries in a bid to optimize seed rate in tune to realization of higher seed yields (revisiting SMRs).

b. Seed physiology, testing and storage

- Validation/up-gradation of field and seed standards/protocols, isolation distance, sample size, physical purity and ODV's in varied crops.
- Standardization of seed testing procedures in field, vegetable, medicinal and green manure crops.

- Standardization of DNA finger printing/molecular markers tools to supplement GOT.
- Use of second and third generation tools for seed quality enhancement.
- Identification of seed vigour traits as a sensitive measure of seed quality in major crops.
- Identification of suitable seed treatments / materials / methods for safe storage of seed.

c. Seed pathology

- Identification of disease-free zones for quality seed production.
- Development of rapid and reliable techniques for detection, identification and screening of seed materials for different seed borne diseases.
- Development of integrated strategies for management of seed borne diseases.
- Development of field and seed standards for seed borne diseases and strengthening of work on biological control of seed borne diseases.
- Revisiting of field and seed standards for seed-borne diseases.
- Monitoring, detection, and management of new seed borne diseases.

d. Seed entomology

- Pest risk analysis for efficient management of insect pests under seed storage.
- Evaluation of new insecticide molecules for management of storage insects.
- Development of integrated management strategies for management of storage insects.
- Management of insect pollinators for increasing pollination efficiency and seed set.
- Determining the efficacy of novel packaging material with new chemistry for management of storage insects.

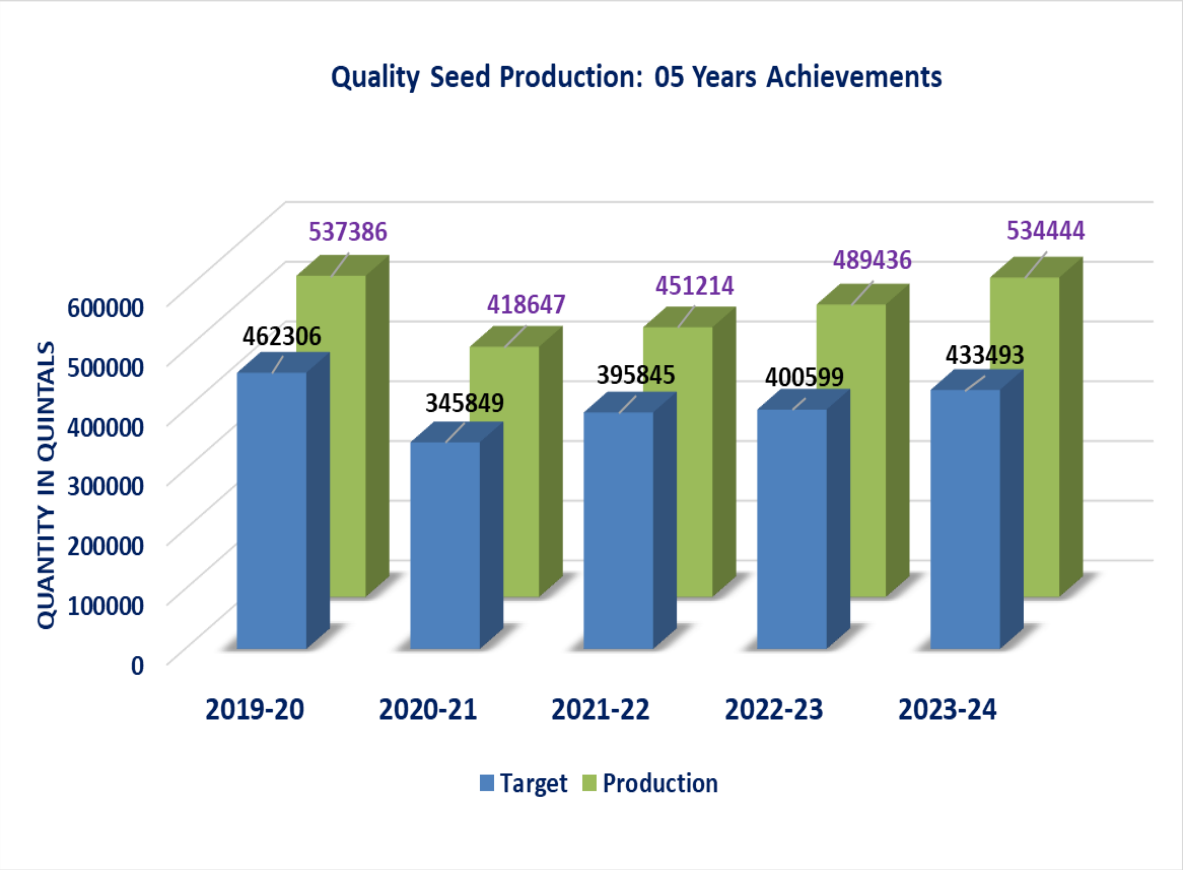
e. Seed processing

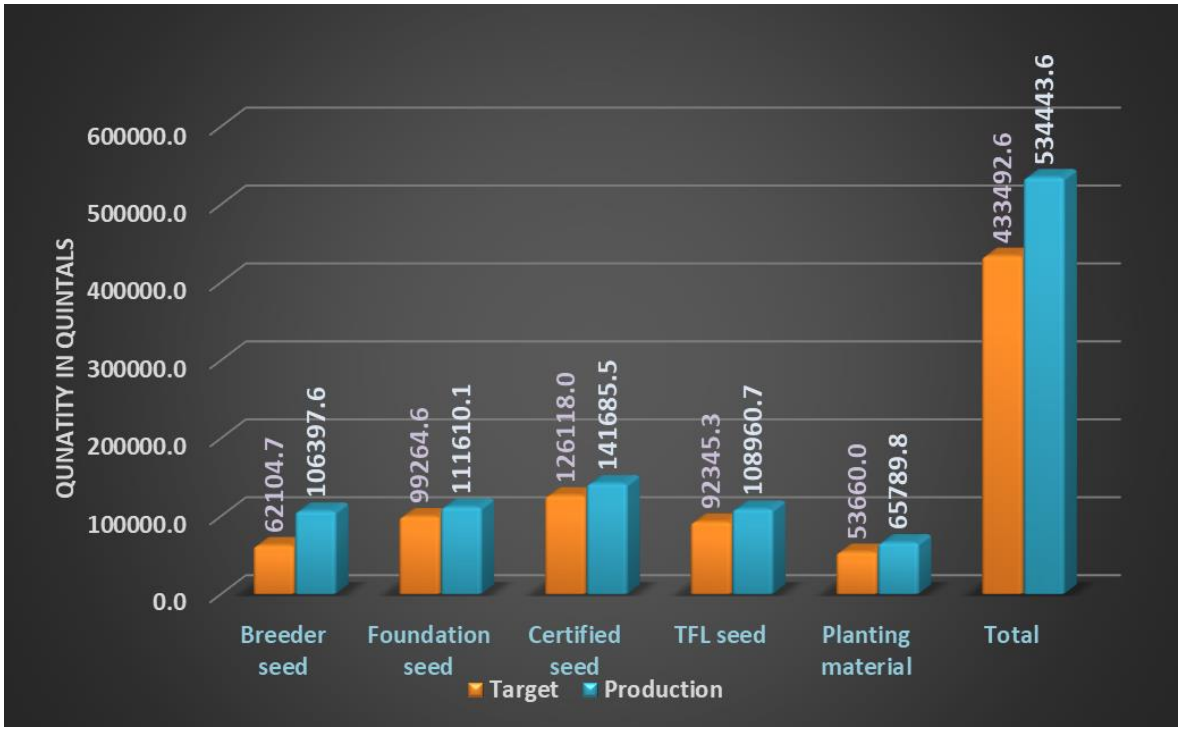
- Standardization of grading sieve sizes (top & bottom sieves) and processing methodologies for new crop varieties/ parental lines.
- Bringing mechanization in seed production to march towards precision farming.

Quality Seed Production during 2023-24

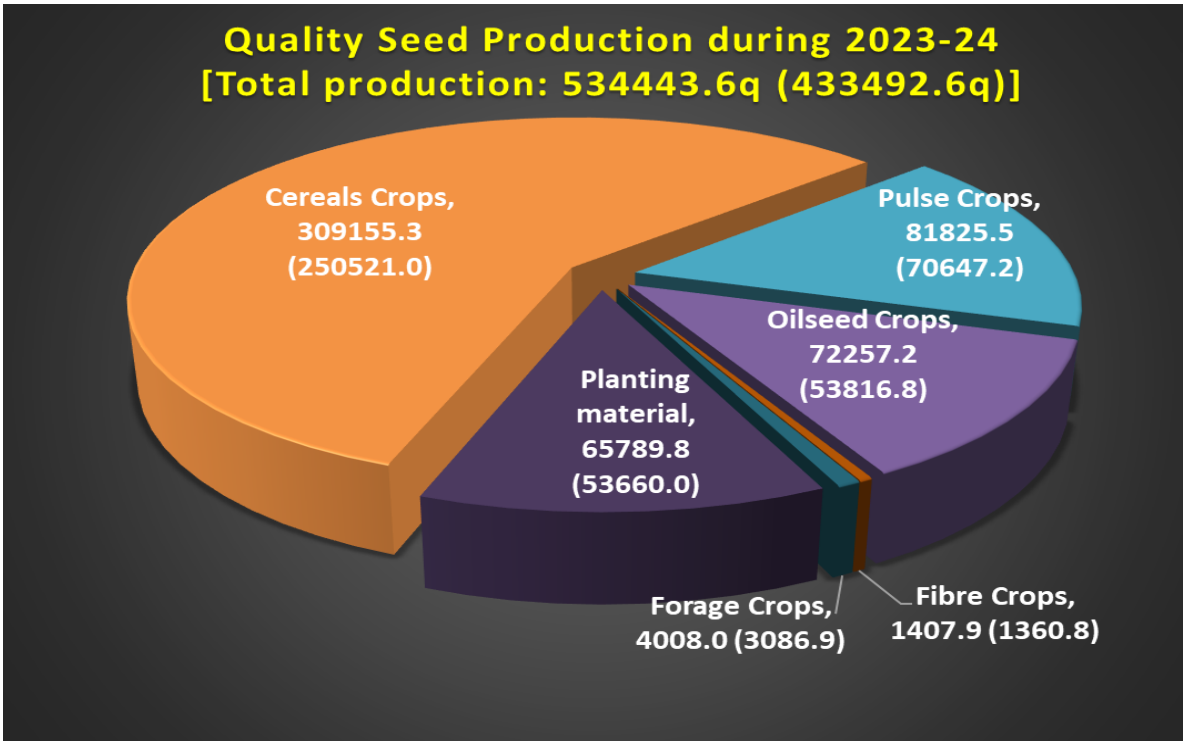
Quality seed production

During the year 2023-24 (Rabi, 2022-23 & Kharif, 2023), total quality seed production in various field crops was 534443.58 q against the target of 433492.60 q. Production comprises of 106397.59 q of breeder seed against the indent of 62104.66 q, 111610.08 q of foundation seed against the target of 99264.64 q, 141685.47 q of certified seed against the target of 126118.04 q, 108960.68 q of truthfully labelled seed against the target of 92345.26 q and 65789.77 q of planting material against the target of 53660.00 q. In addition, 103.89 lakh planting material and 10.38 lakh tissue culture plantlets were produced against the targets of 70.44 and 9.73 lakhs, respectively. Apart from marginal shortfall in few varieties due to climate vagaries the major requirement has been met as per indents in varied crops. Perusal of statistics clearly suggests that the present level of breeder seed production is surpassing the national requirement and is sufficient to produce required quantum of certified seed for realizing the targeted SRR in varied crops.





Class-wise quality seed production under AICRP on Seed (Crops) during 2023-24

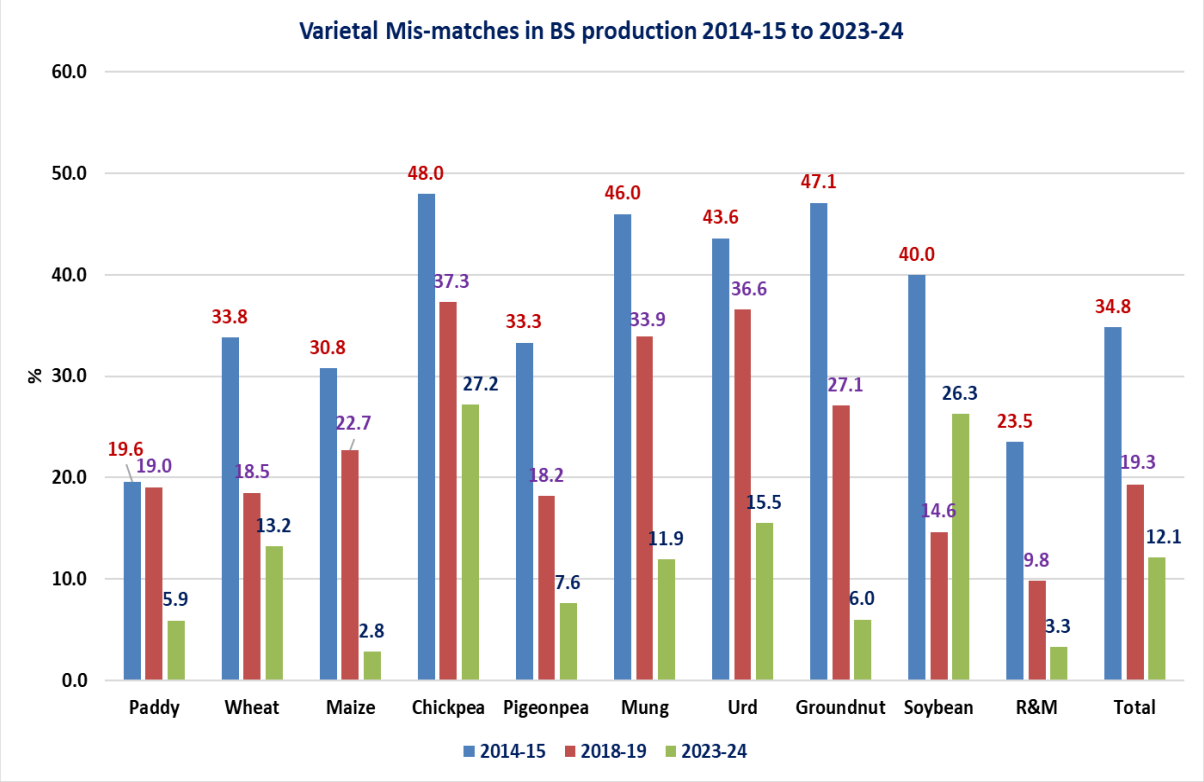


Values in parentheses indicate targets

Commodity-wise quality seed production under AICRP on Seed (Crops) during 2023-24

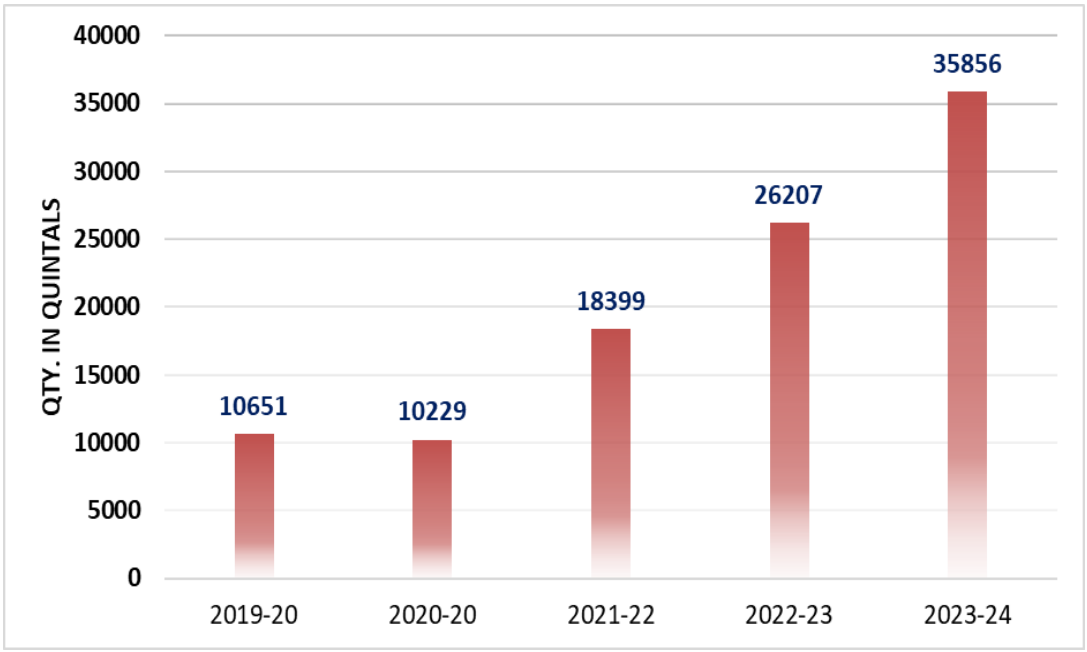
Varietal mis-match in breeder seed production

Quantum of breeder seed production always surpassed the indents reflects successful progression of AICRP on Seed (Crops). Imperceptible varietal mis-matches in breeder seed production were observed during past years, below referred illustration clearly depicts that, there is a discernible decrease in mis-matches observed in all major field crops. For example, during the year 2014-15; among 1172 varieties in seed chain, mis-match was reflected in 408 varieties (34.8%). In comparison, during 2016-17, 2017-18, 2018-19, 2019-20, 2020-21, 2021-22, 2022-23 and 2023-24; among 1169, 1205, 1302, 1296, 1388, 1399, 1556 and 1798 varieties in seed chain, mis-matches were reflected in 295 (25.2%), 278 (23.1%), 251 (19.3%), 226 (17.4%), 235 (16.9%), 183 (13.1%), 207 (13.3%) and 217 (12.1%) varieties, respectively.



Quality seed production in bio-fortified varieties

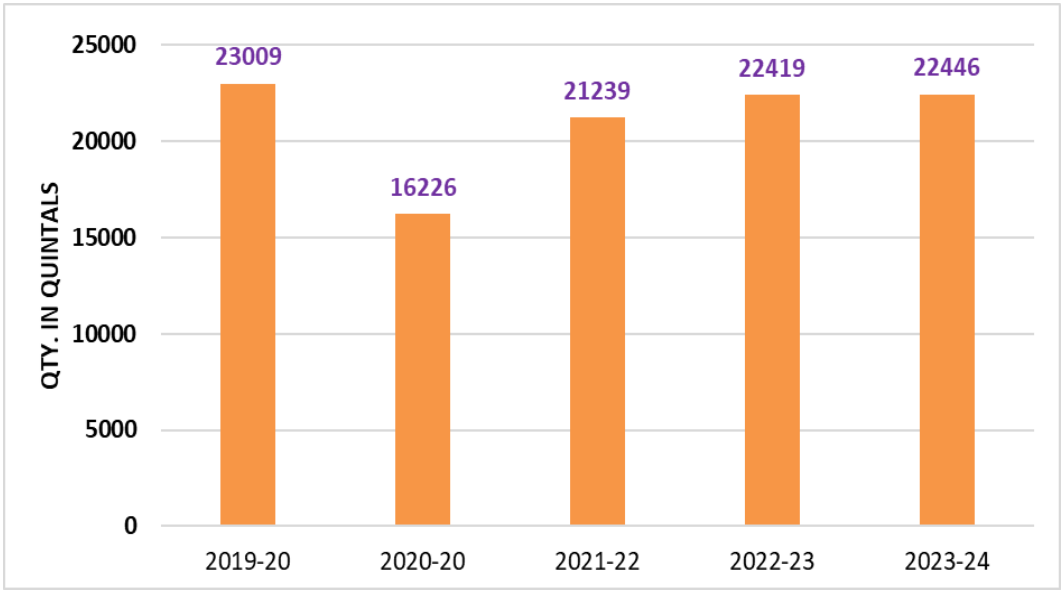
Under the ambit of AICRP on Seed (Crops), due emphasis has been given for quality seed production of bio-fortified crop varieties and thereby contributing part in addressing nutritional security via seed as a carrier in this regard. During the 2023-24, 35856.13 quintals of quality seed was produced in bio-fortified varieties. Production comprises of 15059.09 q of breeder seed and 20797.04 q of other classes of seed (F/S, C/S and TFL).



Quality seed production in bio-fortified crop varieties during 2019-20 to 2023-24

Quality seed production in multiple stress tolerant varieties

Under the ambit of AICRP on Seed (Crops), due emphasis has been given for quality seed production of multiple stress tolerant (flood and low moisture stress) crop varieties. During the 2023-24, 22446.74 quintals of quality seed was produced in multiple stress tolerant crop varieties. Production comprises of 2582.93 q of breeder seed and 19863.81 q of other classes of seed (F/S, C/S and TFL).



Quality seed production in multiple stress tolerant crop varieties during 2019-20 to 2023-24

Table 2.1: Summary of centre-wise quality seed production in university/ institute farms (Rabi 2022-23 and Kharif 2023)

(In quintals)

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
1	AAU, Anand	734.15	1029.92	710.00	800.30	2390.00	2284.10	1406.50	1468.12	**5240.65**	**5582.44**
2	ANGRAU, Guntur	5950.43	5774.86	10344.00	9315.24	1543.78	1449.14	1056.50	1525.02	**18894.71**	**18064.26**
3	AU, Kota	1859.90	2488.34	0.00	2680.58	0.00	849.92	0.00	5878.27	**1859.90**	**11897.11**
4	BAU, Ranchi	33.95	93.38	1105.00	1419.76	0.00	0.00	0.00	0.00	**1138.95**	**1513.14**
5	BAU, Sabour	1128.80	935.15	2564.20	2243.42	958.50	801.30	17.50	40.00	**4669.00**	**4019.87**
6	BCKV, Mohanpur	70.62	71.20	340.00	322.00	1520.00	1413.00	610.00	678.00	**2540.62**	**2484.20**
7	BHU, Varanasi	200.50	286.45	824.70	861.10	0.00	0.00	0.00	0.00	**1025.20**	**1147.55**
8	BSKKV, Dapoli	129.27	242.62	255.50	279.27	0.00	0.00	980.40	1004.45	**1365.17**	**1526.34**
9	CCSHAU, Hisar	971.94	1296.27	1166.00	1385.35	3833.50	4237.55	4221.00	4662.60	**10192.44**	**11581.77**
10	CSAUAT, Kanpur	170.35	587.57	2639.50	2766.42	52.50	65.58	0.00	150.73	**2862.35**	**3570.30**
11	Palampur	575.22	822.75	164.91	228.32	0.00	0.00	0.00	0.00	**740.13**	**1051.07**
12	GBPUAT, Pantnagar	387.30	4670.73	0.00	119.10	0.00	161.00	0.00	512.79	**387.30**	**5463.62**
13	IGKV, Raipur	2010.94	2198.32	8702.00	12327.98	1372.00	4138.00	0.00	0.00	**12084.94**	**18664.30**
14	JAU, Jamnagar	3383.17	4349.35	438.00	575.15	3020.00	3489.95	2210.00	4174.94	**9051.17**	**12589.39**
15	JNKVV, Jabalpur	3406.97	12918.69	0.00	0.00	0.00	0.00	0.00	0.00	**3406.97**	**12918.69**
16	KAU, Thrissur	33.03	58.20	0.00	0.00	0.00	0.00	202.75	213.21	**235.78**	**271.41**
17	MPKV, Rahuri	3201.48	6457.70	40.40	140.46	1156.00	1343.90	252.25	383.98	**4650.13**	**8326.04**
18	MPUAT, Udaipur	672.00	565.22	1911.00	1936.77	898.00	911.35	9.00	9.10	**3490.00**	**3422.44**
19	NAU, Navsari	144.12	246.46	493.53	538.22	1366.91	1374.79	2001.92	2270.69	**4006.48**	**4430.16**
20	NDUAT, Ayodhya	124.90	428.34	6456.00	7373.57	1280.00	1313.63	6.00	7.75	**7866.90**	**9123.29**
21	OUAT, Bhubaneswar	396.53	293.02	1397.98	1386.50	0.00	0.00	5.00	5.00	**1799.51**	**1684.52**
22	PAJANCOA&RI, Karaikal	7.00	10.00	8.00	10.50	0.00	0.00	43.50	54.89	**58.50**	**75.39**
23	PAU, Ludhiana	2660.90	3757.52	5904.50	6350.23	24961.00	26342.21	11633.80	12353.78	**45160.20**	**48803.74**
24	PDKV, Akola	1382.62	9287.15	0.00	0.00	1768.00	2187.34	1104.60	1226.39	**4255.22**	**12700.88**

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
25	PJTSAU, Hyderabad	2423.87	2537.62	4244.25	4635.24	177.00	233.31	690.50	920.23	**7535.62**	**8326.40**
26	RPCAU, Pusa	826.85	891.07	1755.50	1985.59	3260.00	3640.40	387.00	403.12	**6229.35**	**6920.18**
27	RVSKVV, Gwalior	5115.00	9090.02	0.00	0.00	0.00	0.00	0.00	100.00	**5115.00**	**9190.02**
28	SDAU, S.K. Nagar	2566.18	2631.24	86.00	90.70	62.00	64.97	2126.63	2229.90	**4840.81**	**5016.81**
29	SKRAU, Bikaner	843.66	1088.58	68.00	80.30	80.00	73.00	2476.00	2762.45	**3467.66**	**4004.33**
30	SKUAST, Jammu	181.25	323.61	1560.00	1241.16	0.00	406.90	0.00	0.00	**1741.25**	**1971.67**
31	SKUASTK, Srinagar	72.03	134.41	755.00	829.84	0.00	0.00	308.00	423.71	**1135.03**	**1387.96**
32	SVBPUAT, Meerut	30.00	85.60	1133.00	706.06	745.00	968.23	460.00	487.31	**2368.00**	**2247.20**
33	TNAU, Coimbatore	1852.66	1927.58	3840.00	3995.10	487.50	521.28	4683.79	4997.87	**10863.95**	**11441.83**
34	UAHS, Shimoga	289.25	236.34	340.00	257.75	1847.00	1374.00	0.00	0.00	**2476.25**	**1868.09**
35	UAS, Bangalore	971.97	472.45	956.00	586.94	1066.00	1166.63	584.15	256.34	**3578.12**	**2482.36**
36	UAS, Dharwad	2084.55	4741.40	4411.50	4534.90	2350.00	2069.00	287.40	244.00	**9133.45**	**11589.30**
37	UAS, Raichur	590.86	901.86	1335.00	1332.15	2768.45	3211.94	293.00	258.34	**4987.31**	**5704.29**
38	UBKV, Pundibari	0.00	0.26	0.00	78.20	0.00	307.27	0.00	225.30	**0.00**	**611.03**
39	VNMKV, Parbhani	1171.99	2404.21	9.00	3.75	0.00	0.00	2341.40	1268.57	**3522.39**	**3676.53**
40	AAU, Jorhat	413.20	455.30	1871.00	2892.43	436.00	483.70	222.85	257.64	**2943.05**	**4089.07**
41	CAU, Imphal	0.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**16.00**
42	ICAR-CAZRI, Jodhpur	0.50	3.90	0.00	0.00	0.00	0.00	170.00	185.21	**170.50**	**189.11**
43	ICAR-CCARI, Goa	43.00	40.00	0.00	0.00	0.00	0.00	12.00	11.50	**55.00**	**51.50**
44	ICAR-CIARI, Port Blair	4.40	6.72	0.00	0.00	0.00	0.00	2.70	3.30	**7.10**	**10.02**
45	ICAR-CICR, Nagpur	6.27	52.85	0.00	0.00	26.00	27.53	10.00	15.44	**42.27**	**95.82**
46	ICAR-CRIJAF, Barrackpore	14.17	15.37	0.00	0.00	700.00	700.00	24.25	25.11	**738.42**	**740.48**
47	ICAR-DGR, Junagadh	332.00	3227.00	0.00	0.00	0.00	0.00	36.00	36.00	**368.00**	**3263.00**
48	ICAR-DRMR, Bharatpur	0.00	0.00	0.00	0.00	0.00	0.00	1195.00	610.73	**1195.00**	**610.73**
49	ICAR-IARI, New Delhi	3916.37	6309.25	0.00	0.00	0.00	0.00	2.92	117.09	**3919.29**	**6426.34**
50	ICAR-IGFRI, Jhansi	0.00	185.97	0.00	0.00	0.00	0.00	0.00	161.80	**0.00**	**347.77**
51	ICAR-IIMR, Hyderabad	0.00	0.00	111.12	137.98	0.00	0.00	0.00	0.00	**111.12**	**137.98**
52	ICAR-IIMR, Ludhiana	54.50	57.80	38.00	42.50	0.00	0.00	0.00	0.00	**92.50**	**100.30**
53	ICAR-IIOR, Hyderabad	23.61	28.97	0.00	0.00	0.00	0.00	0.60	0.65	**24.21**	**29.62**

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
54	ICAR-IIPR, Kanpur	651.56	747.78	0.00	0.00	0.00	0.00	44.00	69.25	**695.56**	**817.03**
55	ICAR-IIRR, Hyderabad	296.93	753.20	0.00	0.00	0.00	0.00	0.00	0.00	**296.93**	**753.20**
56	ICAR-IISR, Indore	784.00	651.95	0.00	0.00	0.00	0.00	0.00	0.00	**784.00**	**651.95**
57	ICAR-IISS, Mau	0.00	232.97	0.00	341.54	0.00	12.70	0.00	162.41	**0.00**	**749.62**
58	ICAR-IIWBR, Karnal	6375.00	6395.22	0.00	0.00	0.00	0.00	2130.00	2363.00	**8505.00**	**8758.22**
59	ICAR-NRRI, Cuttack	321.36	637.40	0.00	0.00	0.00	0.00	0.00	0.00	**321.36**	**637.40**
60	ICAR-VPKAS, Almora	111.08	129.68	0.00	0.00	0.00	0.00	7.30	8.20	**118.38**	**137.88**
61	ICAR-NEH, Manipur	100.50	114.80	0.95	1.50	42.30	52.30	93.90	96.22	**237.65**	**264.82**
	Grand Total	**62104.66**	**106397.59**	**67979.54**	**76833.87**	**60167.44**	**67675.92**	**44350.11**	**55320.40**	**234601.75**	**306227.77**

Table 2.2: Summary of centre-wise quality seed production in farmers' field (Rabi 2022-23 and Kharif 2023)

(In quintals)

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
1	AAU, Anand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
2	ANGRAU, Guntur	0.00	0.00	1743.90	1732.07	910.00	1072.97	2774.50	4960.91	**5428.40**	**7765.95**
3	AU, Kota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
4	BAU, Ranchi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
5	BAU, Sabour	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
6	BCKV, Mohanpur	0.00	0.00	0.00	0.00	421.00	383.00	690.00	668.00	**1111.00**	**1051.00**
7	BHU, Varanasi	0.00	0.00	0.00	0.00	823.00	861.05	2535.80	2596.73	**3358.80**	**3457.78**
8	BSKKV, Dapoli	0.00	0.00	0.00	0.00	0.00	0.00	1966.00	2317.78	**1966.00**	**2317.78**
9	CCSHAU, Hisar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
10	CSAUAT, Kanpur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
11	Palampur	0.00	0.00	0.00	0.00	95.00	102.00	4691.35	5599.76	**4786.35**	**5701.76**
12	GBPUAT, Pantnagar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
13	IGKV, Raipur	0.00	0.00	650.00	992.00	0.00	0.00	0.00	0.00	**650.00**	**992.00**
14	JAU, Jamnagar	0.00	0.00	0.00	0.00	0.00	0.00	2810.00	4075.05	**2810.00**	**4075.05**

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
15	JNKVV, Jabalpur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
16	KAU, Thrissur	0.00	0.00	0.00	0.00	0.00	0.00	1000.00	1076.21	**1000.00**	**1076.21**
17	MPKV, Rahuri	0.00	0.00	0.00	0.00	7700.00	11300.00	0.00	0.00	**7700.00**	**11300.00**
18	MPUAT, Udaipur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
19	NAU, Navsari	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
20	NDUAT, Ayodhya	0.00	0.00	80.00	94.00	1535.00	1729.00	770.00	881.00	**2385.00**	**2704.00**
21	OUAT, Bhubaneswar	0.00	0.00	226.00	178.60	20.00	20.00	0.00	0.00	**246.00**	**198.60**
22	PAJANCOA&RI, Karaikal	0.00	0.00	110.00	132.90	60.00	70.80	25.00	30.00	**195.00**	**233.70**
23	PAU, Ludhiana	0.00	0.00	0.00	0.00	670.00	687.90	10.00	10.00	**680.00**	**697.90**
24	PDKV, Akola	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
25	PJTSAU, Hyderabad	0.00	0.00	7321.00	8453.36	400.00	419.91	2460.00	2667.75	**10181.00**	**11541.02**
26	RPCAU, Pusa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.13	**0.00**	**48.13**
27	RVSKVV, Gwalior	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
28	SDAU, S.K. Nagar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
29	SKRAU, Bikaner	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
30	SKUAST, Jammu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.00	**0.00**	**74.00**
31	SKUASTK, Srinagar	0.00	0.00	0.00	0.00	0.00	0.00	3547.00	3824.60	**3547.00**	**3824.60**
32	SVBPUAT, Meerut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
33	TNAU, Coimbatore	0.00	0.00	3692.00	3869.42	2108.00	2186.33	349.23	386.64	**6149.23**	**6442.39**
34	UAHS, Shimoga	0.00	0.00	0.00	0.00	4800.00	4312.00	0.00	0.00	**4800.00**	**4312.00**
35	UAS, Bangalore	0.00	0.00	30.00	40.00	8687.00	9756.97	3973.00	3149.37	**12690.00**	**12946.34**
36	UAS, Dharwad	0.00	0.00	3025.00	2859.40	15535.00	13998.70	525.10	514.10	**19085.10**	**17372.20**
37	UAS, Raichur	0.00	0.00	11745.00	12926.00	9220.00	10010.40	0.00	0.00	**20965.00**	**22936.40**
38	UBKV, Pundibari	0.00	0.00	0.00	9.90	0.00	496.70	0.00	163.10	**0.00**	**669.70**
39	VNMKV, Parbhani	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
40	AAU, Jorhat	0.00	0.00	1369.00	1358.00	3650.00	4047.00	1136.00	844.00	**6155.00**	**6249.00**
41	CAU, Imphal	0.00	0.00	0.00	0.00	400.00	425.00	180.00	164.59	**580.00**	**589.59**
42	ICAR-CAZRI, Jodhpur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
43	ICAR-CCARI, Goa	0.00	0.00	0.00	0.00	0.00	0.00	155.00	158.00	**155.00**	**158.00**
44	ICAR-CIARI, Port Blair	0.00	0.00	0.00	0.00	0.00	0.00	50.00	45.97	**50.00**	**45.97**

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
45	ICAR-CICR, Nagpur	0.00	0.00	0.00	0.00	0.00	0.00	2.50	3.50	**2.50**	**3.50**
46	ICAR-CRIJAF, Barrackpore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
47	ICAR-DGR, Junagadh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
48	ICAR-DRMR, Bharatpur	0.00	0.00	0.00	0.00	0.00	0.00	430.00	249.03	**430.00**	**249.03**
49	ICAR-IARI, New Delhi	0.00	0.00	0.00	0.00	0.00	0.00	13003.40	13498.65	**13003.40**	**13498.65**
50	ICAR-IGFRI, Jhansi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
51	ICAR-IIMR, Hyderabad	0.00	0.00	0.00	0.00	0.00	0.00	165.00	175.00	**165.00**	**175.00**
52	ICAR-IIMR, Ludhiana	0.00	0.00	0.00	0.00	5625.00	6257.00	0.00	0.00	**5625.00**	**6257.00**
53	ICAR-IIOR, Hyderabad	0.00	0.00	0.00	0.00	0.00	0.00	663.00	678.38	**663.00**	**678.38**
54	ICAR-IIPR, Kanpur	0.00	0.00	1225.00	1612.67	1200.00	1568.00	0.00	0.00	**2425.00**	**3180.67**
55	ICAR-IIRR, Hyderabad	0.00	0.00	0.00	0.00	0.00	0.00	130.70	130.70	**130.70**	**130.70**
56	ICAR-IISR, Indore	0.00	0.00	0.00	21.60	0.00	401.70	0.00	189.05	**0.00**	**612.35**
57	ICAR-IISS, Mau	0.00	0.00	0.00	418.29	0.00	1526.02	160.00	211.71	**160.00**	**2156.02**
58	ICAR-IIWBR, Karnal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
59	ICAR-NRRI, Cuttack	0.00	0.00	0.00	0.00	0.00	0.00	867.00	1011.00	**867.00**	**1011.00**
60	ICAR-VPKAS, Almora	0.00	0.00	0.00	0.00	0.00	0.00	209.57	209.77	**209.57**	**209.77**
61	ICAR-NEH, Manipur	0.00	0.00	68.20	78.00	2091.60	2377.10	2716.00	3027.80	**4875.80**	**5482.90**
	Grand Total	**0.00**	**0.00**	**31285.10**	**34776.21**	**65950.60**	**74009.55**	**47995.15**	**53640.28**	**145230.85**	**162426.04**

Table 2.3: Summary of centre-wise total quality seed production (Rabi 2022-23 and Kharif 2023)

(In quintals)

Sl. No	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
1	AAU, Anand	734.15	1029.92	710.00	800.30	2390.00	2284.10	1406.50	1468.12	**5240.65**	**5582.44**
2	ANGRAU, Guntur	5950.43	5774.86	12087.90	11047.31	2453.78	2522.11	3831.00	6485.93	**24323.11**	**25830.21**
3	AU, Kota	1859.90	2488.34	0.00	2680.58	0.00	849.92	0.00	5878.27	**1859.90**	**11897.11**
4	BAU, Ranchi	33.95	93.38	1105.00	1419.76	0.00	0.00	0.00	0.00	**1138.95**	**1513.14**
5	BAU, Sabour	1128.80	935.15	2564.20	2243.42	958.50	801.30	17.50	40.00	**4669.00**	**4019.87**

Sl. No	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
6	BCKV, Mohanpur	70.62	71.20	340.00	322.00	1941.00	1796.00	1300.00	1346.00	**3651.62**	**3535.20**
7	BHU, Varanasi	200.50	286.45	824.70	861.10	823.00	861.05	2535.80	2596.73	**4384.00**	**4605.33**
8	BSKKV, Dapoli	129.27	242.62	255.50	279.27	0.00	0.00	2946.40	3322.23	**3331.17**	**3844.12**
9	CCSHAU, Hisar	971.94	1296.27	1166.00	1385.35	3833.50	4237.55	4221.00	4662.60	**10192.44**	**11581.77**
10	CSAUAT, Kanpur	170.35	587.57	2639.50	2766.42	52.50	65.58	0.00	150.73	**2862.35**	**3570.30**
11	CSKHPKV, Palampur	575.22	822.75	164.91	228.32	95.00	102.00	4691.35	5599.76	**5526.48**	**6752.83**
12	GBPUAT, Pantnagar	387.30	4670.73	0.00	119.10	0.00	161.00	0.00	512.79	**387.30**	**5463.62**
13	IGKV, Raipur	2010.94	2198.32	9352.00	13319.98	1372.00	4138.00	0.00	0.00	**12734.94**	**19656.30**
14	JAU, Jamnagar	3383.17	4349.35	438.00	575.15	3020.00	3489.95	5020.00	8249.99	**11861.17**	**16664.44**
15	JNKVV, Jabalpur	3406.97	12918.69	0.00	0.00	0.00	0.00	0.00	0.00	**3406.97**	**12918.69**
16	KAU, Thrissur	33.03	58.20	0.00	0.00	0.00	0.00	1202.75	1289.42	**1235.78**	**1347.62**
17	MPKV, Rahuri	3201.48	6457.70	40.40	140.46	8856.00	12643.90	252.25	383.98	**12350.13**	**19626.04**
18	MPUAT, Udaipur	672.00	565.22	1911.00	1936.77	898.00	911.35	9.00	9.10	**3490.00**	**3422.44**
19	NAU, Navsari	144.12	246.46	493.53	538.22	1366.91	1374.79	2001.92	2270.69	**4006.48**	**4430.16**
20	NDUAT, Ayodhya	124.90	428.34	6536.00	7467.57	2815.00	3042.63	776.00	888.75	**10251.90**	**11827.29**
21	OUAT, Bhubaneswar	396.53	293.02	1623.98	1565.10	20.00	20.00	5.00	5.00	**2045.51**	**1883.12**
22	PAJANCOA&RI, Karaikal	7.00	10.00	118.00	143.40	60.00	70.80	68.50	84.89	**253.50**	**309.09**
23	PAU, Ludhiana	2660.90	3757.52	5904.50	6350.23	25631.00	27030.11	11643.80	12363.78	**45840.20**	**49501.64**
24	PDKV, Akola	1382.62	9287.15	0.00	0.00	1768.00	2187.34	1104.60	1226.39	**4255.22**	**12700.88**
25	PJTSAU, Hyderabad	2423.87	2537.62	11565.25	13088.60	577.00	653.22	3150.50	3587.98	**17716.62**	**19867.42**
26	RPCAU, Pusa	826.85	891.07	1755.50	1985.59	3260.00	3640.40	387.00	451.25	**6229.35**	**6968.31**
27	RVSKVV, Gwalior	5115.00	9090.02	0.00	0.00	0.00	0.00	0.00	100.00	**5115.00**	**9190.02**
28	SDAU, S. K. Nagar	2566.18	2631.24	86.00	90.70	62.00	64.97	2126.63	2229.90	**4840.81**	**5016.81**
29	SKRAU, Bikaner	843.66	1088.58	68.00	80.30	80.00	73.00	2476.00	2762.45	**3467.66**	**4004.33**
30	SKUAST, Jammu	181.25	323.61	1560.00	1241.16	0.00	406.90	0.00	74.00	**1741.25**	**2045.67**
31	SKUASTK, Srinagar	72.03	134.41	755.00	829.84	0.00	0.00	3855.00	4248.31	**4682.03**	**5212.56**
32	SVBPUAT, Meerut	30.00	85.60	1133.00	706.06	745.00	968.23	460.00	487.31	**2368.00**	**2247.20**
33	TNAU, Coimbatore	1852.66	1927.58	7532.00	7864.52	2595.50	2707.61	5033.02	5384.51	**17013.18**	**17884.22**
34	UAHS, Shimoga	289.25	236.34	340.00	257.75	6647.00	5686.00	0.00	0.00	**7276.25**	**6180.09**

Sl. No	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Grand Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
35	UAS, Bangalore	971.97	472.45	986.00	626.94	9753.00	10923.60	4557.15	3405.71	**16268.12**	**15428.70**
36	UAS, Dharwad	2084.55	4741.40	7436.50	7394.30	17885.00	16067.70	812.50	758.10	**28218.55**	**28961.50**
37	UAS, Raichur	590.86	901.86	13080.00	14258.15	11988.45	13222.34	293.00	258.34	**25952.31**	**28640.69**
38	UBKV, Pundibari	0.00	0.26	0.00	88.10	0.00	803.97	0.00	388.40	**0.00**	**1280.73**
39	VNMKVV, Parbhani	1171.99	2404.21	9.00	3.75	0.00	0.00	2341.40	1268.57	**3522.39**	**3676.53**
40	AAU, Jorhat	413.20	455.30	3240.00	4250.43	4086.00	4530.70	1358.85	1101.64	**9098.05**	**10338.07**
41	CAU, Imphal	0.00	16.00	0.00	0.00	400.00	425.00	180.00	164.59	**580.00**	**605.59**
42	ICAR-CAZRI, Jodhpur	0.50	3.90	0.00	0.00	0.00	0.00	170.00	185.21	**170.50**	**189.11**
43	ICAR-CCARI, Goa	43.00	40.00	0.00	0.00	0.00	0.00	167.00	169.50	**210.00**	**209.50**
44	ICAR-CIARI, Port Blair	4.40	6.72	0.00	0.00	0.00	0.00	52.70	49.27	**57.10**	**55.99**
45	ICAR-CICR, Nagpur	6.27	52.85	0.00	0.00	26.00	27.53	12.50	18.94	**44.77**	**99.32**
46	ICAR-CRIJAF, Barrackpore	14.17	15.37	0.00	0.00	700.00	700.00	24.25	25.11	**738.42**	**740.48**
47	ICAR-DGR, Junagadh	332.00	3227.00	0.00	0.00	0.00	0.00	36.00	36.00	**368.00**	**3263.00**
48	ICAR-DRMR, Bharatpur	0.00	0.00	0.00	0.00	0.00	0.00	1625.00	859.76	**1625.00**	**859.76**
49	ICAR-IARI, New Delhi	3916.37	6309.25	0.00	0.00	0.00	0.00	13006.32	13615.74	**16922.69**	**19924.99**
50	ICAR-IGFRI, Jhansi	0.00	185.97	0.00	0.00	0.00	0.00	0.00	161.80	**0.00**	**347.77**
51	ICAR-IIMR, Hyderabad	0.00	0.00	111.12	137.98	0.00	0.00	165.00	175.00	**276.12**	**312.98**
52	ICAR-IIMR, Ludhiana	54.50	57.80	38.00	42.50	5625.00	6257.00	0.00	0.00	**5717.50**	**6357.30**
53	ICAR-IIOR, Hyderabad	23.61	28.97	0.00	0.00	0.00	0.00	663.60	679.03	**687.21**	**708.00**
54	ICAR-IIPR, Kanpur	651.56	747.78	1225.00	1612.67	1200.00	1568.00	44.00	69.25	**3120.56**	**3997.70**
55	ICAR-IIRR, Hyderabad	296.93	753.20	0.00	0.00	0.00	0.00	130.70	130.70	**427.63**	**883.90**
56	ICAR-IISR, Indore	784.00	651.95	0.00	21.60	0.00	401.70	0.00	189.05	**784.00**	**1264.30**
57	ICAR-IISS, Mau	0.00	232.97	0.00	759.83	0.00	1538.72	160.00	374.12	**160.00**	**2905.64**
58	ICAR-IIWBR, Karnal	6375.00	6395.22	0.00	0.00	0.00	0.00	2130.00	2363.00	**8505.00**	**8758.22**
59	ICAR-NRRI, Cuttack	321.36	637.40	0.00	0.00	0.00	0.00	867.00	1011.00	**1188.36**	**1648.40**
60	ICAR-VPKAS, Almora	111.08	129.68	0.00	0.00	0.00	0.00	216.87	217.97	**327.95**	**347.65**
61	ICAR-RC NEH, Manipur	100.50	114.80	69.15	79.50	2133.90	2429.40	2809.90	3124.02	**5113.45**	**5747.72**
	Grand Total	**62104.66**	**106397.59**	**99264.64**	**111610.08**	**126118.04**	**141685.47**	**92345.26**	**108960.68**	**379832.60**	**468653.81**

Table 2.4: Summary of crop-wise total quality seed production (Rabi 2022-23 and Kharif 2023)

(In quintals)

Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
A	**Cereal Crops**										
1	Paddy	11069.96	18465.18	49414.78	56758.88	42193.66	46903.94	40468.44	45703.32	**143146.84**	**167831.32**
2	Wheat	17842.91	34019.21	16133.70	17755.03	24503.00	28599.25	20776.90	27145.05	**79256.51**	**107518.54**
3	Barley	301.25	449.15	354.20	367.09	167.00	175.30	761.00	933.38	**1583.45**	**1924.92**
4	Maize	140.16	206.66	298.90	338.40	5920.80	6464.01	1950.45	2524.57	**8310.31**	**9533.64**
5	Sorghum	67.90	376.02	874.27	954.37	8527.00	12239.46	291.50	302.81	**9760.67**	**13872.66**
6	Pearl Millet	4.97	37.44	0.00	0.00	44.00	40.00	126.22	133.47	**175.19**	**210.91**
7	Finger Millet	113.48	154.26	764.60	525.10	5125.00	5460.06	1120.27	1001.90	**7123.35**	**7141.32**
8	Little Millet	21.76	26.33	63.00	56.50	30.00	24.60	94.82	71.87	**209.58**	**179.30**
9	Kodo Millet	39.06	76.43	19.00	19.00	30.00	30.00	39.20	27.79	**127.26**	**153.22**
10	Foxtail Millet	103.65	126.25	121.00	115.50	22.00	20.80	346.20	308.90	**592.85**	**571.45**
11	Barnyard Millet	9.65	11.75	20.00	20.75	43.00	40.60	29.90	29.04	**102.55**	**102.14**
12	Browntop Millet	0.50	4.00	0.00	0.00	0.00	0.00	16.00	1.60	**16.50**	**5.60**
13	Proso Millet	8.96	12.42	8.00	3.00	20.00	15.20	17.70	9.80	**54.66**	**40.42**
14	Italian Millet	0.66	0.66	0.00	0.00	0.00	0.00	28.05	29.07	**28.71**	**29.73**
15	Buckwheat	1.15	1.30	0.30	0.45	0.00	0.00	18.80	24.30	**20.25**	**26.05**
16	Grain Amaranth	0.07	0.26	0.00	0.00	0.00	0.00	12.20	13.80	**12.27**	**14.06**
	Total Cereal Crops	**29726.09**	**53967.32**	**68071.75**	**76914.07**	**86625.46**	**100013.22**	**66097.65**	**78260.67**	**250520.95**	**309155.28**
B	**Pulse Crops**										
1	Chickpea	7384.58	10861.47	7189.35	8384.42	7804.00	8098.89	3756.70	5458.71	**26134.63**	**32803.49**
2	Pigeon pea	351.36	592.00	6506.98	7478.68	11180.50	12374.15	659.95	980.24	**18698.79**	**21425.07**
3	Mung	575.68	980.92	1853.70	1996.09	1820.81	1471.25	1589.13	1754.13	**5839.32**	**6202.39**
4	Urd	712.42	941.03	5607.10	5906.52	4421.50	4609.03	3323.95	3484.95	**14064.97**	**14941.53**
5	Field Pea	541.89	470.94	499.30	560.34	363.10	400.85	349.60	351.40	**1753.89**	**1783.53**
6	Lentil	570.28	787.24	367.00	436.74	903.40	952.05	612.70	751.26	**2453.38**	**2927.29**
7	Cowpea	83.38	75.59	193.70	168.75	180.00	158.68	117.10	125.82	**574.18**	**528.84**

Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
8	Rajmah	19.10	47.97	2.00	2.00	105.00	107.00	263.85	351.40	**389.95**	**508.37**
9	Horse Gram	23.11	26.13	29.00	22.25	0.00	1.85	73.50	94.47	**125.61**	**144.70**
10	Moth Bean	66.06	40.17	0.00	0.00	0.00	0.00	100.00	109.80	**166.06**	**149.97**
11	Indian Bean	7.04	4.13	13.80	13.02	0.00	0.00	79.70	51.57	**100.54**	**68.72**
12	Lathyrus	130.14	118.00	12.00	13.05	18.00	13.18	47.00	48.12	**207.14**	**192.35**
13	Cluster bean	11.00	16.00	0.00	0.00	0.00	0.00	127.70	133.21	**138.70**	**149.21**
	Total Pulse Crops	**10476.04**	**14961.59**	**22273.93**	**24981.86**	**26796.31**	**28186.93**	**11100.88**	**13695.08**	**70647.16**	**81825.46**
C	**Oilseed Crops**										
1	Groundnut	6766.91	11642.53	2075.00	2138.43	2563.50	3145.01	2283.50	4156.66	**13688.91**	**21082.63**
2	Soybean	13964.25	23263.50	5231.50	5683.26	6447.70	6002.76	2487.88	2310.99	**28131.33**	**37260.51**
3	Sunflower	40.45	55.90	9.00	3.75	837.00	864.87	82.10	55.06	**968.55**	**979.58**
4	Safflower	77.36	373.75	495.00	520.79	551.00	599.30	830.00	833.87	**1953.36**	**2327.71**
5	Sesame	56.96	88.27	61.00	45.17	94.02	115.82	440.20	613.24	**652.18**	**862.50**
6	Linseed	118.67	384.33	359.25	313.67	18.00	20.48	127.70	137.93	**623.62**	**856.41**
7	Niger	35.24	15.67	9.50	19.45	30.00	26.00	16.60	12.25	**91.34**	**73.37**
8	Castor	32.30	53.73	0.00	0.00	375.00	396.00	1162.50	1263.70	**1569.80**	**1713.43**
9	Indian Mustard	51.31	193.12	190.95	510.70	269.00	482.35	2474.40	2372.84	**2985.66**	**3559.01**
10	Toria	12.29	54.58	192.00	178.73	358.50	624.15	908.10	651.62	**1470.89**	**1509.08**
11	Karan Rai	0.50	0.64	0.00	0.00	0.00	0.00	0.00	0.00	**0.50**	**0.64**
12	Rai/Sarson	4.09	121.44	80.50	92.37	2.50	4.38	210.00	224.25	**297.09**	**442.44**
13	G. Sarson	7.65	16.00	13.60	14.34	130.00	168.28	587.00	654.50	**738.25**	**853.12**
14	B. Sarson	1.60	2.50	20.00	20.84	0.00	0.00	85.05	101.04	**106.65**	**124.38**
15	Y. Sarson	0.00	0.00	0.00	3.00	0.00	14.67	12.00	10.28	**12.00**	**27.95**
16	A. Sarson	0.60	0.65	0.00	0.00	0.00	0.00	1.00	1.00	**1.60**	**1.65**
17	Raya	3.10	10.28	1.50	1.80	5.00	5.00	513.00	562.75	**522.60**	**579.83**
18	Taramira	0.00	0.00	0.00	0.00	0.00	0.00	2.50	3.00	**2.50**	**3.00**
	Total Oilseed Crops	**21173.28**	**36276.89**	**8738.80**	**9546.30**	**11681.22**	**12469.07**	**12223.53**	**13964.98**	**53816.83**	**72257.24**
D	**Fiber Crops**										
1	Cotton	35.01	130.36	0.90	0.90	0.00	0.00	138.55	169.91	**174.46**	**301.17**

Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
2	Flax	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.60	**0.50**	**0.60**
3	Mesta	1.45	1.45	14.00	14.68	3.00	3.00	5.80	6.85	**24.25**	**25.98**
4	Sunhemp	8.50	8.60	0.00	0.00	203.00	173.00	690.50	717.57	**852.00**	**899.17**
5	Jute	8.47	10.17	2.00	5.50	160.00	142.16	18.10	23.10	**188.57**	**180.93**
	Total Fiber Crops	**53.43**	**150.58**	**16.90**	**21.08**	**366.00**	**318.16**	**1324.45**	**918.03**	**1360.78**	**1407.85**
E	**Forage Crops**										
1	Subabul	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.09	**0.50**	**1.09**
2	Sesbania	0.00	0.00	0.00	0.00	0.00	0.00	1.50	2.16	**1.50**	**2.16**
3	F. Bajra	6.15	11.82	0.00	0.00	0.00	0.00	83.50	89.19	**89.65**	**101.01**
4	Berseem	57.00	59.02	24.50	11.35	191.00	200.40	27.00	32.71	**299.50**	**303.48**
5	Cluster bean	16.98	89.35	25.00	24.00	14.00	14.15	385.50	422.02	**441.48**	**549.52**
6	F. Rice bean	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.20	**0.10**	**0.22**
7	F. Cowpea	2.65	9.74	4.00	4.00	0.00	0.00	4.30	9.67	**10.95**	**23.41**
8	Dhaincha	7.00	4.70	0.00	0.00	0.00	0.00	196.30	263.94	**203.30**	**268.64**
9	Desmanthus	0.07	0.00	0.00	0.00	0.00	0.00	10.70	13.86	**10.77**	**13.86**
10	Deenanath grass	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.14	**0.00**	**0.28**
11	Dhaman Grass	0.20	0.37	0.00	0.00	0.00	0.00	0.00	0.12	**0.20**	**0.49**
12	Anjan Grass	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	**0.00**	**0.20**
13	F. Maize	98.00	94.96	55.00	55.00	410.00	444.50	291.20	318.71	**854.20**	**913.17**
14	F. Sorghum	47.33	65.48	41.00	38.30	0.00	0.00	113.02	88.78	**201.35**	**192.56**
15	Guinea Grass	0.25	1.75	0.00	0.00	0.00	0.00	1.00	3.00	**1.25**	**4.75**
16	Fenugreek	4.00	4.71	0.00	0.00	0.00	0.00	1.03	1.54	**5.03**	**6.25**
17	Lucerne	9.29	8.80	0.00	0.00	0.05	0.04	21.70	12.45	**31.04**	**21.29**
18	Oats	421.50	683.38	13.50	13.75	34.00	39.00	437.50	837.04	**906.50**	**1573.17**
19	Metha	1.00	2.50	0.00	0.00	0.00	0.00	18.00	19.20	**19.00**	**21.70**
20	White Clover	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
21	Rye Grass	4.00	4.22	0.00	0.00	0.00	0.00	6.00	6.00	**10.00**	**10.22**
22	Tall Fescue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
23	Red Clove	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	**0.01**	**0.02**

Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
24	Setaria	0.05	0.05	0.25	0.35	0.00	0.00	0.00	0.00	**0.30**	**0.40**
25	Sewan Grass	0.25	0.10	0.00	0.00	0.00	0.00	0.00	0.00	**0.25**	**0.10**
	Total Forage Crops	**675.82**	**1041.21**	**163.26**	**146.77**	**649.05**	**698.09**	**1598.75**	**2121.92**	**3086.88**	**4007.99**
	Grand Total	**62104.66**	**106397.59**	**99264.64**	**111610.08**	**126118.04**	**141685.47**	**92345.26**	**108960.68**	**379832.60**	**468653.81**

Table 2.5: Summary of centre-wise planting material's production (Rabi, 2022-23 and Kharif, 2023)

S. No.	Centre	Planting material (q)		Planting material (lakhs)		Tissue culture plantlets (lakhs)	
		Target	Production	Target	Production	Target	Production
1	AAU, Anand	0.00	0.00	2.00	4.00	0.00	0.00
2	AAU, Jorhat	440.00	575.00	0.00	0.00	0.00	0.00
3	ANGRAU, Guntur	0.00	895.50	0.00	0.00	0.00	0.00
4	BAU, Sabour	80.00	100.00	0.00	0.00	0.00	0.00
5	BSKKV, Dapoli	0.00	0.00	1.30	1.31	0.00	0.00
6	CSKHPKV, Palampur	0.00	0.00	6.00	7.07	0.00	0.00
7	IGFRI, Jhansi	0.00	0.00	0.00	4.79	0.00	0.00
8	IGKV, Raipur	0.00	0.00	0.00	4.42	0.00	0.00
9	ICAR-IISR, Lucknow	0.00	10430.00	0.00	0.00	0.00	0.00
10	JAU, Junagadh	260.00	1915.58	1.50	1.51	0.15	0.17
11	MPKV, Rahuri	0.00	0.00	48.47	67.41	0.00	0.00
12	NAU, Navsari	0.00	0.00	2.10	2.92	0.01	0.01
13	PAU, Ludhiana	5000.00	5680.00	0.80	0.80	0.50	0.53
14	PJTSAU, Hyderabad	0.00	0.00	0.02	0.23	0.00	0.00
15	ICAR-SBI, Coimbatore	1670.00	3499.12	0.15	0.25	0.50	1.24
16	SKRAU, Bikaner	0.00	0.00	0.05	0.05	0.00	0.00
17	TNAU, Coimbatore	2020.00	2046.99	7.05	7.24	7.57	7.59
18	UAS, Bangalore	32250.00	23030.00	1.00	1.50	1.00	0.85
19	UAS, Dharwad	11850.00	17570.00	0.00	0.00	0.00	0.00
20	VSI, Pune	90.00	47.58	0.00	0.38	0.00	0.00
	Grand Total	**53660.00**	**65789.77**	**70.44**	**103.89**	**9.73**	**10.38**

Note: Planting material in quintals includes cuttings of sugarcane and forage grasses. While planting material in lakhs consists of single/ two eyed sets of sugarcane and single/ two budded cuttings and root slips of forage grasses. Similarly, tissue culture plantlets in lakhs include tissue culture plantlets of sugarcane.

Quality seed production during Rabi 2023-24 (Expected)

During Rabi, 2023-24, total expected quality seed production including all classes in various field crops is 292667.09 against the target of 226778.60q. Production comprises 81990.42 quintals of breeder seed, 49849.87 quintals of foundation seed, 87678.81 quintals of certified seeds, 73147.99 quintals of truthfully labelled seed.

Table 3.1: Summary of centre-wise total quality seed production during Rabi, 2023-24 (Expected)

(In quintals)

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
1	AAU, Anand	586.23	658.65	65.00	70.00	690.00	797.00	620.00	646.07	**1961.23**	**2171.72**
2	ANGRAU, Guntur	5943.30	5675.10	6779.00	6802.00	2432.00	2432.00	3735.50	4382.50	**18889.80**	**19291.60**
3	AU, Kota	184.15	233.50	0.00	3170.00	0.00	1420.00	0.00	7884.00	**184.15**	**12707.50**
4	BAU, Ranchi	18.40	27.20	471.50	402.50	0.00	0.00	0.00	0.00	**489.90**	**429.70**
5	BAU, Sabour	771.00	771.00	984.00	984.00	139.00	139.00	6.00	6.00	**1900.00**	**1900.00**
6	BCKV, Mohanpur	51.00	58.70	125.50	163.30	278.00	349.00	271.00	316.00	**725.50**	**887.00**
7	BHU, Varanasi	173.90	202.00	703.00	729.00	453.50	467.00	1348.00	1375.00	**2678.40**	**2773.00**
8	BSKKV, Dapoli	42.80	62.97	0.00	0.00	0.00	0.00	220.30	262.10	**263.10**	**325.07**
9	CCSHAU, Hisar	710.12	863.50	1251.00	1315.40	6230.00	6472.00	5575.00	5915.75	**13766.12**	**14566.65**
10	CSAUAT, Kanpur	260.88	1235.75	1713.00	1831.92	36.00	241.70	36.00	36.00	**2045.88**	**3345.37**
11	Palampur	606.40	763.36	518.50	568.45	130.00	178.00	1975.00	2407.85	**3229.90**	**3917.66**
12	GBPUAT, Pantnagar	305.11	9288.00	0.00	0.00	0.00	0.00	0.00	130.00	**305.11**	**9418.00**
13	IGKV, Raipur	624.81	1045.00	2050.00	2737.70	1405.00	2107.00	0.00	0.00	**4079.81**	**5889.70**
14	JAU, Jamnagar	584.40	764.45	80.00	61.00	1830.00	1403.40	3625.00	6842.40	**6119.40**	**9071.25**
15	JNKVV, Jabalpur	1769.33	11949.50	0.00	0.00	0.00	0.00	0.00	0.00	**1769.33**	**11949.50**
16	KAU, Thrissur	22.10	24.40	0.00	0.00	0.00	0.00	975.00	992.18	**997.10**	**1016.58**
17	MPKV, Rahuri	655.49	2436.60	170.00	235.00	8900.00	12500.00	1176.00	1525.00	**10901.49**	**16696.60**

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
18	MPUAT, Udaipur	31.50	31.50	130.00	132.00	3060.00	3071.00	84.00	84.00	**3305.50**	**3318.50**
19	NAU, Navsari	99.63	111.00	5.60	7.50	40.40	49.00	277.20	334.40	**422.83**	**501.90**
20	NDUAT, Ayodhya	67.00	76.30	5671.00	5987.00	2242.00	2317.96	505.00	567.00	**8485.00**	**8948.26**
21	OUAT, Bhubaneswar	0.50	0.50	505.00	515.00	200.00	200.00	0.00	0.00	**705.50**	**715.50**
22	PAJANCOA&RI, Karaikal	8.00	11.25	380.00	449.90	0.00	0.00	10.00	17.50	**398.00**	**478.65**
23	PAU, Ludhiana	3690.00	3690.00	2572.80	2572.80	19600.00	19600.00	7159.00	7159.00	**33021.80**	**33021.80**
24	PDKV, Akola	1151.50	8467.22	0.00	0.00	390.00	448.40	231.00	231.00	**1772.50**	**9146.62**
25	PJTSAU, Hyderabad	749.64	767.40	4520.00	4759.00	535.00	565.00	297.50	364.35	**6102.14**	**6455.75**
26	RPCAU, Pusa	1378.90	1531.70	1220.00	1330.00	1710.00	1910.00	400.00	460.00	**4708.90**	**5231.70**
27	RVSKVV, Gwalior	1830.00	3010.00	0.00	0.00	0.00	0.00	0.00	0.00	**1830.00**	**3010.00**
28	SDAU, S.K. Nagar	3049.09	3067.27	38.00	40.00	10.00	10.00	593.00	611.50	**3690.09**	**3728.77**
29	SKRAU, Bikaner	935.96	1229.20	70.00	70.00	175.00	175.00	2310.00	2505.00	**3490.96**	**3979.20**
30	SKUAST, Jammu	193.70	494.02	1125.00	1105.00	0.00	0.00	0.00	0.00	**1318.70**	**1599.02**
31	SKUASTK, Srinagar	53.05	106.10	40.00	42.00	0.00	0.00	1252.00	1412.50	**1345.05**	**1560.60**
32	SVBPUAT, Meerut	180.00	202.00	929.00	945.50	140.00	140.00	210.00	215.00	**1459.00**	**1502.50**
33	TNAU, Coimbatore	1084.51	1083.72	4084.00	4245.30	636.50	687.25	2297.29	2376.13	**8102.30**	**8392.40**
34	UAHS, Shimoga	50.00	35.00	315.00	245.00	1425.00	1185.00	0.00	0.00	**1790.00**	**1465.00**
35	UAS, Bangalore	88.00	103.00	179.00	355.00	4371.00	4386.50	498.00	482.65	**5136.00**	**5327.15**
36	UAS, Dharwad	709.28	3361.90	4380.00	5934.50	8486.00	10324.00	152.00	79.50	**13727.28**	**19699.90**
37	UAS, Raichur	173.70	319.00	716.00	880.00	808.00	935.00	168.00	180.00	**1865.70**	**2314.00**
38	UBKV, Pundibari	0.00	4.00	0.00	137.85	0.00	831.50	0.00	3.00	**0.00**	**976.35**
39	VNMKV, Parbhani	10.79	2764.46	0.00	0.00	0.00	0.00	22.00	22.00	**32.79**	**2786.46**
40	AAU, Jorhat	12.00	15.00	246.00	235.00	3610.00	2910.00	78.50	96.30	**3946.50**	**3256.30**
41	CAU, Imphal	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	**3.50**	**0.00**
42	ICAR-CAZRI, Jodhpur	0.00	0.00	0.00	0.00	0.00	0.00	25.00	25.00	**25.00**	**25.00**
43	ICAR-CCARI, Goa	8.00	8.00	0.00	0.00	0.00	0.00	40.00	40.00	**48.00**	**48.00**

Sl. No.	Centre	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
44	ICAR-CIARI, Port Blair	1.40	1.95	0.00	0.00	6.00	7.50	4.00	4.50	**11.40**	**13.95**
45	ICAR-CICR, Nagpur	0.00	0.00	2.00	2.05	30.20	40.45	0.00	0.00	**32.20**	**42.50**
46	ICAR-CRIJAF, Barrackpore	2.50	3.00	0.00	0.00	300.00	310.00	10.00	11.90	**312.50**	**324.90**
47	ICAR-DGR, Junagadh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
48	ICAR-DRMR, Bharatpur	0.00	0.00	0.00	0.00	0.00	0.00	860.00	754.00	**860.00**	**754.00**
49	ICAR-IARI, New Delhi	3188.94	5997.00	0.00	0.00	0.00	0.00	17580.00	17520.20	**20768.94**	**23517.20**
50	ICAR-IGFRI, Jhansi	260.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**260.23**	**0.00**
51	ICAR-IIMR, Hyderabad	26.01	57.70	0.00	0.00	0.00	0.00	62.00	224.50	**88.01**	**282.20**
52	ICAR-IIMR, Ludhiana	62.00	52.00	5.00	2.00	7200.00	6500.00	0.00	0.00	**7267.00**	**6554.00**
53	ICAR-IIOR, Hyderabad	29.32	33.60	0.00	0.00	0.00	0.00	250.50	265.70	**279.82**	**299.30**
54	ICAR-IIPR, Kanpur	315.23	381.50	625.00	750.00	775.00	985.00	11.00	16.00	**1726.23**	**2132.50**
55	ICAR-IIRR, Hyderabad	107.35	107.35	0.00	0.00	0.00	0.00	0.64	0.00	**107.99**	**107.35**
56	ICAR-IISR, Indore	105.00	105.00	0.00	20.00	0.00	0.00	0.00	0.00	**105.00**	**125.00**
57	ICAR-IISS, Mau	190.00	0.00	710.00	0.00	3390.00	0.00	0.00	110.00	**4290.00**	**110.00**
58	ICAR-IIWBR, Karnal	8025.00	8477.00	0.00	0.00	0.00	0.00	2690.00	2940.00	**10715.00**	**11417.00**
59	ICAR-NRRI, Cuttack	74.82	90.50	0.00	0.00	0.00	0.00	0.00	0.00	**74.82**	**90.50**
60	ICAR-SBI, Coimbatore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
61	ICAR-VPKAS, Almora	115.00	115.50	0.00	0.00	0.00	0.00	310.50	310.50	**425.50**	**426.00**
62	ICAR-NEH, Manipur	18.90	19.10	2.50	17.20	1318.30	1584.15	965.00	1004.01	**2304.70**	**2624.46**
	Total	**41385.87**	**81990.42**	**43381.40**	**49849.87**	**82981.90**	**87678.81**	**58919.43**	**73147.99**	**226668.60**	**292667.09**

Table 3.2: Summary of crop-wise total quality seed production during Rabi, 2023-24 (Expected)

(In quintals)

Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
A	**Cereal Crops**										
1	Paddy	4484.17	4370.76	14565.20	15237.60	2627.00	3081.75	3997.14	4347.59	**25673.51**	**27037.70**
2	Wheat	22916.60	46262.40	17803.00	20496.02	36488.10	35603.60	40170.40	50068.24	**117378.10**	**152430.26**
3	Barley	562.95	828.40	222.00	239.40	1107.40	1108.00	1168.00	1309.00	**3060.35**	**3484.80**
4	Maize	95.30	112.41	5.00	2.00	7591.50	6913.75	84.80	88.34	**7776.60**	**7116.50**
5	Sorghum	86.80	1031.68	508.00	855.00	9102.10	12503.50	385.80	565.00	**10082.70**	**14955.18**
6	Pearl Millet	0.80	14.25	0.00	0.00	10.00	10.00	25.80	25.80	**36.60**	**50.05**
7	Finger Millet	15.09	19.09	115.00	122.00	2380.00	2210.00	344.20	188.21	**2854.29**	**2539.30**
8	Little Millet	0.00	2.00	0.00	0.00	0.00	0.00	2.00	22.00	**2.00**	**24.00**
9	Kodo Millet	0.00	0.00	0.00	0.00	0.00	0.00	2.70	3.24	**2.70**	**3.24**
10	Foxtail Millet	18.00	20.00	0.00	0.00	0.00	0.00	376.00	400.00	**394.00**	**420.00**
11	Barnyard Millet	1.80	2.80	0.00	0.00	0.00	0.00	2.00	6.00	**3.80**	**8.80**
12	Browntop Millet	0.00	1.00	0.00	0.00	0.00	0.00	0.00	4.00	**0.00**	**5.00**
13	Proso Millet	0.00	3.00	0.00	0.00	0.00	0.00	13.00	25.00	**13.00**	**28.00**
14	Italian Millet	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	**1.00**	**1.00**
15	Grain Amaranth	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	**1.00**	**1.00**
16	Buckwheat	0.00	0.00	0.00	0.00	0.00	0.00	83.60	82.61	**83.60**	**82.61**
	Total Cereal Crops	**28181.51**	**52667.79**	**33218.20**	**36952.02**	**59306.10**	**61430.60**	**46657.44**	**57137.03**	**167363.25**	**208187.44**
B	**Pulse Crops**										
1	Chickpea	7032.33	17503.80	2947.10	4624.10	9013.90	10490.10	2371.30	4081.40	**21364.63**	**36699.40**
2	Pigeon pea	38.25	148.90	351.00	352.00	45.00	45.00	51.10	60.20	**485.35**	**606.10**
3	Mung	42.00	49.76	473.00	461.00	171.00	233.00	152.20	204.10	**838.20**	**947.86**
4	Urd	163.14	205.34	449.00	459.60	2473.00	2491.00	1803.00	2100.00	**4888.14**	**5255.94**
5	Field Pea	342.14	543.18	682.00	733.90	551.50	862.50	165.10	176.50	**1740.74**	**2316.08**
6	Lentil	757.96	1348.50	476.50	639.30	397.70	504.20	378.00	448.60	**2010.16**	**2940.60**
7	Cowpea	16.76	46.26	190.00	181.50	86.00	78.00	41.00	111.00	**333.76**	**416.76**
8	Rajmah	3.30	63.00	0.00	0.00	10.00	8.00	339.50	345.00	**352.80**	**416.00**

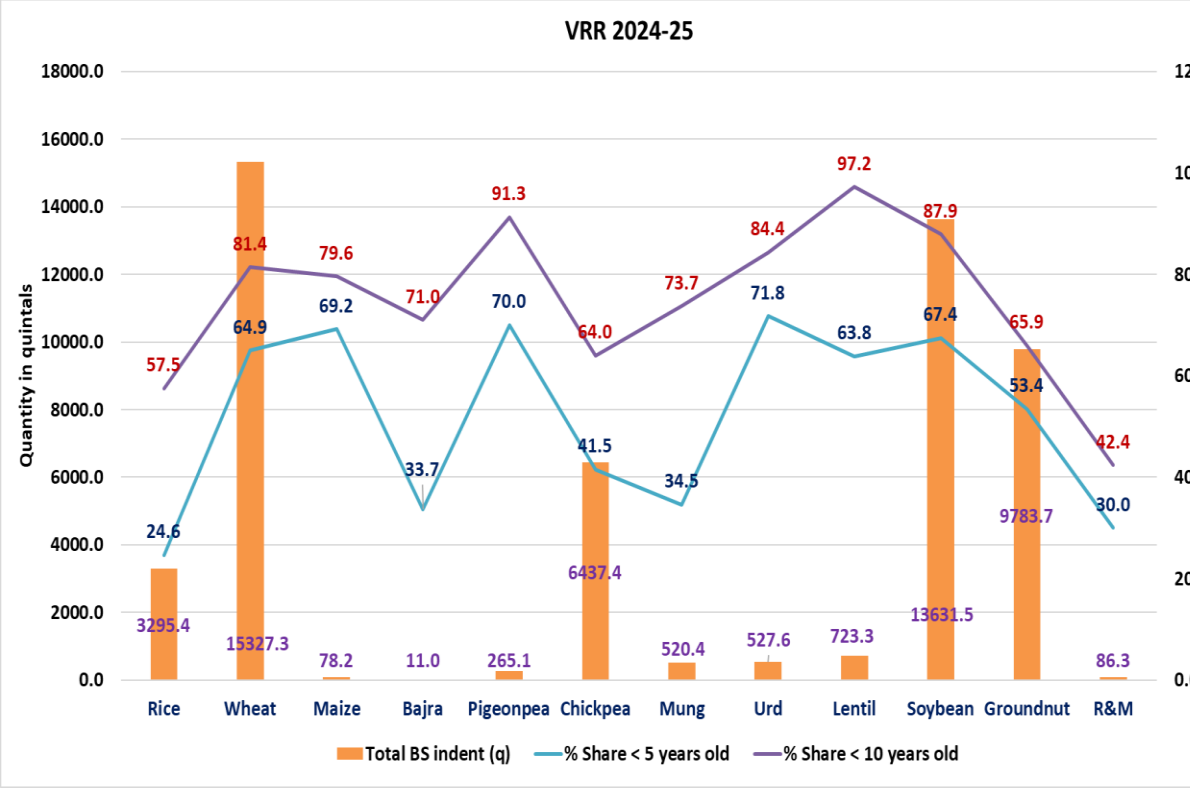
Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
9	Horse Gram	5.70	6.20	24.00	0.00	80.00	83.50	54.00	39.50	**163.70**	**129.20**
10	Moth Bean	2.30	2.30	0.00	0.00	0.00	0.00	20.00	21.00	**22.30**	**23.30**
11	Field Bean	2.04	3.00	0.00	0.00	36.00	39.20	151.40	109.55	**189.44**	**151.75**
12	Rice Bean	3.50	3.40	0.00	0.00	0.00	0.00	0.00	0.00	**3.50**	**3.40**
13	Lathyrus	118.44	174.00	75.00	126.00	35.00	50.00	23.00	37.00	**251.44**	**387.00**
	Total Pulse Crops	**8527.86**	**20097.64**	**5667.60**	**7577.40**	**12899.10**	**14884.50**	**5549.60**	**7733.85**	**32644.16**	**50293.39**
C	**Oilseed Crops**										
1	Groundnut	2869.50	3794.50	1019.00	1124.00	1015.50	1175.50	388.00	851.10	**5292.00**	**6945.10**
2	Soybean	217.00	1172.00	1600.00	1925.00	1700.00	2100.00	0.00	0.00	**3517.00**	**5197.00**
3	Sunflower	19.59	29.69	5.00	0.00	1040.00	1000.00	46.50	22.20	**1111.09**	**1051.89**
4	Safflower	26.37	1547.16	330.00	455.90	724.00	800.80	228.00	215.00	**1308.37**	**3018.86**
5	Sesame	18.05	18.55	41.50	41.50	24.00	23.00	50.09	48.90	**133.64**	**131.95**
6	Linseed	173.85	644.30	296.10	377.50	101.00	281.50	127.00	147.00	**697.95**	**1450.30**
7	Niger	0.00	24.50	2.00	2.00	2.00	2.00	10.80	12.80	**14.80**	**41.30**
8	Castor	10.00	12.10	0.00	0.00	390.00	425.50	400.10	445.00	**800.10**	**882.60**
9	Indian Mustard	103.69	536.23	302.30	484.85	1766.20	2227.81	1884.50	2349.60	**4056.69**	**5598.49**
10	Toria	43.05	148.76	158.80	139.80	3604.00	2906.00	381.80	387.80	**4187.65**	**3582.36**
11	Karan Rai	0.00	0.00	2.50	3.50	0.00	0.00	200.00	200.00	**202.50**	**203.50**
12	Rai	2.36	161.95	415.00	435.40	0.00	21.60	0.00	0.00	**417.36**	**618.95**
13	G. Sarson	17.00	18.75	14.40	14.00	60.00	60.00	367.00	599.43	**458.40**	**692.18**
14	B. Sarson	1.69	3.15	41.00	43.50	0.00	0.00	100.00	115.00	**142.69**	**161.65**
15	Y. Sarson	0.00	0.00	0.00	0.00	0.00	0.00	10.00	6.00	**10.00**	**6.00**
16	A. Sarson	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	**0.50**	**0.50**
17	Raya	12.16	22.75	205.00	211.00	11.00	11.00	907.00	949.00	**1135.16**	**1193.75**
18	Taramira	0.00	0.00	0.00	0.00	0.00	0.00	4.00	124.00	**4.00**	**124.00**
	Total Oilseed Crops	**3514.81**	**8134.89**	**4432.60**	**5257.95**	**10437.70**	**11034.71**	**5104.79**	**6472.83**	**23489.90**	**30900.38**
D	**Fiber Crops**										
1	Cotton	1.53	1.53	0.00	0.00	0.00	0.00	1.50	1.50	**3.03**	**3.03**
2	Flax	2.50	3.00	0.00	0.00	0.00	0.00	1.00	1.50	**3.50**	**4.50**

Sl. No	Commodity/Crops	Breeder seed		Foundation seed		Certified seed		Truthfully labelled seed		Total	
		Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
3	Sunhemp	4.00	4.00	12.00	12.00	0.00	0.00	324.30	264.50	**340.30**	**280.50**
	Total Fiber Crops	**8.03**	**8.53**	**12.00**	**12.00**	**0.00**	**0.00**	**326.80**	**267.50**	**346.83**	**288.03**
E	**Forage Crops**										
1	Sesbania (Agathi)	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.40	**1.20**	**1.40**
2	F. Bajra	5.95	6.00	0.00	0.00	0.00	0.00	1.00	0.60	**6.95**	**6.60**
3	Berseem	180.48	144.50	41.00	40.50	274.00	274.00	13.00	13.50	**508.48**	**472.50**
4	Cluster bean	0.00	0.00	0.00	0.00	0.00	0.00	12.00	12.50	**12.00**	**12.50**
5	F. Cowpea	3.75	3.81	0.00	0.00	50.00	40.00	0.00	0.00	**53.75**	**43.81**
6	Dhaincha	3.00	5.00	0.00	0.00	0.00	0.00	85.70	95.00	**88.70**	**100.00**
7	Desmanthus	0.00	0.00	0.00	0.00	0.00	0.00	8.10	8.51	**8.10**	**8.51**
8	F. Maize	5.20	5.25	0.00	0.00	0.00	0.00	49.50	51.25	**54.70**	**56.50**
9	F. Sorghum	0.00	0.00	0.00	0.00	0.00	0.00	17.20	18.40	**17.20**	**18.40**
10	Lucerne	15.23	17.15	0.00	0.00	0.00	0.00	8.00	11.00	**23.23**	**28.15**
11	Oats	933.45	891.50	10.00	10.00	15.00	15.00	1152.00	1281.50	**2110.45**	**2198.00**
12	Metha	0.50	0.50	0.00	0.00	0.00	0.00	18.00	18.00	**18.50**	**18.50**
13	F. Rice Bean	0.10	0.16	0.00	0.00	0.00	0.00	0.00	0.00	**0.10**	**0.16**
15	Rye Grass	5.50	7.20	0.00	0.00	0.00	0.00	25.00	25.00	**30.50**	**32.20**
16	Sababul	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.12	**0.10**	**0.12**
17	Dhaman Grass	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	**0.50**	**0.50**
	Total Forage Crops	**1153.66**	**1081.57**	**51.00**	**50.50**	**339.00**	**329.00**	**1390.80**	**1536.78**	**2934.46**	**2997.85**
	Total	**41385.87**	**81990.42**	**43381.40**	**49849.87**	**82981.90**	**87678.81**	**59029.43**	**73147.99**	**226778.60**	**292667.09**

Varietal Replacement Rate (VRR) in major field crops

Varietal Replacement Rate (VRR) is one of the important factors in realizing higher crop productivity. The pace of progress in food production is largely depend upon the progress of seed programme that could able to supply quality seed of high yielding varieties with superior genetics.

Comparison of Varietal Replacement Rate (VRR) among major field crops



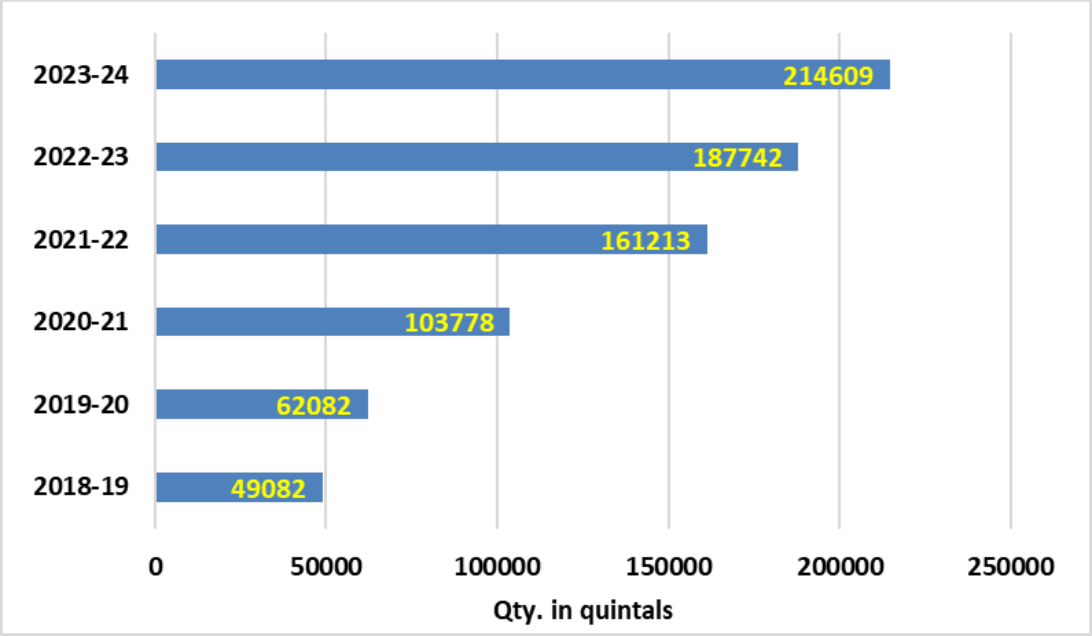
Perusal of breeder seed indents during 2024-25 suggests that, across the crops, there has been a significant enhancement in VRR. In rice, share of varieties, notified during last five years and ten years in total breeder seed indent were 24.6 % and 57.5 % during 2024-25 as compared to 12.8 % and 43.2 % during 2018-19, respectively. Similarly, in wheat, the share of five years and ten years old varieties were 64.9 % and 81.4 % during 2024-25 as compared to 49.4 % and 75.1 % during 2018-19, respectively. Among pulses, pigeon pea had the share of 70.0 % and 91.3 % during 2024-25 as compared to 3.5 % and 36.5 % during 2018-19, respectively. Similarly, lentil had the share of 63.8 % and 97.2 % during 2024-25 as compared to 20.4 % and 53.8 % during 2018-19, respectively, indicating better VRR. In general, pace of VRR among all major field crops were found to be adequate for reaping the benefits of modern crop varieties. Meanwhile, the rationalization of breeder seed indents was also achieved in crops viz. wheat, soybean, groundnut and chickpea.

Quality seed production in new crop varieties under AICRP on Seed (Crops)

Varietal Replacement Rate (VRR) is one of the important factors in realizing higher crop productivity. Although discernible progress was made in quality seed production, still some

of the issues such as Varietal Replacement Rate (VRR) and Seed Replacement Rate (SRR) need to be tackled. Under the ambit of AICRP on Seed (Crops), due emphasis has been given for quality seed production of new crop varieties. In recent years, cooperating centres are promoting large scale seed production of new varieties through farmers participatory seed production programmes. During 2023-24, 214609.31 quintals of quality seed was produced in new varieties under AICRP on Seed (Crops).

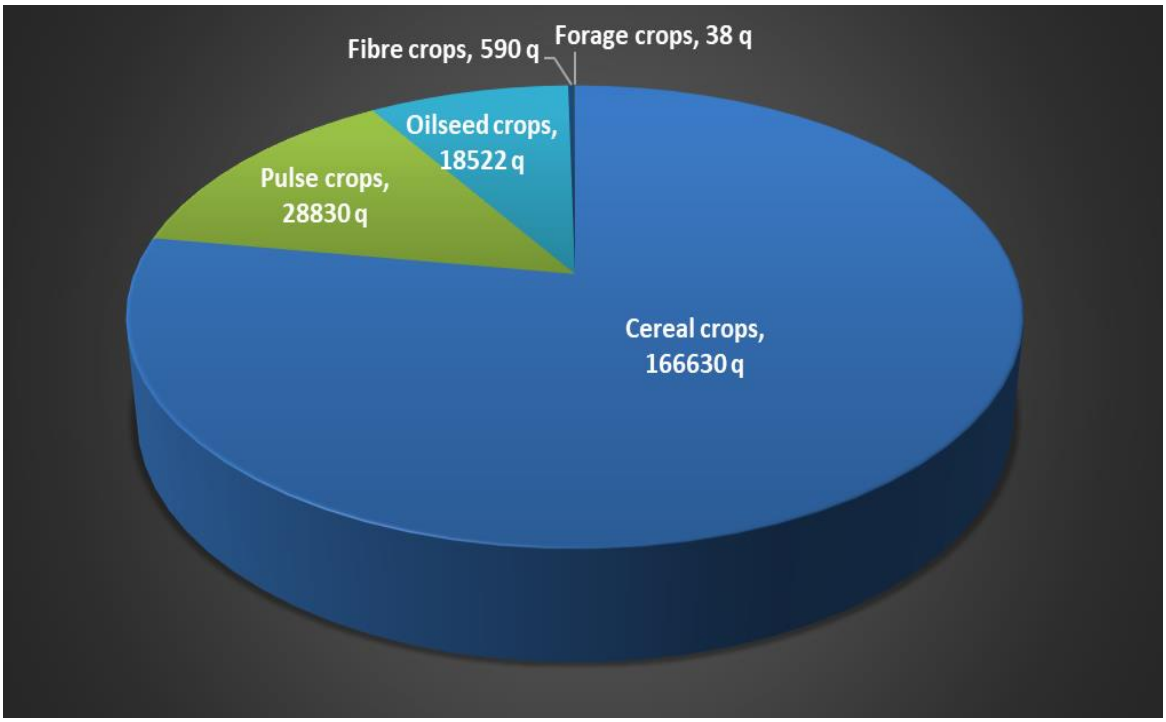
Quality seed production in newly released varieties under AICRP on Seed (Crops) (< 5 years old)



Crop-wise quality seed production in new crop varieties under AICRP on Seed (Crops)

During 2023-24, out of the total quality seed produced in new crop varieties, the major share belongs to cereal crops i.e., 166630q in which maximum quality seed was produced for paddy (111644q) followed by wheat (35785q). Under pulse crops a total of 28830q quality seed was produced out of which 12355q was alone contributed by pigeon pea followed by chickpea (11632q) and urd bean (3241q). In oilseeds, total quality seed production was 18522q; soybean and groundnut together have contributed to 15517q. Quality seed produced in case of fiber crops was 590q. In case of forage crops, quality seed production was 38q, out of which 19q alone was contributed by forage sorghum.

Crop-wise quality seed production in new varieties, 2023-24



Centre-wise quality seed production in new crop varieties under AICRP on Seed (Crops)

During 2023-24, out of 214609q of total quality seed produced in new crop varieties, majority share was produced in centres viz. ANGRAU, Guntur (78219q), PAU, Ludhiana (33532q), UAS, Dharwad (29474q), ICAR-IIWBR, Karnal (11867q), UAS, Raichur (8674q), ICAR-IIMR, Ludhiana (7257q) and PJTSAU, Hyderabad (4766q).

Seed Technology Research Highlights 2023-24

A. Seed Production and Certification

❖ Optimization of organic seed production systems in selected crops

Paddy

Unified Observation: The experiment was conducted at six locations viz., ICAR RC NEHR Manipur; AAU, Jorhat; IGKV, Raipur; IISS, Mau; PJTSAU, Hyderabad and UAS, Bangalore to evaluate paddy varieties for their suitability under organic seed production and study the influence of organic nutrient sources on seed yield and quality attributes under organic seed production systems. However, data was not reported by AAU Jorhat. The varieties of paddy used by the cooperating centres is given below:

Varieties	ICAR RC NEHR Manipur	IGKV Raipur	ICAR- IISS Mau	PJTSAU Hyderabad	UAS Bangalore
V1	Chakhao Poireiton (Black	Dubraj Selection-1	KN3	KNM 118	Hemashri
V2	Chakhao Poireiton (ICAR)	Badshabhog Selection-1	BK101	RNR 15048	Ratna Chodi
V3	Chakhao White	Vishnubhog Selection-1	BK102	WGL-44	Rajamudi
V4			Kiran		Muthina Sanna

The results revealed that N_2 (State Recommended Dose of Fertilizer) recorded highest field emergence (88.52 %), plant stand establishment (32.98), plant height at 30 DAS and at harvest (48.2 cm and 126.7 cm), days at first flowering and 50% flowering (92 and 101), no. of tillers/m^2 (385), seed yield (38.67 q/hac), including net monetary returns (Rs. 62,990/-) and BC ratio (2.37). However, the treatment N_3 (RDN through Green manure/ FYM/ Vermicompost/ Neem Cake/ Azospirillum, as either sole application or combination of different sources + 10 kg PSB/ ha + 10 kg KSB/ ha) performed better as compared to control. Hence, the 1000 seed weight (17.97 g) and seed quality attributes (Germination: 91 % and SV-I: 1504) was high in organic nutrient management with all the varietal combinations as compared to inorganic and control.

The interactions could not be compared, as the varieties selected for this experiment were different for the different centres. Moreover, ICAR RC NEHR, Manipur (Black Rice); IGKV, Raipur and PJTSAU, Hyderabad conducted the experiment on three varieties, whereas other centres, ICAR-IISS, Mau and UAS, Bangalore conducted the experiment on four varieties. Hence, there was lack of uniformity with respect to number of varieties. **The data of following**

parameters was not reported viz. field emergence, plant stand establishment, no. of tillers/m^2 (ICAR-IISS, Mau), no. of tillers/m^2 (IGKV, Raipur).

Comparative analysis of seed yield: Among the nutrient management treatments, 68.5% seed yield superiority of N_2 (State Recommended Dose of NPK Fertilizer), was observed over N_1 (control) across the centres viz. ICAR RC NEHR Manipur (32%); IGKV, Raipur (85.75%); ICAR-IISS, Mau (50%); PJTSAU Hyderabad (112%) and UAS, Bangalore (50.42%). However, in case of N_3 (organic practices), overall yield superiority was 39.7% over N_1 (control), whereas it was 22.3%, 98.3%, 17.1%, 58.6% and 17% at ICAR RC NEHR, Manipur; IGKV, Raipur; ICAR-IISS, Mau; PJTSAU, Hyderabad and UAS, Bangalore, respectively. Hence, N_2 (State Recommended Dose of NPK Fertilizer) fared better over N_3 (organic practices), whereas adoption of organic nutrient management resulted in overall yield penalty of 8%, ranging between 17-25% across the centres. However, IGKV, Raipur was an exception, wherein yield penalty was not observed in case of organic practices and in fact, N_3 showed 6.75% yield superiority over N_2. Hence, we can adopt organic seed production practices, yield penalty was observed in most of the varieties over SRDF.

Among the varieties, Chakhao Poireiton (Black), Vishnubhog Selection 1, BK-101 & BK-102, KNM-118, Ratna Chodi & Rajamudi performed better under organic management at ICAR RC NEHR, Manipur, IGKV, Raipur, ICAR-IISS, Mau PJTSAU, Hyderabad, and UAS, Bangalore, respectively. Hence, these varieties can be recommended for organic seed production systems in the respective zones.

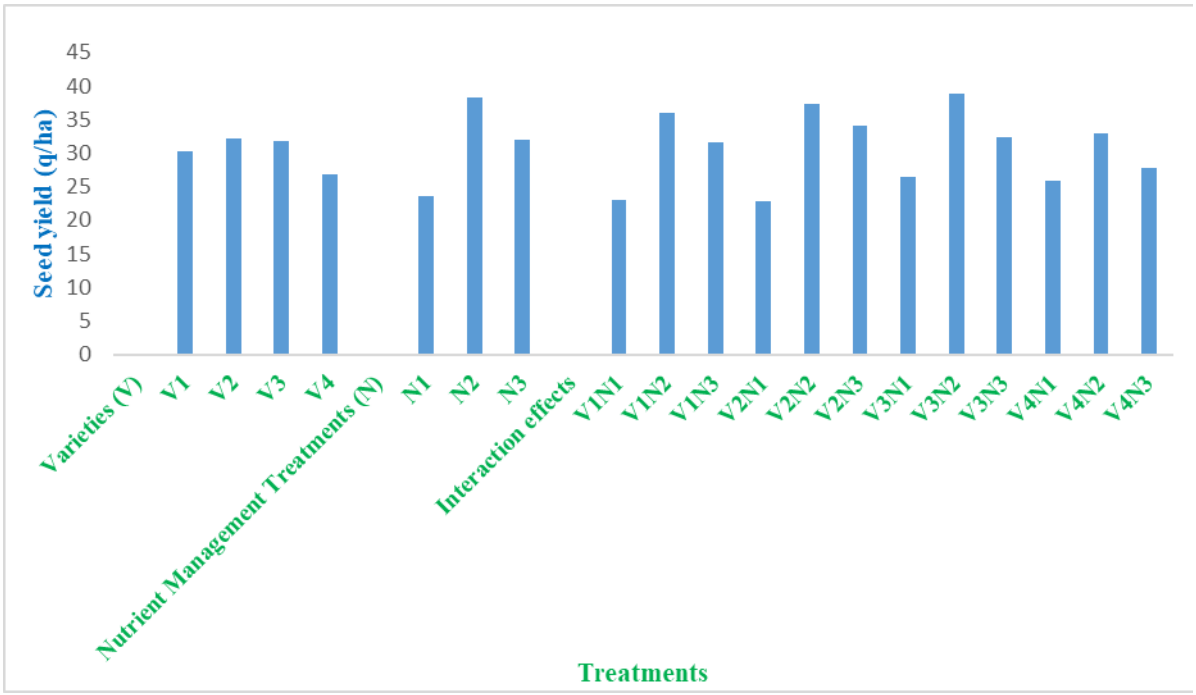


Fig. 1.1: Effect of organic nutrient management on seed yield in paddy

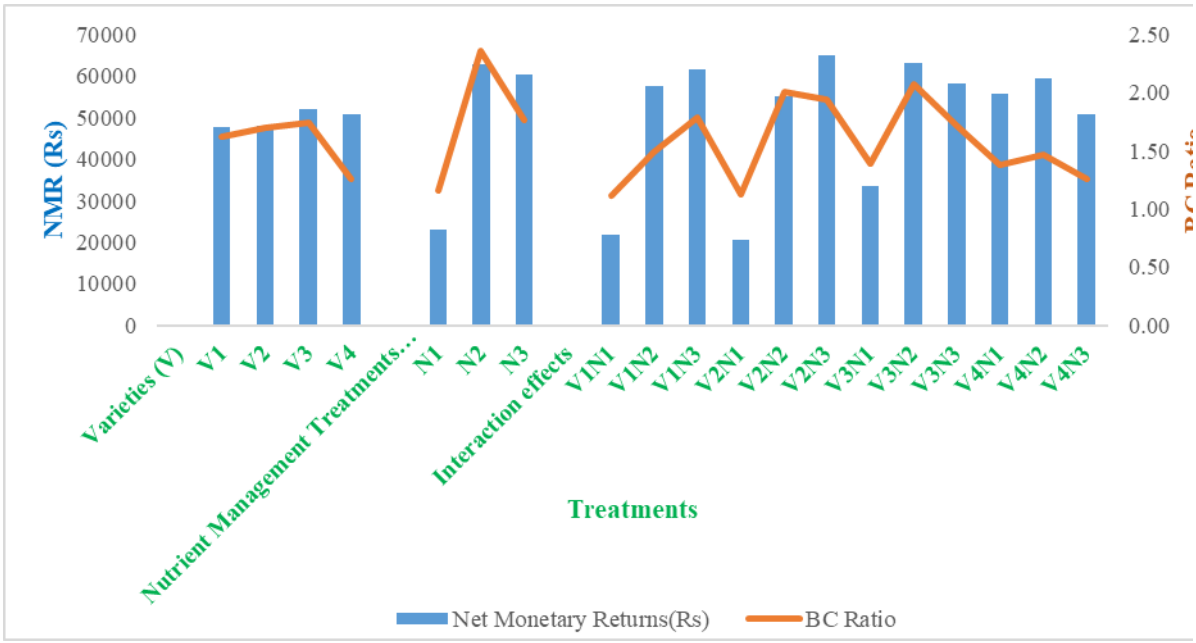


Fig. 1.2: Effect of organic nutrient management on seed economic indicators in paddy

Fig. 1.3: Field view of organic seed production plot at SRTC, Rajendra nagar, Hyderabad

Maize

Unified Observation: The experiment was conducted at four locations *viz.,* GBPUAT, Pantnagar; UAS, Dharwad; ICAR RC NEHR Manipur Centre and PJTSAU, Hyderabad to evaluate maize varieties for their suitability under organic seed production and study the influence of organic nutrient sources on seed yield and quality attributes. The varieties of maize used at cooperating centres is given below:

Varieties		GBPUAT Pantnagar	UAS Dharwad	ICAR RC NEHR Manipur	PJSTAU Hyderabad
V1		DOP-303	GH-0727	Pusa Composite	BML-6
V2		Kanchan	GH-105125	RC Manichujak 2	BML-7
V3		Pant Sankul Makka 3	CI-4	Local Chandel	BML-45
V4					PFSR-3

The results revealed that N_2 (State Recommended Dose of Fertilizer) recorded highest plant stand establishment (7.95), plant height at 30 DAS and at harvest (52.53 cm and 170.24 cm), number of cobs/m^2 (3.9), days at first flowering and 50% flowering (61 and 75), seed yield (105.7 g/plant and 40.7 q/ha), seed recovery (92 %) and 1000 seed weight (213 g) including net monetary returns (Rs. 75,800 /-) and BC ratio (3.09).

However, the treatment N_3 (RDN through Green manure/ FYM/ Vermicompost/ Neem Cake/ Azospirillum, as either sole application or combination of different sources + 10 kg PSB/ ha + 10kg KSB/ ha) was at par with N_2 with respect to field emergence (93.9 %), and seed quality attributes (Germination and Seedling Vigour index – I).

The interactions cannot be compared, as the varieties selected for this experiment were different for the different centres. Moreover, GBPUAT, Pantnagar, UAS, Dharwad, and ICAR RC NEHR, Manipur conducted the experiment on three varieties, whereas the centre PJTSAU, Hyderabad conducted the experiment on four varieties. Hence, there was lack of uniformity with respect to number of varieties. **The data of following parameters was not reported viz, plant stand establishment (PJTSAU, Hyderabad), NMR and BC ratio (GBPUAT, Pantnagar), seed yield/ plant (ICAR RC NEHR, Manipur), Raipur). Moreover, the NMR and BC ratio values reported by PJTSAU, Hyderabad were not considered, as the values were not line with other centres.**

Comparative analysis of seed yield: Among the nutrient management treatments, 23.2 % seed yield superiority of N_2 (State Recommended Dose of NPK Fertilizer), was observed over N_1 (control) across the centres viz. GBPUAT, Pantnagar (8.07%), UAS, Dharwad (8.1%), ICAR RC NEHR Manipur (21.5%); and PJTSAU Hyderabad (203%). However, in case of N_3 (organic practices), overall yield superiority was 16.5% over N_1 (control), whereas it was 3.3%, 26.6%, 29.3% and 51.7% at GBPUAT, Pantnagar, UAS, Dharwad, ICAR RC NEHR, Manipur and PJTSAU, Hyderabad respectively. Hence, N_2 (State Recommended Dose of NPK Fertilizer) fared better over N_3 (organic practices), whereas adoption of organic nutrient management resulted in overall yield penalty of 5.42%, ranging between 4.5 - 11% across the centres. However, ICAR RC NEHR, Manipur was an exception, wherein yield penalty was not observed in case of organic practices and in fact, N_3 recorded 6.33% higher seed yield as compared to N_2. Hence, we can adopt organic seed production practices, yield penalty was observed in most of the varieties over SRDF.

Among the varieties, Kanchan/ Pant Sankul Makka 3, GH-105125, RC Manichujak 2, and BML 6 performed better under organic management at GBPUAT, Pantnagar, UAS, Dharwad, ICAR RC NEHR, Manipur, and PJTSAU, Hyderabad, respectively. Hence, these varieties can be recommended for organic seed production systems in the respective zones.

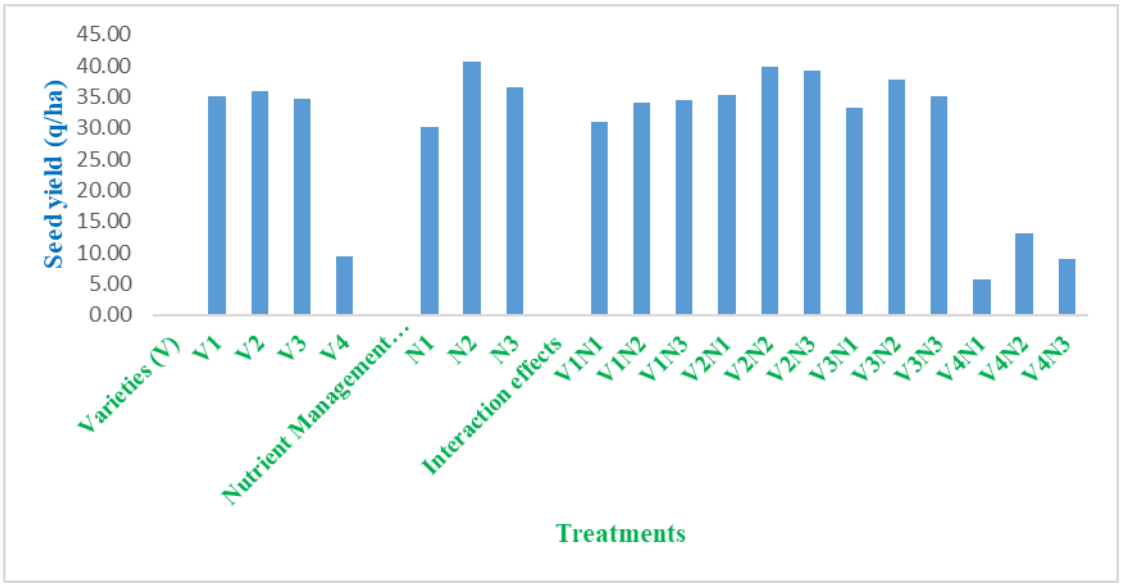


Fig. 1.4: Effect of organic nutrient management on seed yield in maize

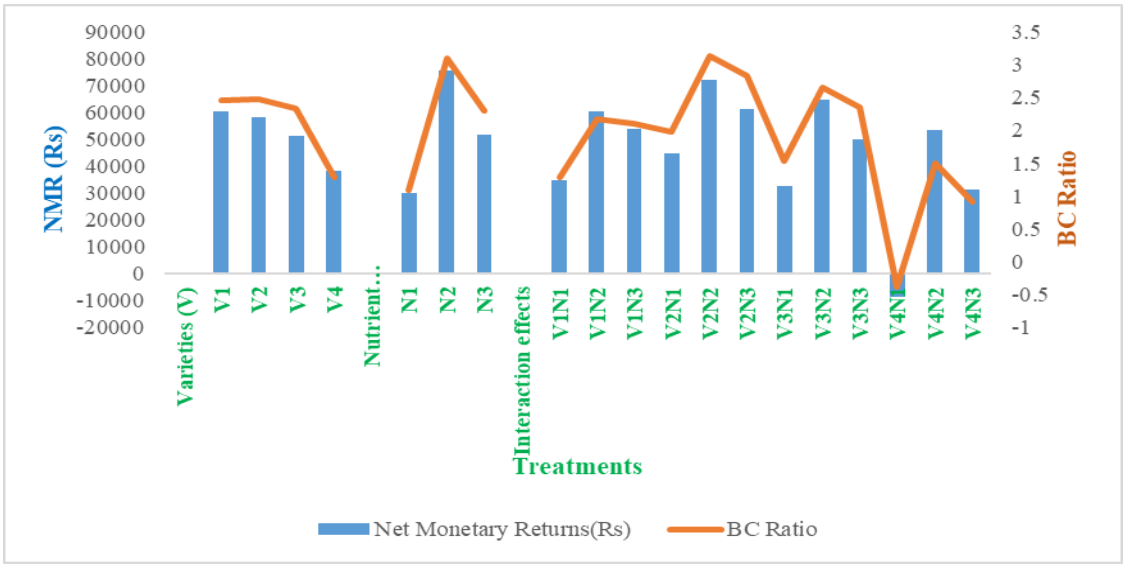


Fig. 1.5: Effect of organic nutrient management on economic indicators in maize

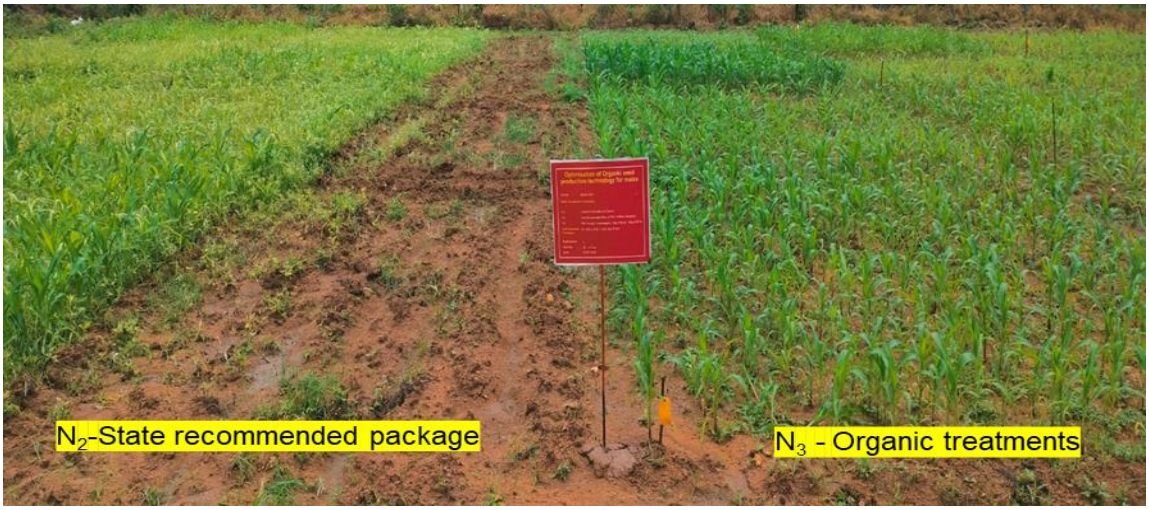


Fig. 1.6: Field view of Experimental plot at SRTC, Rajendranagar, Hyderabad

Ragi

Unified Observation: The experiment was conducted at three locations *viz.* UAS, Bangalore; PDKV, Akola and ICAR RC NEHR Sikkim. The varieties of Ragi used at cooperating centres is given below:

Varieties	UAS(B)	PDKV-Akola	ICAR RC NEHR Sikkim
V1	Indaf -9	BFM-19-1	Sikkim Ragi 3043
V2	ML-365	BFM-19-1-5	VL- Mandua 373
V3	GPU-66	BFM-19-14-3	Sikkim Ragi 3032
V4	KMR-630		

The nutrient management N_2 (State recommended dose of fertilizer) significantly influenced the seed yield and attributing parameters of finger millet viz., field emergence (83.14%), plant height at 30 DAS and at harvest (44.8 cm and 89.6 cm), seed yield (19.14 g/plant and 29.88 q/ha), seed recovery (82.62 %), and seed quality attributes (Germination: 79 % and SV Index-I: 1187). The net monetary returns (Rs 1,53,571) and BC ratio (3.36). However, the treatment N_3 (RDN through Green manure/ FYM/ Vermicompost/ Neem Cake/ Azospirillum, as either sole application or combination of different sources + 10 kg PSB/ha + 10 kg KSB/ha) performed better as compared to control with respect to plant stand establishment /m^2 (34.37), no. of tillers per m^2 (121.2) whereas, it was at par with N_2 with respect to days to flowering (first and 50%) and 1000 seed weight. The interactions could not be compared, as the varieties selected for this experiment were different for the different centres. PDKV, Akola and ICAR RC NEHR Sikkim performed the experiment on three varieties whereas UAS, Bangalore conducted the experiment on four varieties. The data sheets provided by ICAR RC NEHR Sikkim did not align with the technical programme.

Comparative analysis of seed yield: Among the nutrient management treatments, 30% seed yield superiority of N_2 (State Recommended Dose of NPK Fertilizer), was observed over N_1(control) across the centres viz. UAS, Bangalore (30.3%) and PDKV, Akola (29.5%). However, in case of N_3 (organic practices), overall yield superiority was 16.1% over N_1 (control), whereas it was 0.34% and 44.3% at UAS, Bangalore and PDKV, Akola, respectively. Hence, N_2 (State Recommended Dose of NPK Fertilizer) fared better over N_3 (organic practices), whereas adoption of organic nutrient management resulted in overall yield penalty of 10.65%, and 23% at UAS, Bangalore. However, PDKV, Akola registered yield superiority in case of organic practices and in fact, N_3 recorded 11.5% higher seed yield as compared to N_2. Being a fully organic state, ICAR RC NEHR, Sikkim Centre performed experiment only on two treatments i.e., N_1 (control) and N_2 (2 Kg FYM + 2.4 Kg Annapurna + 40 g NALPAK per plot), wherein N_2 exhibited a yield superiority of 41% over the control (N_1). Similarly, N_2 recorded higher values of NMR (Rs. 69435/-) and BC ratio (1.94), which was 78.7% and 28% higher over N_1, respectively.

Among the varieties, V_2 - BFM-19-1-5, VL - Mandua 373 and V_2 – ML-365 performed better under organic management at PDKV, Akola; ICAR RC NEHR Sikkim; and UAS, Bangalore, respectively. Hence, these varieties can be recommended for organic seed production systems in the respective zones.

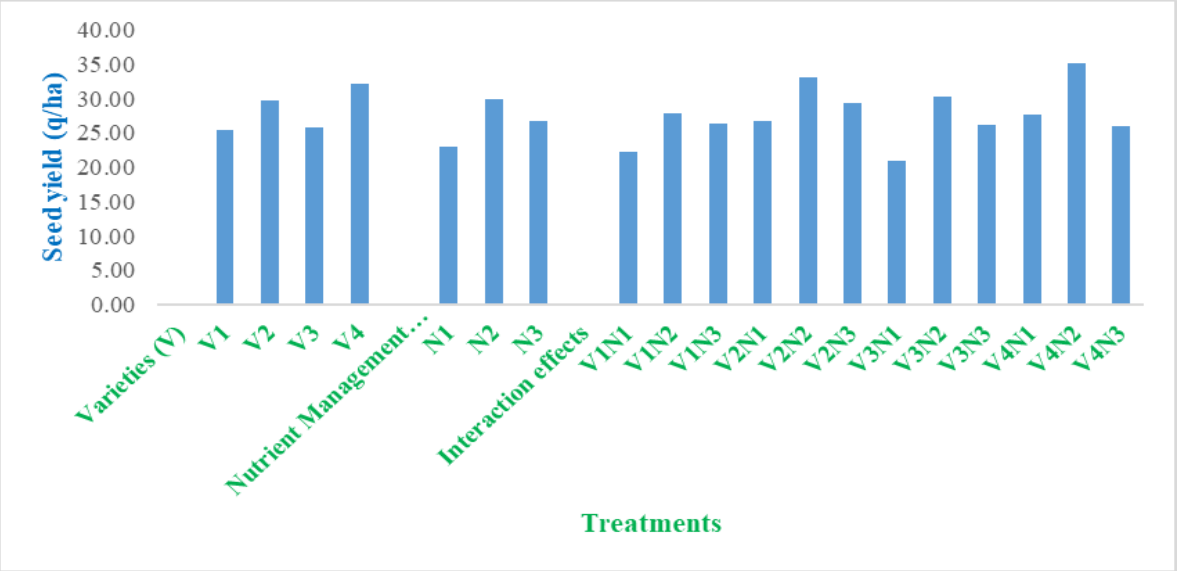


Fig. 1.7: Effect of organic nutrient management on seed yield in ragi

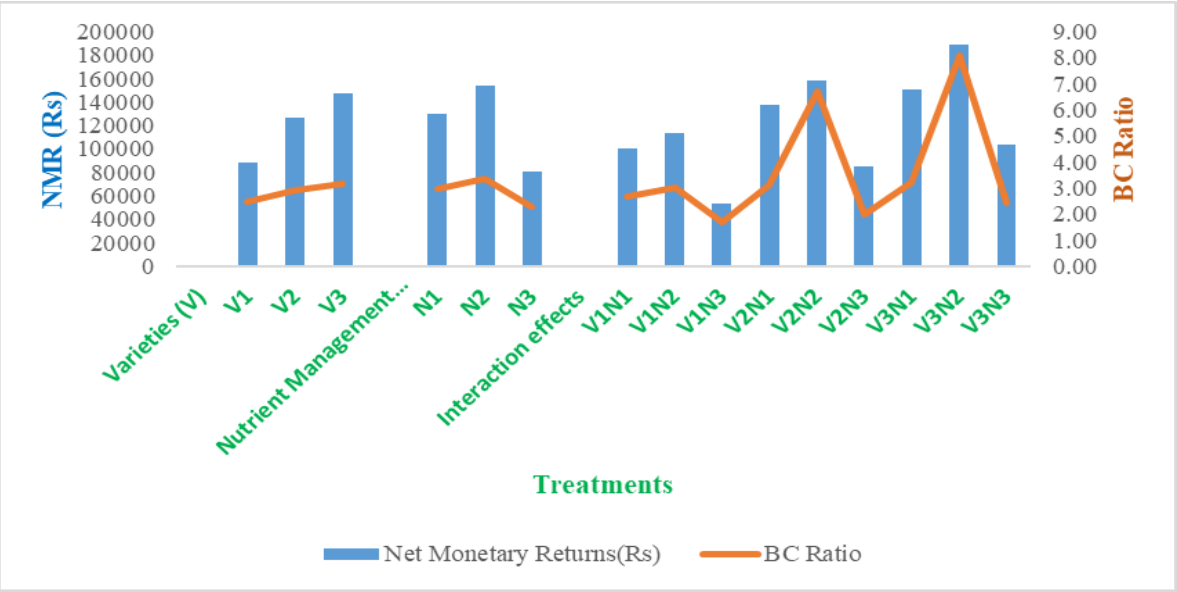


Fig. 1.8: Effect of organic nutrient management on economic indicators in ragi

Fig. 1.9: Experimental Layout of Organic seed production systems in finger millet

Fig. 1.10: Expression of panicle over the treatment in three genotypes of finger millet

❖ **Optimization of seed rate for enhancing seed yield and recovery of pure live seed**

Chickpea

Unified Observation: The experiment was conducted at nine locations viz., UAS, Bengaluru; UAS, Raichur and PJTSAU Hyderabad; MPKV, Rahuri; RARI, Durgapura; ICAR-IARI, Jharkhand; ICAR-IARI, New Delhi; CCSHAU, Hisar and PDKV, Akola; to evaluate chickpea varieties for their optimum seed rate for maximizing seed yield and recovery of pure live seeds. However, the experiment was vitiated at UAS, Raichur due to poor plant emergence and growth; and the data was not reported by ICAR-IARI, Jharkhand.

The varieties of chickpea used at different centers is given below:

UAS, Bengaluru	PJTSAU, Hyderabad	MPKV, Rahuri	RARI, Durgapura	ICAR-IARI, New Delhi	CCSHAU, Hisar	PDKV, Akola
JG-11	NBeG-452	Phule Vikrant	RSG 974	PUSA 4005	HC 3	Jaki 9218

The following seed rates were used in chickpea:

Small seeded (100 seed weight: <20g)	Medium seeded (100 seed weight:20-30g)	Large seeded (100 seed weight: 30-40g)
T_1: 60 kg/ha (Recommended Seed rate)- Control	T_1: 90 kg/ha (Recommended Seed rate)- Control	T_1: 120 kg/ha (Recommended Seed rate)- Control
T_2: 54 kg/ha (10% less than the recommended seed rate)	T_2: 81 kg/ha (10% less than the recommended seed rate)	T_2: 108 kg/ha (10% less than the recommended seed rate)
T_3: 48 kg/ha (20% less than the recommended seed rate)	T_3: 72 kg/ha (20% less than the recommended seed rate)	T_3: 96 kg/ha (20% less than the recommended seed rate)
T_4:42 kg/ha (30% less than the recommended seed rate)	T_4: 63 kg/ha (30% less than the recommended seed rate)	T_4: 84 kg/ha (30% less than the recommended seed rate)
T_5: 36 kg/ha (40% less than the recommended seed rate)	T_5: 54 kg/ha (40%less than the recommended seed rate)	T_5: 72 kg/ha (40% less than the recommended seed rate)
Sowing method: Direct sowing, depth of sowing: 6-8 cm		

The detailed mean data over locations is presented below:

The result revealed highest field emergence (82.5) and plant stand establishment (34.54) in the seed rate T_1 (90 kg/ha). However, plant height, days to flowering and seed quality parameters were at par in all the treatments. Further, it was observed that seed yield, seed recovery (%), NMR and BC Ratio were at par in T_1, T_2 and T_3. On the basis of these results, it can be inferred that 10 to 20% deduction in recommended seed rate i.e., 72-81 kg/ha will realize similar seed yields in medium seeded chickpea. However, the results are not conclusive and experimentation is required for one more year.

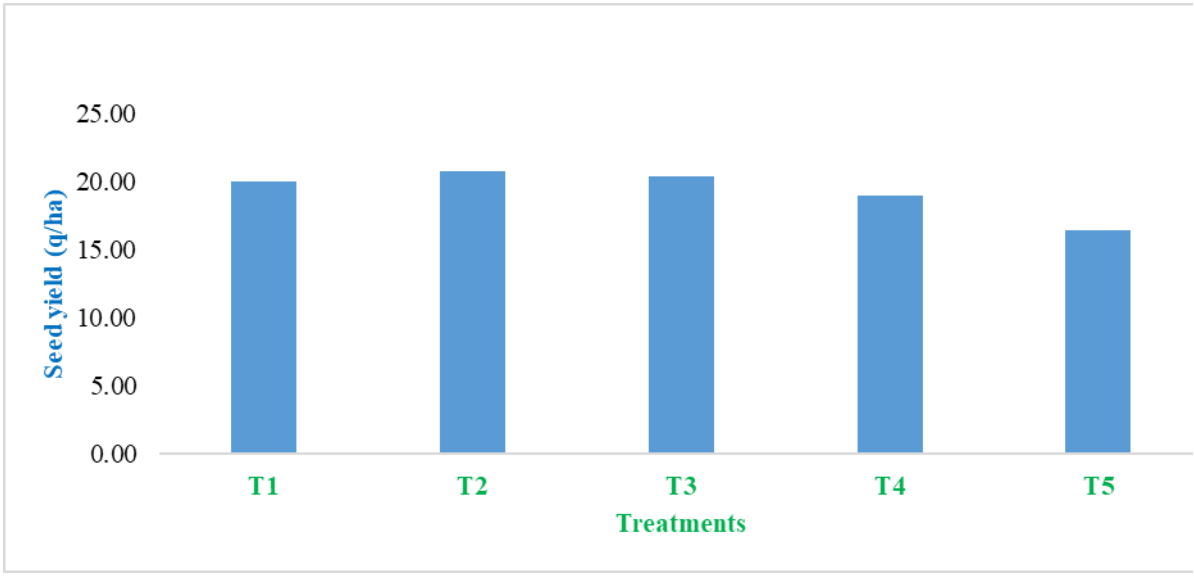


Fig. 1.11: Effect of treatments (seed rate) for enhancing seed yield in chickpea

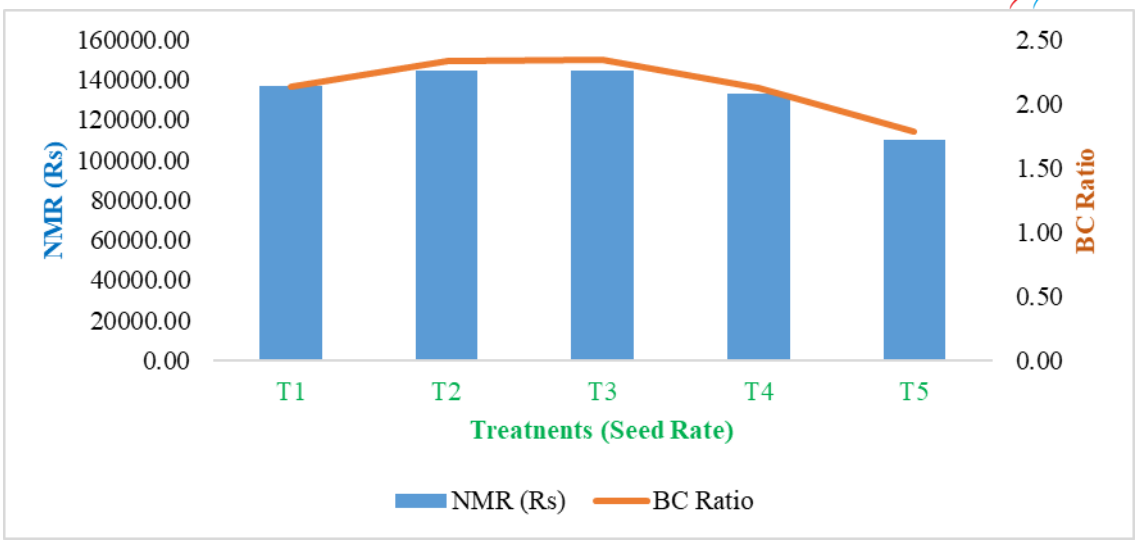


Fig. 1.12: Effect of treatments (seed rate) for economic indicators in chickpea

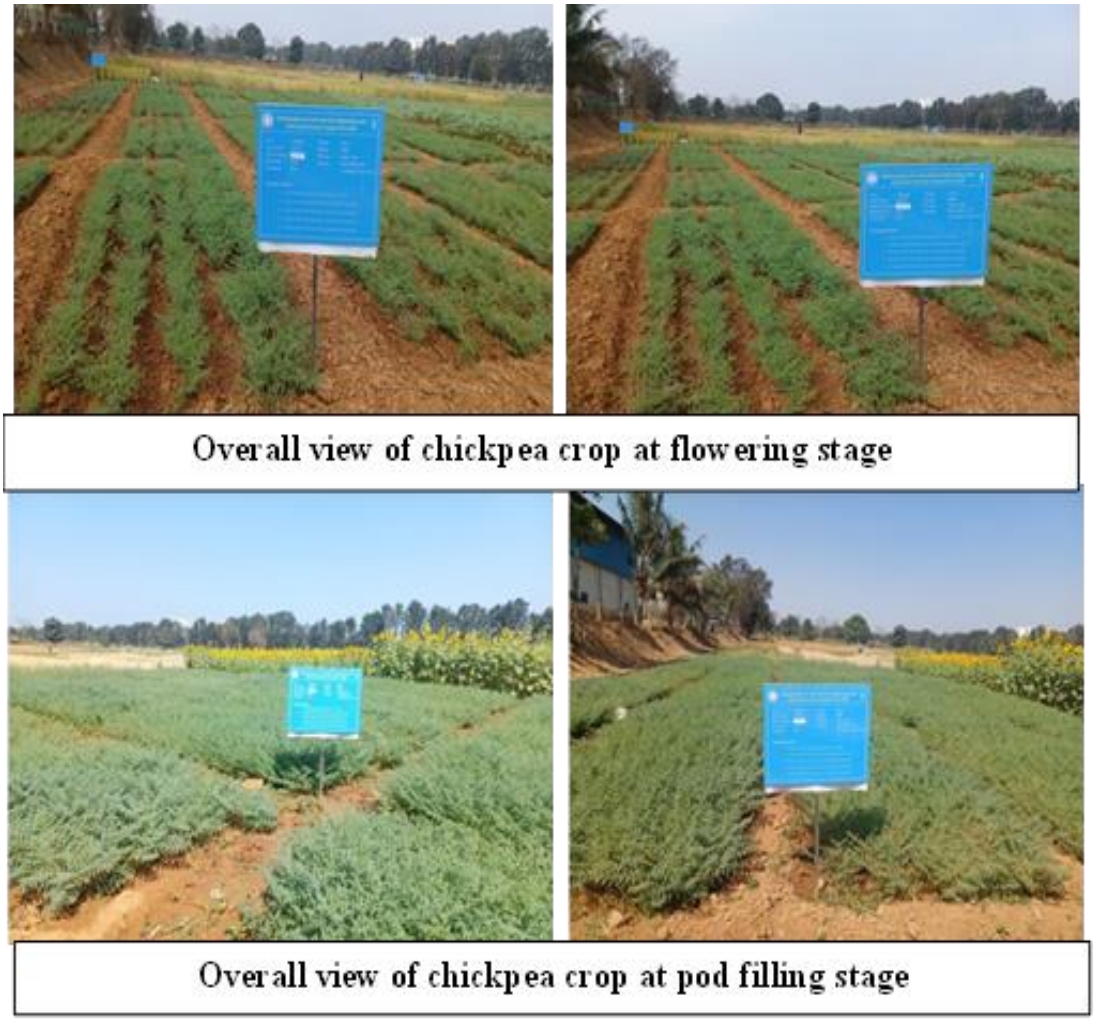


Fig 1.13: Chickpea experiment plot view, UAS (Bangalore)

Wheat

Unified observation: The experiment was conducted at eight locations viz., ICAR-IARI New Delhi; PAU, Ludhiana; MPKV, Rahuri; ICAR-IARI, Jharkhand; RARI, Durgapura; JNKVV Jabalpur; IGKV Raipur and ICAR-IISS, Mau; to evaluate wheat varieties for their optimum seed rate for maximizing seed yield and recovery of pure live seeds. However, the data was not reported by three centres; ICAR-IARI, Jharkhand; CSKHPKV, Palampur and IISS, Mau.

The varieties of wheat used at different centers is given below:

ICAR-IARI, New Delhi	PAU, Ludhiana	VNMKV, Parbhani	RARI, Durgapura	JNKVV, Jabalpur	MPKV, Rahuri	IGKV Raipur
HD 2967, HD 3059	PBW 826	Trimbak	Raj 4238	JW 3336	Phule Samadhan	CG Gehu - 3

Sowing method: direct sowing; depth of sowing: 5-6 cm

Treatments (Seed rates):

- T1: 100 kg/ha (Recommended seed rate)- Control
- T2: 90 kg/ha (10% less than the recommended seed rate)
- T3: 80 kg/ha (20% less than the recommended seed rate)
- T4: 70 kg/ha (30% less than the recommended seed rate)
- T5: 60 kg/ha (40% less than the recommended seed rate)

The detailed mean data over locations is presented below:

The results revealed that highest plant stand establishment (140.13), seed yield (unprocessed/ graded), NMR (Rs 119291 /-) and BC Ratio (1.9) were found to be highest at T1 (Recommended seed rate – 100 kg/ha). However, other parameters like field emergence, plant height, days to flowering, seed recovery (%), and seed quality parameters were at par in all the treatments. On the basis of these results, it can be inferred that seed rate of 100 kg/ha was found to be optimum for wheat seed crop. However, the experimentation will be conducted for one more year.

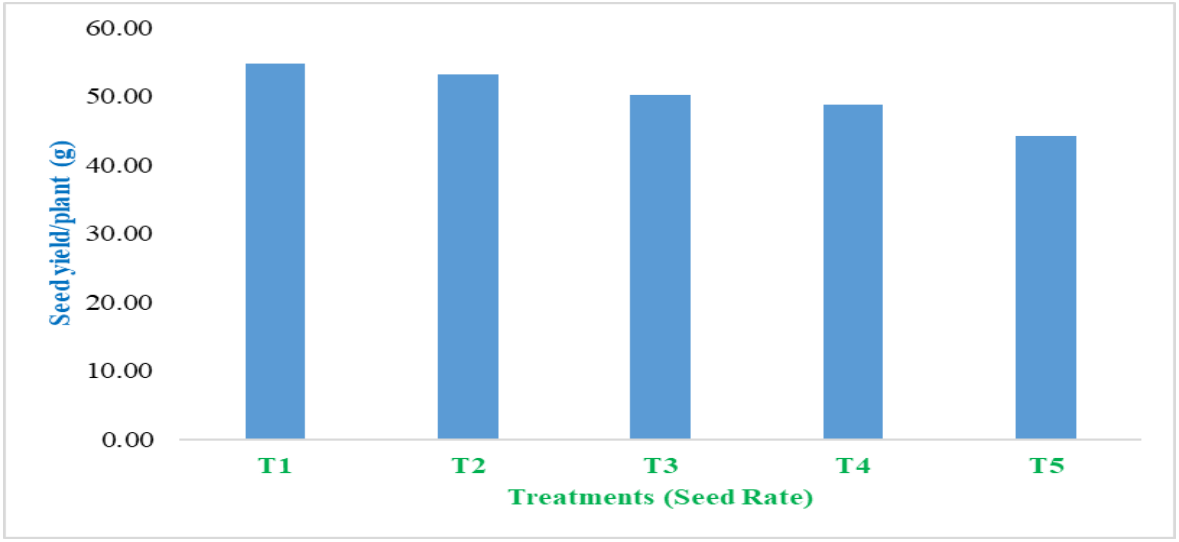


Fig. 1.14: Effect of differential seed rates on seed yield in wheat

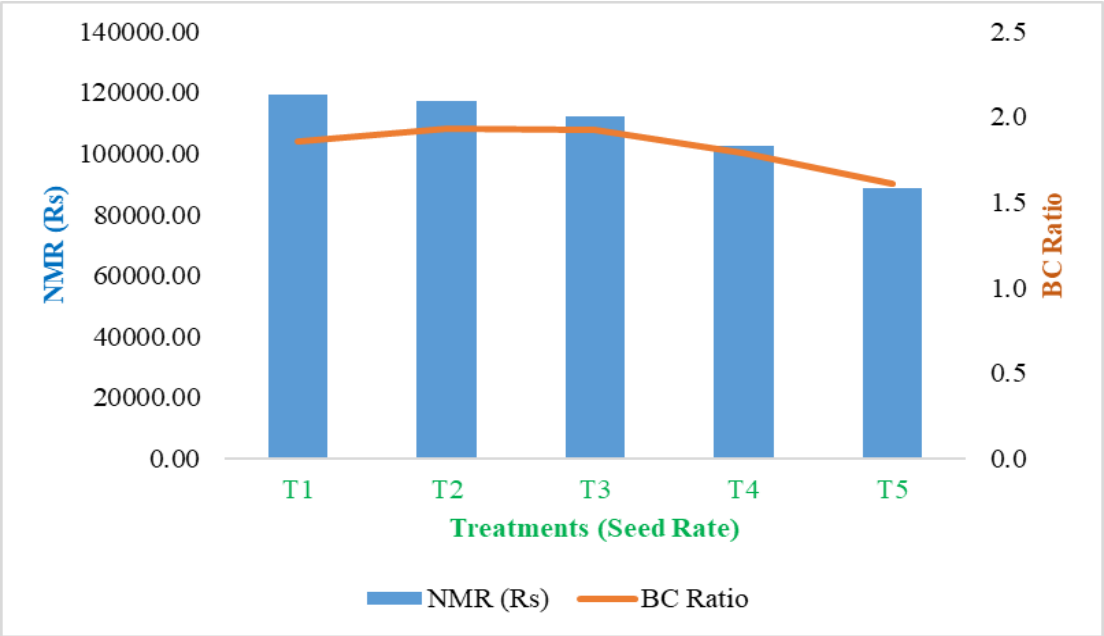


Fig. 1.15: Effect of differential seed rate on economic indicators in wheat

Fig 1.16: Optimization of seed rate of pure live seed in Wheat at RARI Durgapura, Jaipur.

❖ **PGPR mediated seed coating for quality seed production.**

Maize

Unified observation: The experiment was conducted during *Kharif* 2023 at five centres namely, ICAR-IARI, New Delhi; PAU, Ludhiana; PJTSAU, Hyderabad; ICAR RC NEHR, Manipur Centre and TNAU, Coimbatore. The treatment details are given below:

Treatments	Treatment details
T_1	Recommended practice (Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg seed and 100% RDF) - Control
T_2	Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg seed (75% N + Full dose of P, K)
T_3	BF1-4 Cyanobacterium consortium (75% N + Full dose of P, K)
T_4	Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg in combination with BF1-4 Cyanobacterium consortium (75% N + Full dose of P, K)
T_5	*Anabaena* sp. + *Providencia* sp. (75% N + Full dose of P, K)
T_6	*Anabaena* sp. + *Providencia* sp. in combination with Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg seed (75% N + Full dose of P, K)
T_7	*Anabaena laxa* (75% N + Full dose of P, K)
T_8	*Anabaena tr* biofilm (75% N+ Full dose of P, K
***Sowing method**: Direct seed sowing @ 20 kg seed/ha (ridges); Spacing of 75x 25cm*	

The detailed mean data over locations is presented below:

A. Effect of PGPR seed coating on plant growth and seed yield attributes in Maize (Mean over locations): The field experiment on PGPR mediated seed coating for quality seed production on maize variety, Pusa HQPM-5 Improved was conducted to study the effect of seed coating with PGPR formulations on seed yield and quality**.** The PGPR seed treatments exhibited significant effect on the plant growth and seed yield attributes. Among the different seed treatments, T_6 (*Anabaena* sp. + *Providencia* sp. in combination with Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg) was found to be superior with respect to field emergence (87.5%), plant stand establishment (9.86), plant height at 30 DAS (104.04 cm) & harvest (212.1 cm), no. of cobs/plant (1.4) and seed yield (184.6 g/plant, 68.5 q/ha). The same treatment also recorded lesser at days to first flowering (49.14), days to 50% flowering (60.5) and leaf chlorophyll content (SPAD value - 40.7).

B. Effect of PGPR seed coating on seed recovery, seed quality and economic indicators in Maize (Mean over locations): The mean over locations revealed that seed treatments had a significant effect on test weight, seed quality attributes (seed germination, vigour index), net monetary returns and BC ratio in maize. Among the various seed treatments, T_6 (*Anabaena* sp. + *Providencia* sp. in combination with Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg) was found to be promising with respect to higher seed recovery (88.1%), 1000 seed weight (257 g), including seed quality parameters viz. seedling vigour index I (3144). The economic indicators also exhibited superiority with respect to Net Monetary Returns (Rs. 102741/-) and Benefit Cost ratio (2.3) in case of T_6.

Significant Observation:

The seed treatment combination, T_6 (*Anabaena* sp. + *Providencia* sp. in combination with Thiram @ 3 g/kg seed + Gaucho @ 10 ml/kg) resulted in significant increase in field emergence (87.5%), plant stand establishment (9.86), plant height at 30 DAS and maturity (104 and 212 cm), seed yield (68.5 q/ha), including net monetary returns (Rs. 102741/-) and Benefit Cost ratio (2.3).

Conclusion: Seed treatment with *Anabaena sp. + Providencia sp.* in combination with Thiram @ 3 kg/seed + Gaucho @ 10 ml/kg (T_6) was effective in improving the plant growth, seed yield (9.3%) as well as reducing the cost of inputs viz., fertilizers in maize and hence ensuring higher profitability in terms of net monetary returns and BC ratio.

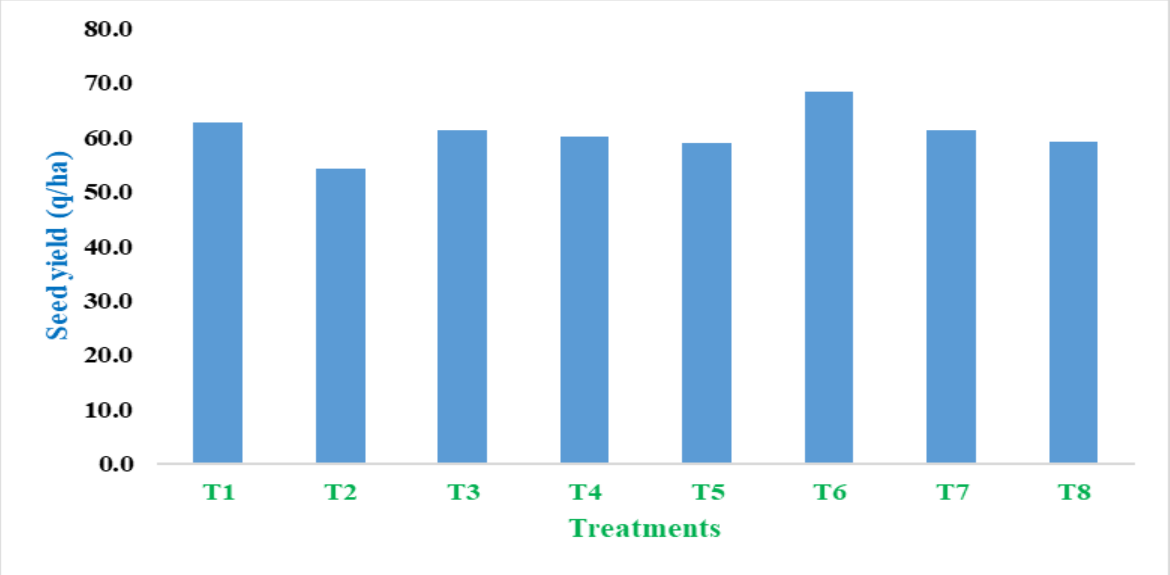


Fig 1.17: Effect of PGPR mediated seed coating on seed yield of maize

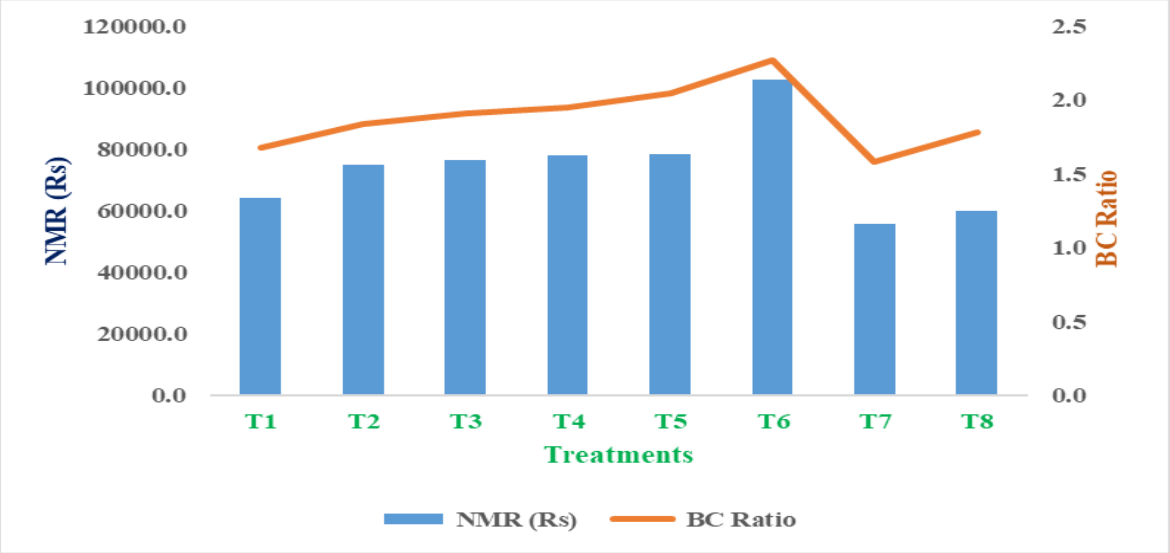


Fig. 1.18: Effect of PGPR mediated seed coating on economic indicators of maize

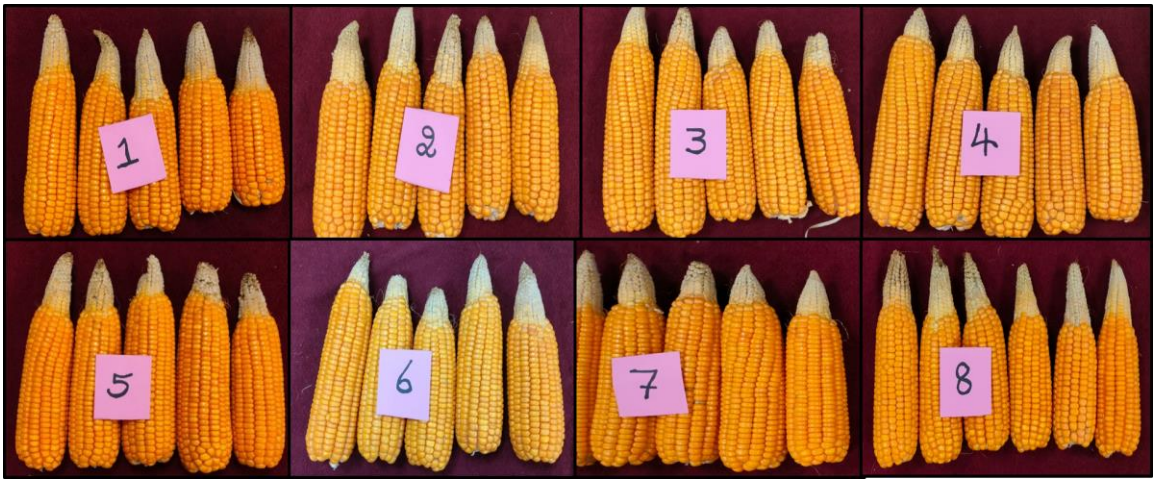


Fig. 1.19: Maize cobs harvested from different treatments at PJTSAU, Hyderabad

Soybean

Unified observation: The experiment was conducted during *Kharif* 2023 at five centres namely, ICAR-IARI, New Delhi; GBPUAT, Pantnagar; MPKV, Rahuri; JNKVV, Jabalpur; UAS, Bengaluru. and VNMKV, Parbhani. However, experiment was hampered by heavy rainfall shortly after sowing, resulting in poor emergence due to water logging and lower soil temperatures at JNKVV, Jabalpur. The treatment details are given below:

Treatments	Treatment details
T_1	Recommended practice (Thiram + Bavistin (2:1) @ 3 g/kg in combination with *Rhizobium* and RDF) - Control
T_2	T_2: Recommended practice (Thiram + Bavistin (2:1) @ 3 g/kg in combination with *Rhizobium* and 75% N + Full dose of P, K*)*
T_3	*Anabaena Rh* (75% N + Full dose of P, K)
T_4	*Anabaena R*h in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)
T_5	BF1-4 *Cyanobacterium* consortium (75% N + Full dose of P, K)
T_6	BF1-4 *Cyanobacterium* consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)
T_7	*Anabaena laxa* (75% N + Full dose of P, K)
T_8	*Anabaena tr* (75% N + Full dose of P, K)
***Sowing method**: Direct sowing @ 70 kg seed/ha, depth of sowing: 4-5 cm*	

The detailed mean data over locations is presented below:

A. Effect of PGPR seed coating on plant growth and seed yield attributes in soybean (Mean over locations): The field experiment on PGPR mediated seed coating for quality seed

production in soybean variety, JS 20-116 was conducted to study the effect of seed coating with PGPR formulations on seed yield and quality. The PGPR seed treatments exhibited significant effect on the plant growth and seed yield attributes. Among the different seed treatments, T_4 (*Anabaena Rh* in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) was found to be superior with respect to field emergence (80 %), plant stand establishment (38.38), no. of nodules/ effective nodules per plant (41.5), no. of pods/plant (72.62), plant height at 30 DAS (32.75 cm) and seed yield (19.87 g/ plant, 2.85 kg/ plot and 23.65 q/ha). The same treatment also recorded lesser days to first flowering (38) & 50% flowering (44), leaf chlorophyll content (SPAD value - 46.86), days to pod formation (59.8) and seed health infection (2.8%).

B. Effect of PGPR seed coating on seed recovery, seed quality and economic indicators in soybean (Mean over locations): The mean over locations revealed that seed coating treatments had a significant effect on seed recovery, seed quality and net monetary returns in soybean. Among the various seed treatments, T_4 (*Anabaena Rh* in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) was found to be promising with respect to higher seed recovery (91.55%), test weight 1000 seeds (116.86) including seed quality parameters viz. Germination (86 %), seedling vigour index – I (1954) and seedling vigour index - II (1914). The economic indicators also exhibited superiority with respect to net monetary returns (Rs. 157578 /-) and Benefit Cost ratio (2.9) in case of T_4.

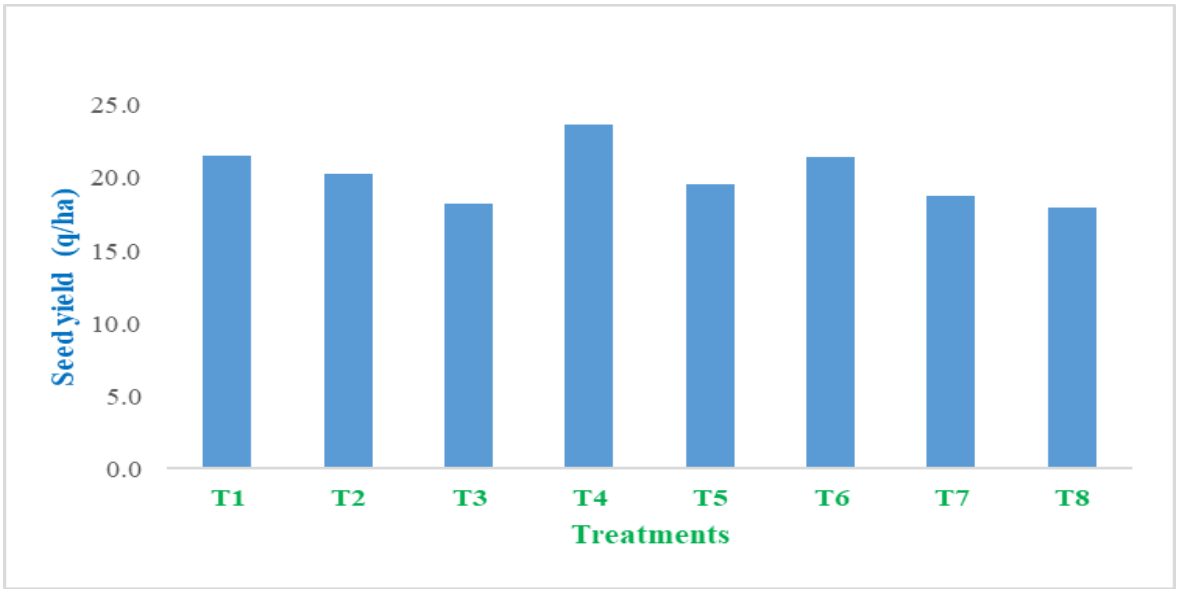


Fig. 1.20: Effect of PGPR mediated seed coating on seed yield in soybean

Significant Observation:

The seed coating treatment combination, T_4 (Anabaena Rh in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) resulted in significant increase in field emergence (79.96%), plant stand establishment (38.38), plant height at 30 DAS (32.75 cm)

and seed yield (19.87 g/plant, 2.85 kg/plot and 23.65 q/ha), including net monetary returns (Rs. 157578/-) and Benefit Cost ratio (2.9).

Conclusion: Seed coating with PGPR formulations (*Anabaena Rh*) was effective in improving the plant growth, seed yield (9.6%), seed quality parameters as well as reducing the cost of inputs viz., fertilizers in soybean, hence ensuring higher profitability to the farmers in terms of net monetary returns (5.5%) and BC ratio.

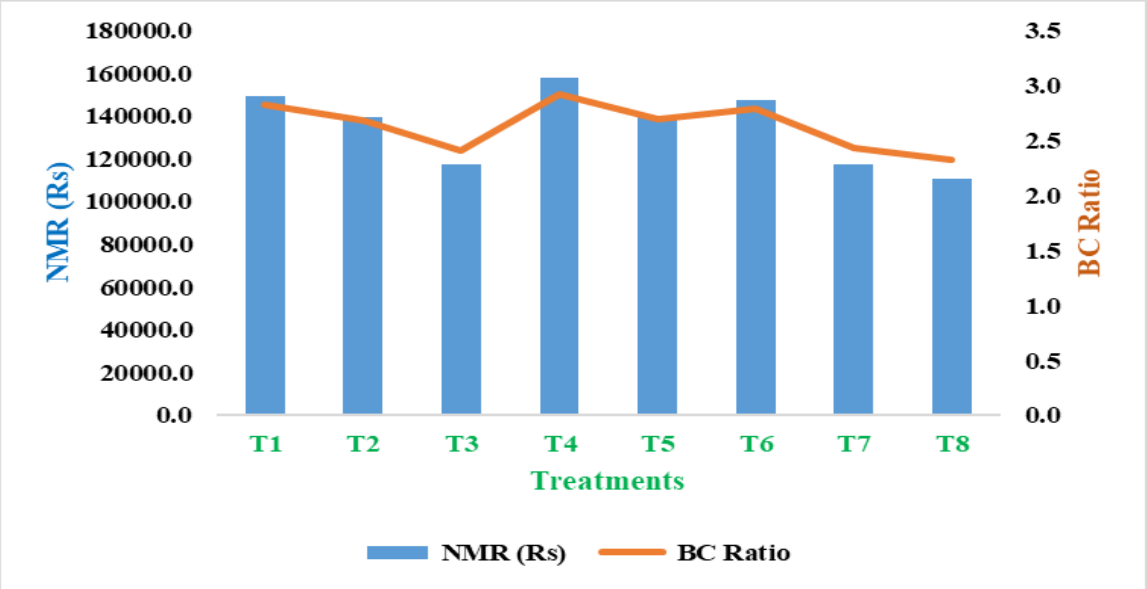


Fig. 1.21: Effect of PGPR mediated seed coating on economic indicators in soybean

Chickpea

Unified observation: The experiment was conducted during *Kharif* 2023 at five centres namely, ICAR-IARI, New Delhi; MPKV, Rahuri; PDKV, Akola; JNKVV, Jabalpur and RARI, Durgapura. The treatment details are given below:

Treatments	Treatment details
T_1	Recommended practice (Thiram + Bavistin (2:1) @ 3 g/kg in combination with *Rhizobium* and RDF) - Control
T_2	T2: Recommended practice (Thiram + Bavistin (2:1) @ 3 g/kg in combination with *Rhizobium* and 75% N + Full dose of P, K*)*
T_3	*Anabaena Rh* (75% N + Full dose of P, K)
T_4	*Anabaena R*h in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)
T_5	BF1-4 Cyanobacterium consortium (75% N + Full dose of P, K)
T_6	BF1-4 Cyanobacterium consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)

T_7	*Anabaena laxa* (75% N + Full dose of P, K)
T_8	*Anabaena tr* (75% N + Full dose of P, K)
***Sowing method**: Direct sowing @ 60-80 kg seed / ha, depth of sowing: 6-8 cm*	

Chickpea (desi) - The detailed mean data over locations is presented below:

A. Effect of PGPR seed coating on plant growth and seed yield attributes (Mean over locations): The results revealed that PGPR seed treatments exhibited significant effect on the plant growth and seed yield attributes. Among the different seed treatments, T_6 (BF1-4 Cyanobacterium consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) was found to be superior with respect to field emergence (85 %), no. of nodules/ effective nodules per plant (19.83), leaf Chlorophyll content (SPAD value - 36.08), and seed yield (23 g/plant, 1.77 kg/plot and 19.69 q/ha). The same treatment also recorded lesser with respect to plant stand establishment (37.44), no. of pods/plant (69.1) and seed health infection (0.57) and plant height at 30 DAS (22.7) and harvest (64.8 cm). However, T_4 was at par with T_6 with respect to seed yield and it was found superior in case of plant height at 30 DAS and harvest (23.6 and 66 cm) and plant stand establishment (37.8).

B. Effect of PGPR seed coating on seed recovery, seed quality and economic indicators (Mean over locations): The mean over locations revealed that seed coating treatments had a significant effect on test weight, seed quality attributes (seed germination, vigour index), net monetary returns and BC ratio. Among the various seed treatments, T_6 (BF1-4 Cyanobacterium consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg) was found to be promising with respect to seed quality parameters viz. Germination (95 %) and seedling vigour index I (2749). The net monetary returns also exhibited superiority with respect in case of T_6 (Rs. 129372/-), followed by T_4. (Rs. 123130 /-). However, BC Ratio was highest in case of T_4 (2.23).

Significant Observation:

Seed treatment with BF1-4 Cyanobacterium consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (T_6) resulted in significant increase in field emergence (85%), no. of nodules/ effective nodules per plant (19.83) and seed yield (19.69 q/ha), including net monetary returns (Rs. 129372 /-), followed by T_4.

Conclusion: Seed treatment with T_6 (BF1-4 Cyanobacterium consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg) and T_4 give considerably higher seed yield (14.7 -14.8%) and NMR (4.01-4.72%) as compared to other treatments.

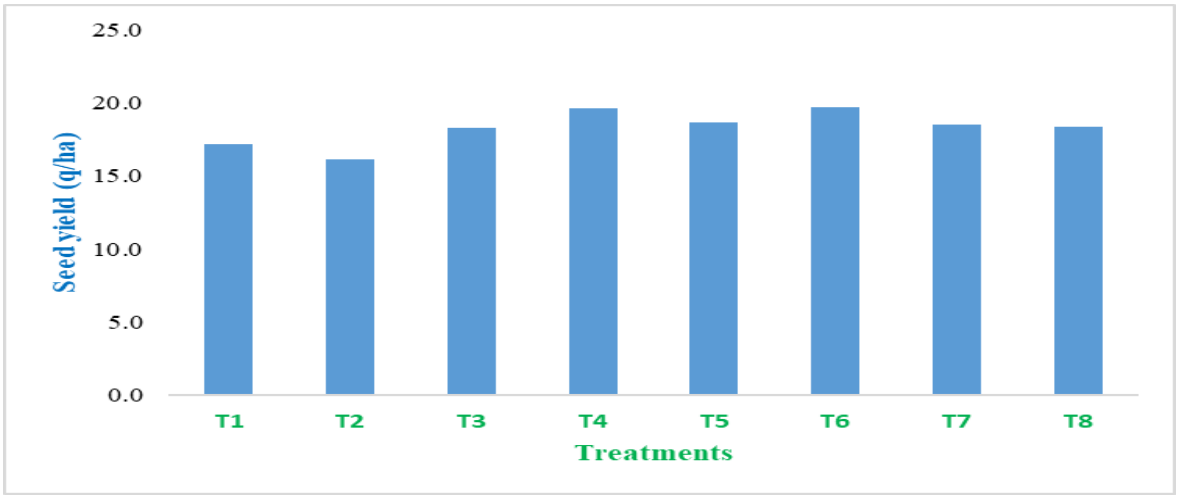


Fig. 1.22: Effect of PGPR mediated seed coating on seed yield of chickpea (desi)

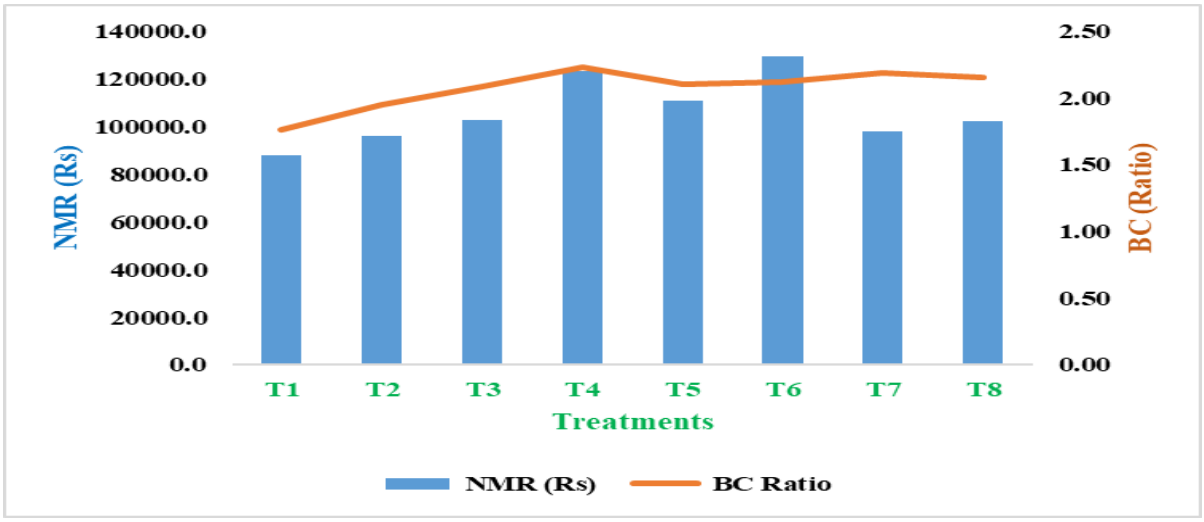


Fig. 1.23: Effect of PGPR mediated seed coating on economic indicators in chickpea (desi)

Chickpea (Kabuli) - The detailed mean data over locations is presented below:

A. Effect of PGPR seed coating on plant growth and seed yield attributes in Chickpea (Mean over locations): The PGPR seed treatments exhibited significant effect on the plant growth and seed yield attributes. Among the different seed treatments, T_6 (BF1-4 *Cyanobacterium* consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) was found to be superior with respect to field emergence (83 %), no. of pods/ plants (79.6), plant height at harvest (64.36 cm). The same treatment also recorded lesser at plant stand establishment (33.3 m^2), leaf Chlorophyll content (SPAD value – 37.09) and plant height at 30 DAS (21.6). However, non-uniformity was observed among the different centers with reference to seed yield. Also, T_4 showed higher seed yields (24.3 g/plant, 1.7 kg/plot and 18.5 q/ha).

B. Effect of PGPR seed coating on seed recovery, seed quality and economic indicators in in Chickpea (Mean over locations): The mean over locations revealed that seed coating treatments had a significant effect on seed recovery, seed quality attributes (seed germination, vigour index), net monetary returns and BC ratio in maize (Table 4.2). Among the various seed treatments, T_6 (BF1-4 Cyanobacterium consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) was found to be promising with respect to, seed recovery (92.5%) and seed quality parameter i.e., seedling vigour index I (2714). However, the seed yield (18.5 q/ha) and economic indicators was found superior in case of net monetary returns (Rs. 169711/-) and Benefit Cost ratio (2.84) in case of T_4.

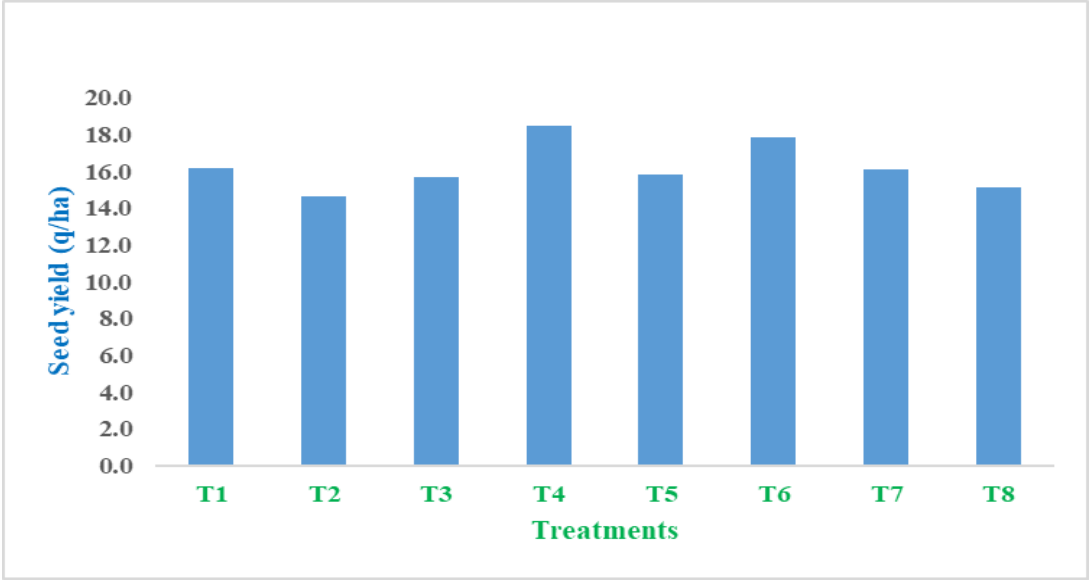


Fig 1.24: Effect of PGPR mediated seed coating on seed yield of Chickpea (kabuli)

Significant Observation:

Mean data over locations revealed that the seed coating treatment combination, T_6 (BF1-4 *Cyanobacterium* consortium in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K)) resulted in significant increase in field emergence (83 %), plant height at harvest (64.36 cm), seed recovery (92.5%) and seed quality parameter i.e., seedling vigour index I (2715). However, this treatment (T_6) also recorded lesser in case of seed yield as compared to other treatments.

Conclusion:

It can be concluded that T_4 (*Anabaena R*h in combination with Thiram + Bavistin (2:1) @ 3 g/kg (75% N + Full dose of P, K) give considerably higher seed yield (14.5%) as compared to other treatments.

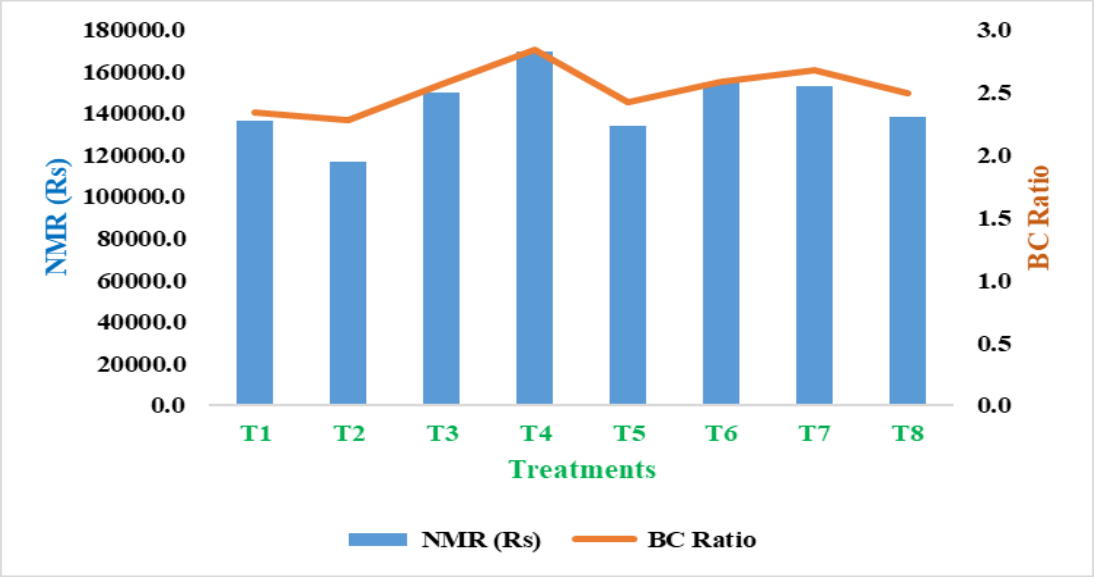


Fig 1.25: Effect of PGPR mediated seed coating on economic indicators in Chickpea (kabuli)

❖ **Evaluation of liquid bio-fertilizers in enhancing seed yield and quality**

Soybean

Unified Observation: The experiment was conducted at six locations viz., VNMKV, Parbhani; JNKVV, Jabalpur; ICAR-IISS, RS, Bengaluru; GBPUAT, Pantnagar; MPKV, Rahuri and PAU, Ludhiana to evaluate the effectiveness of liquid biofertilizers on seed yield and quality using variety, JS 20- 116. However, the experimental data was not reported by PAU, Ludhiana, as the variety JS 20-116 was found to be highly susceptible to MYMV and the crop succumbed to the disease.

The treatment details are given below:

Treatments	Treatment details
T_1	No seed treatment – Control
T_2	SRDF + Recommended seed treatment practice (Thiram + Bavistin (2:1) @ 3 g/kg in combination with Rhizobium @ 5 g/kg seed
T_3	SRDF + seed treatment with Jawahar EM culture @ 20 ml/kg seed
T_4	SRDF + seed treatment with Jawahar PSB @ 20 ml/kg seed
T_5	SRDF + seed treatment with Jawahar KSB @ 20 ml/kg seed
T_6	SRDF + seed treatment with Jawahar *Azospirillum* @ 20 ml/kg seed
T_7	SRDF + seed treatment with Jawahar *Pseudomonas* @ 20 ml/kg seed
T_8	SRDF + seed treatment with Jawahar Rhizobium culture @ 20 ml/kg seed

Sowing method: *Direct sowing @ 70 kg seed/ha; depth of sowing: 4-5cm*

Note: The seeds were treated with liquid inoculum strains @ 20 ml per kg seed at JNKVV, Jabalpur (2.52 ml per 126 gm seed for each replication per treatment) and supplied to the cooperating centres.

Effect of seed treatment with liquid biofertilizer on plant growth and seed yield attributes in soybean: Among the different seed treatments, T_3 (SRDF+ seed treatment with Jawahar EM culture @ 20 ml/kg) was found to be superior with respect to field emergence (75.5%), leaf chlorophyll content (46.6), no. of nodules/plant (47), plant height at harvest (53.3 cm) and seed yield (18.53 g/ plant, 2.9 kg/plot and 25.5 q/ha) as compared to T_2 (SRDF + Recommended seed treatment practice (Thiram + Bavistin (2:1) @ 3 g/kg in combination with Rhizobium @ 5 g/kg seed), Further, the same treatment was found to be promising in terms of higher seed recovery (87.8%), including economic indicators viz. net monetary returns (Rs. 142545.1) and Benefit Cost ratio (2.5) **The NMR and BC Ratio were not reported by GBPUAT, Pantnagar. Moreover, the values of seed yield were not in line with other centres.**

Significant Observation: It was revealed that the seed coating treatment combination, T_3 (SRDF + seed treatment with Jawahar EM culture @ 20 ml/kg) resulted in significant increase in field emergence (75.5%), plant height at harvest (53.3 cm), and seed yield (18.53 g/ plant 2.9 kg/plot and 25.5 q/ha), including net monetary returns (Rs. 142545.1) and Benefit Cost ratio (2.5).

Conclusion: Seed treatment with Jawahar EM culture @ 20 ml/kg + SRDF (T_3) gave considerably higher seed yield (3.2%) in comparison to other treatments. The experimentation will be continued for one more year to draw logical conclusions.

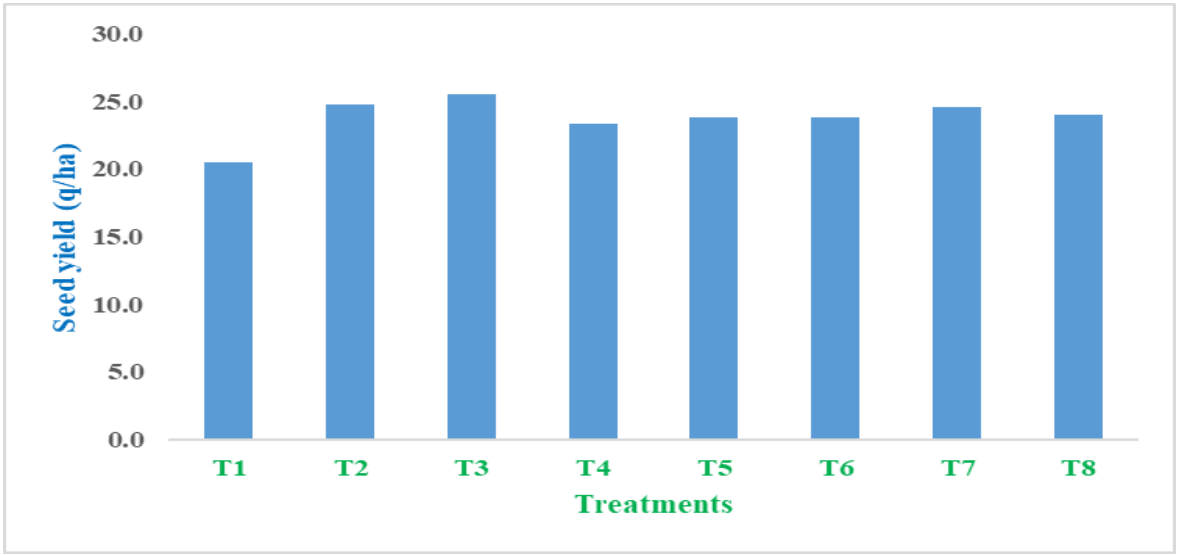


Fig 1.26: Effect of liquid bio-fertilizer on seed yield in soybean

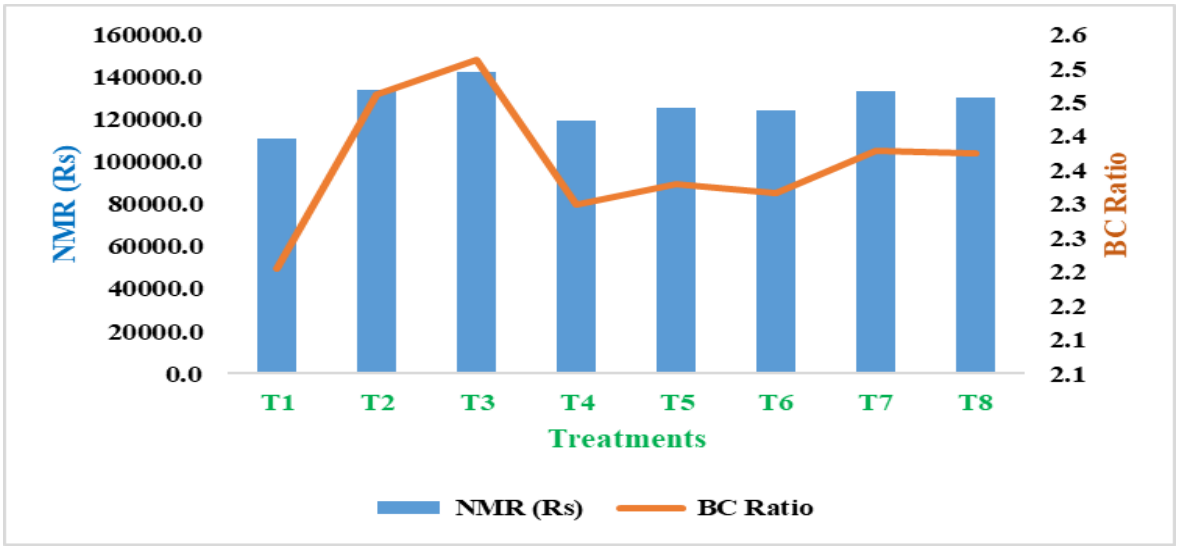


Fig 1.27: Effect of liquid bio-fertilizer on economic indicators in soybean

B. Seed Physiology, Storage and Testing

Experiment 1: To reaffirm the validity periods of certified seeds of field crops (as per the IMSCS regulations)

Crop – Castor

Centre: JAU, Junagadh

Packaging materials significantly affected all studied characters except for DCH-177 in seedling length, seed vigour index-I, and seedling dry weight. ICH-66 maintained germination above IMSCS (70 %) up to 17 months in Jute bags (71.25 %) and 19 months in HDPE bags (70.25 %). DCH-177 maintained germination above IMSCS (70 %) up to 20 months in Jute bags (70.25 %) and 21 months in HDPE bags (71.50 %). Castor hybrid seeds showed better storability in HDPE bags compared to Jute bags under ambient conditions. DCH-177 seeds exhibited better storability compared to ICH-66 seeds under ambient conditions.

Centre: PJTSAU, Hyderabad

ICH-66 and DCH-177 maintained germination above IMSCS in Jute and HDPE bags for up to 12 months. No significant difference was observed in storage conditions affecting germination.

Centre: OUAT, Bhubaneswar

An increase in storage period led to a slight increase in seed moisture content, more pronounced in cloth bags than HDPE bags. Germination, first count, seedling growth, and vigour indices declined with increasing storage period. After fifteen months, the mean germination of ICH-66 and DCH-177 decreased to 60.8% and 56.8%, respectively. HDPE bags recorded higher germination (67.7%) compared to cloth bags (50.0%) after fifteen months.

Centre: TNAU, Tamil Nadu

Seeds stored in HDPE bags showed better seedling emergence, vigour index, and field emergence compared to Jute bags. HDPE bags maintained IMSCS-recommended germination for 15 months in ICH-66 and 6 months in DCH-177, while Jute bags maintained IMSCS-recommended germination for 12 months in ICH-66 and 4 months for DCH-177. Moisture content increased during storage, more in Jute bags compared to HDPE bags. HDPE bags provided better storage conditions for maintaining seed quality and germination rates compared to Jute bags, with DCH-177 generally exhibiting better storability than ICH-66.

Crop: Pearl Millet

Centre: CCSHAU, Hisar

RHB-233 and RHB-234 hybrids and HHB-67 maintained germination above IMSCS (>75%) during storage. HDPE bags maintained significantly higher seed quality parameters compared to Jute bags. RHB-233 in HDPE bags-maintained germination above IMSCS for 11 months,

while RHB-234 maintained it for 10 months from harvesting. HHB-67 in HDPE bags-maintained germination above IMSCS for 13 months, and in Jute bags, also for 13 months.

Centre: JAU Junagadh

RHB-233 and RHB-234 hybrids-maintained germination above IMSCS (75%) up to 9 months in Jute bags and 11 months in HDPE bags from harvesting. Seed viability loss was more pronounced in Jute bags than HDPE bags. HDPE bags provided better storability for pearl millet hybrid seeds under ambient conditions.

Centre: MPKV Rahuri

RHB-233 maintained significantly higher germination than RHB-234 throughout the storage period. HDPE bags showed higher germination compared to jute bags. The results indicate that HDPE bags are more effective in maintaining seed quality and germination rates for pearl millet hybrids compared to Jute bags. RHB-233 exhibited higher storability compared to RHB-234, with HDPE bags.

Crop: Sorghum

Centre: PDKV Akola

Sorghum varieties CSV 15 and CSV 32 F were stored in both cloth bags and HDPE bags. Germination percentages varied over time and between storage containers. Both varieties maintained IMSCS-recommended germination (70%) for certain periods, depending on storage conditions.

Centre: TNAU Coimbatore

Sorghum variety CSV 15 maintained IMSCS recommended germination (70%) up to one month of storage, while CSV 32 F maintained it up to four months, depending on storage conditions. HDPE bags generally maintained higher seed vigour and germination percentages compared to Jute bags.

Centre: VNMKV Parbhani

Experiment conducted to study the planting values of sorghum seeds obtained in August 2023. Storage periods negatively impacted seed viability parameters, germination percentages decreased with increasing storage duration and varied based on the packaging material used.

Crop: Finger millet

Centre: UAS, Dharwad

Finger millet variety Maruthi's seed quality parameters were significantly affected during storage. Seeds stored in HDPE bags maintained higher seed quality attributes compared to those stored in cloth bags.

Centre: UAS, Bengaluru

Different finger millet varieties (Maruthi, MR-6, ML-365) stored in cloth bags and HDPE bags had varying moisture content and germination percentages. Germination percentages varied depending on the variety and packaging material, with some varieties maintaining IMSCS recommended germination percentages for certain periods.

Centre: OUAT, Bhubaneshwar

Moisture content increased slightly with storage period, more pronounced in cloth bags compared to HDPE bags. Seeds stored in HDPE bags generally maintained higher germination percentages compared to cloth bags.

Centre: BSKKV, Dapoli

Finger millet seeds stored in HDPE bags experienced fewer moisture content fluctuations than those stored in Jute bags. Initial germination percentages declined over storage periods, especially in seeds stored in Jute bags. Seeds stored in HDPE bags-maintained germination above IMSCS (75%) for up to three months of storage in Konkan conditions.

Crop: Barnyard millet

Centre: MPKV Rahuri

Seed germination of barnyard millet varieties was monitored monthly, with variety DHBM 93-2 showing superiority over other varieties. HDPE bags generally exhibited numerically higher germination rates compared to cloth bags. Moisture content varied among varieties, with Phule Barti recording higher moisture content than DHBM 93-2 in December 2023. DHBM 93-2 exhibited higher germination, seedling vigour index-I, and seedling vigour index-II compared to DHBM 93-3 and Phule Barti varieties.

Crop: Foxtail millet

Centre: UAS, Raichur

First count: The highest first count (88.90%) was observed in the SiA 3156 (T1) lot stored in an HDPE bag, while the lowest (79.58%) was noticed in the DHFT 109-3 (T4) lot stored in a cloth bag after one month of storage. After six months, the SiA 3156 lot in an HDPE bag maintained the highest first count (80.91%), whereas the lowest (70.56%) was in the DHFT 109-3 lot stored in a cloth bag.

Seed germination: After six months, SiA 3156 lot in HDPE bag recorded the highest germination (88.25%), while the lowest (81.40%) was in DHFT 109-3 lot stored in cloth bag.

Seedling vigour index: After six months, the T1 lot in the HDPE bag maintained the highest seedling vigour indices (1565 and 108), while the lowest was in the T4 lot stored in the cloth bag (968 and 87).

Field emergence and final plant establishment: After one month, the T1 lot stored in an HDPE bag recorded the highest field emergence and final plant establishment (92.50% and 96.38%), with the lowest in the T4 lot stored in a cloth bag (86.00% and 88.00%).

Centre: SKNAU, Jobner

Foxtail millet varieties-maintained germination above IMSCS in both jute/cloth bags and HDPE bags for an extended period, with no decline observed till the date of the report.

Inference:

Castor	**ICH 66**		**DCH 177**	
	Jute bag	**HDPE bag**	**Jute bag**	**HDPE bag**
JAU, Junagadh	17 months	19 months	20 months	21months
PJTSAU, Hyderabad	12 months	12 months	12 months	12 months
OUAT, Bhubaneswar	07 months	14 months	05 months	05 months
TNAU, Coimbatore	12 months	15 months	04 months	06 months

Pearl millet	**RHB-233**		**RHB-234**	
	Jute bag	**HDPE bag**	**Jute bag**	**HDPE bag**
CCSHAU, Hisar	06 months	06 months	06 months	06 months
JAU, Junagadh	09 months	11 months	09 months	10 months
MPKV, Rahuri	09 months	11 months	09 months	11 months

Sorghum	**CSV 15**		**CSV 32**	
	Jute bag	**HDPE bag**	**Jute bag**	**HDPE bag**
PDKV, Akola (Expt contd as G% is >IMSCS)	03 months	06 months	06 months	06 months
TNAU, Coimbatore	01 months	01 months	04 months	04 months
VNMKV, Parbhani (Expt shd be contd as G% is >IMSCS)	06 months	06 months	06 months	06 months

Finger millet	Maruthi		MR-6		ML-365	
	Jute bag	**HDPE bag**	**Jute bag**	**HDPE bag**	**Jute bag**	**HDPE bag**
UAS Dharwad	06 months	06 months				
UAS Bengaluru (Expt contd as G% is >IMSCS)	06 months	06 months	06 months	06 months	06 m	06 m
	Maruthi		Arjun			
OUAT Bhubaneshwar	07 months	07 months	07 months	07 months		
BSKKV Dapoli	01 months	03months				

Barnyard millet	DHBM 93-2	DHBM 93-3	Phule Barti

MPKV Rahuri (Expt shd be contd as G% is >IMSCS)	Germination % is above 90 during two months of storage after the inception of the experiment and is in continuation.

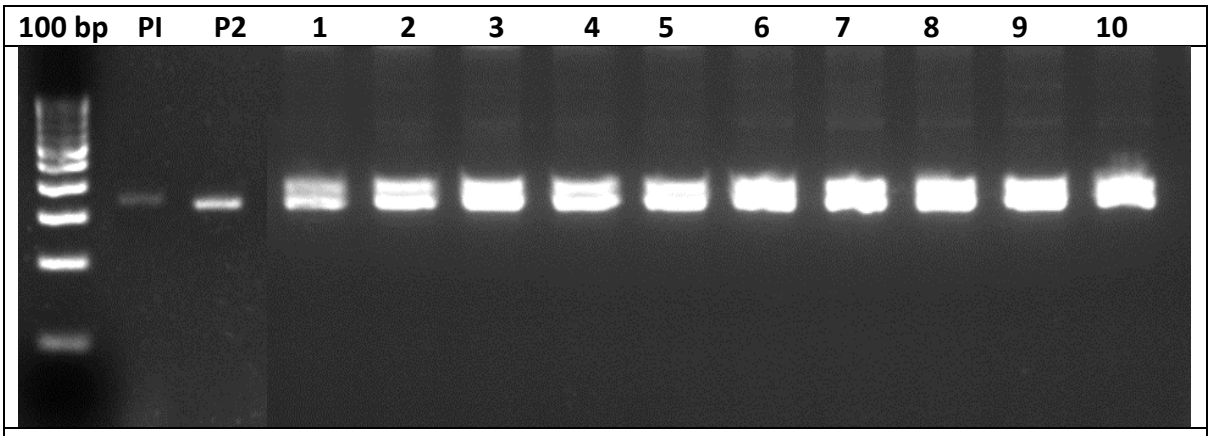
Foxtail millet	SiA 3156		DHFT 109-3	
	Jute bags	**HDPE bags**	**Jute bags**	**HDPE bags**
UAS Raichur (Expt contd as G% is >IMSCS)	06 months	06 months	06 months	06 months
SKNAU Jobner (Expt contd as G% is >IMSCS)	06 months	06 months	06 months	06 months

Experiment 2: Hybrid purity testing using molecular markers in public sector hybrids of field crops

Crop: Castor

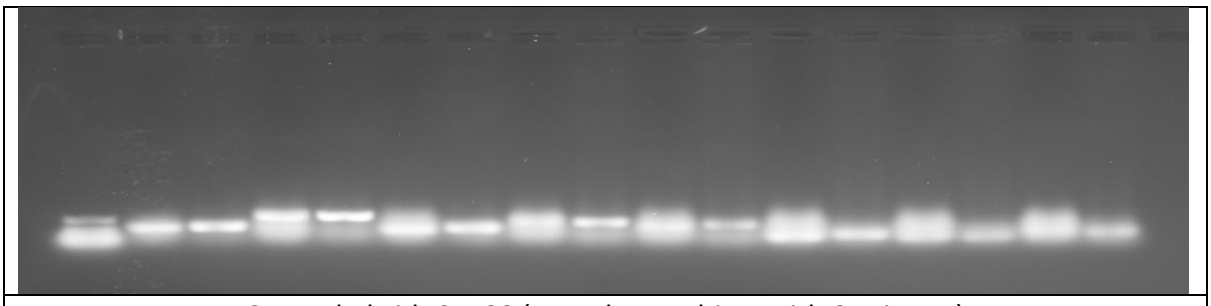
Centre: PJTSAU Hyderabad

The castor hybrid (ICH 66) 's hybridity was tested using a designated marker (mRcDOR-07) and resolved on a 3.5% Agarose gel.



Castor hybrid ICH-66 confirmed with marker mRcDOR-07

Centre: ICAR-IIISS, Mau



Castor hybrid ICH-66 (no polymorphism with 8 primers)

Crop: Maize

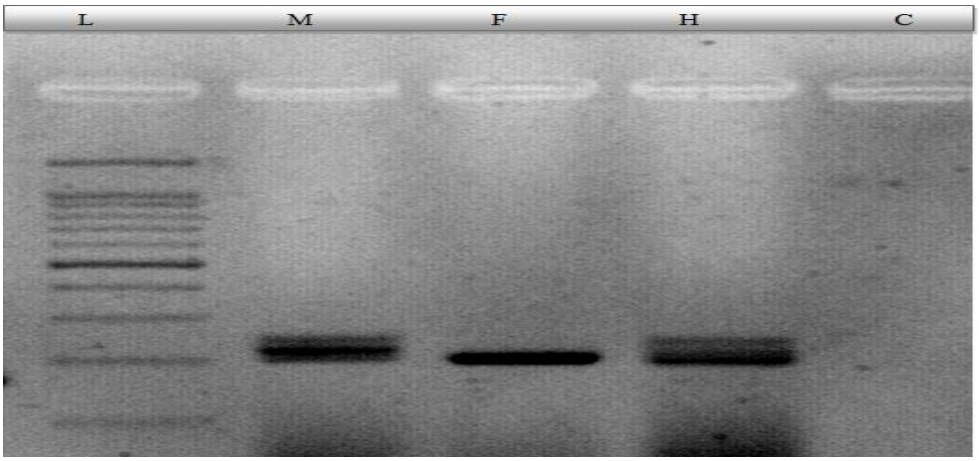
Centre: ICAR-IISS, Mau

Hybrid purity of different maize hybrids was assessed with delineated markers earmarked by the developing centre; however, no polymorphism was observed.

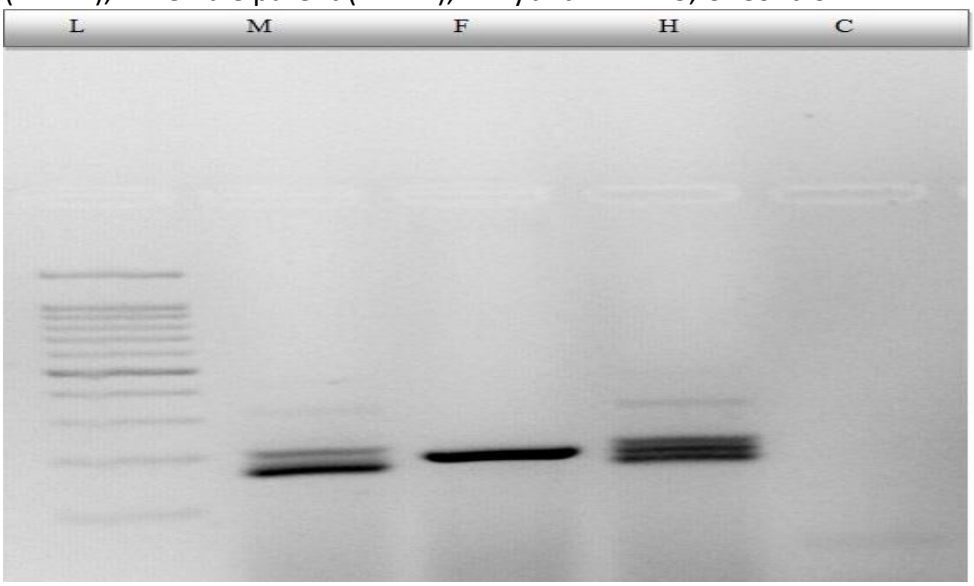
Centre: PAU Ludhiana

Hybrids: PMH 13; Female parent: LM 27; Male parent: LM 17

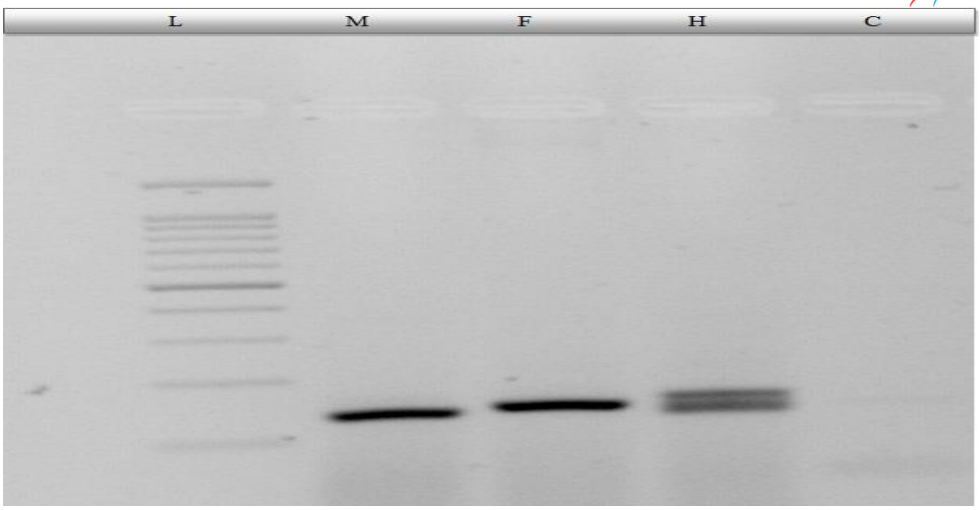
SSR markers bnlg381, phi053, and umc 1066 can distinguish parental lines LM 17 and LM 27 of the maize hybrid PMH 13 and can be used to test the hybrid purity of PMH 13 seed lots.



DNA banding pattern using SSR marker bnlg 381. L- Ladder, M-Male parent (LM 17), F- Female parent (LM 27), H-Hybrid PMH 13, C- Control.



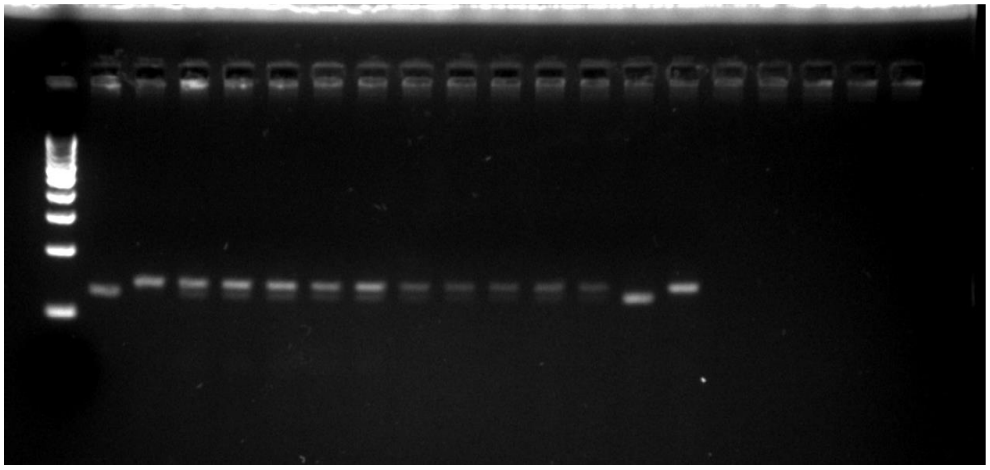
DNA banding pattern using SSR marker phi 053. L- Ladder, M- Male parent (LM 17), F- Female parent (LM 27), H- Hybrid PMH 13,C- Control



DNA banding pattern using SSR marker umc 1066. L- Ladder, M-Male parent (LM 17), F-Female parent (LM 27), H-Hybrid PMH 13, C- Control.

Centre: PJTSAU Hyderabad

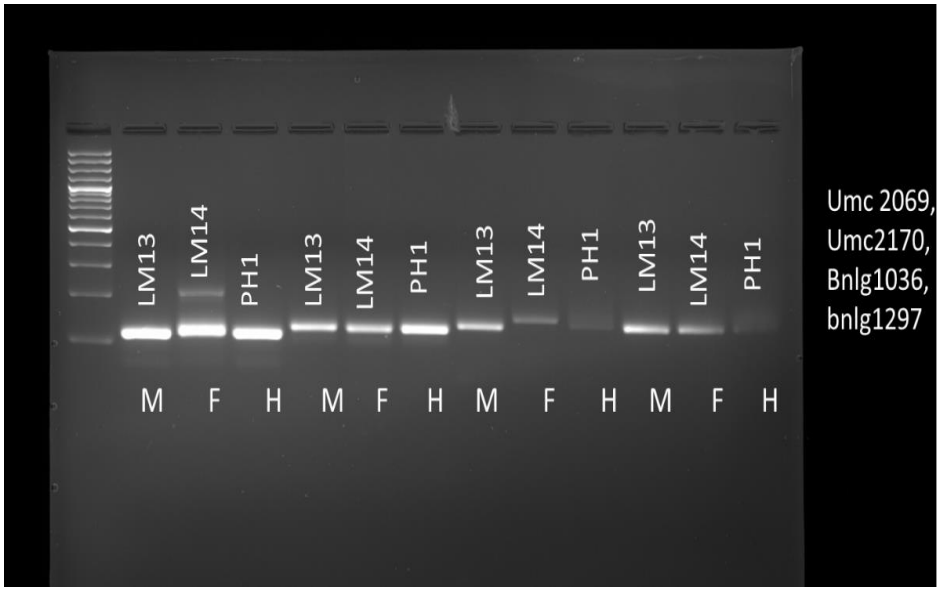
The marker *umc* 1627 confirmed the hybridity for maize hybrid PMH-10.



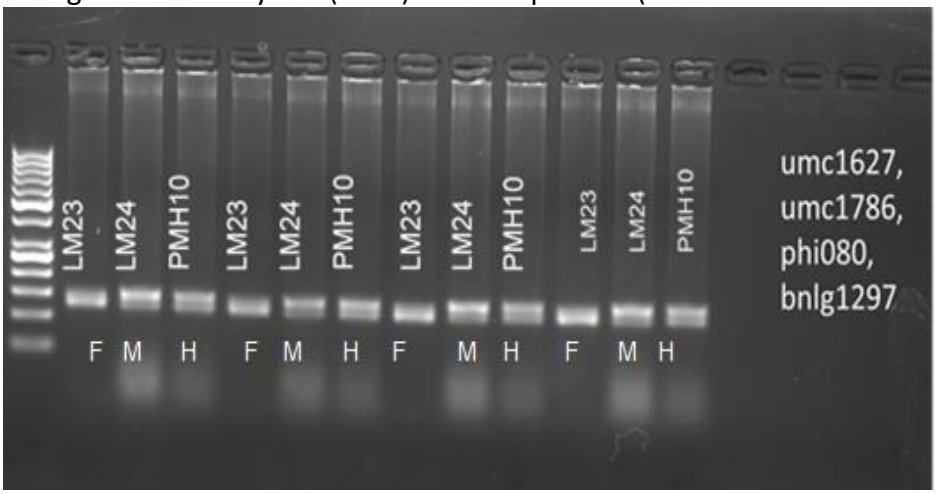
Maize hybrid PMH-10 confirmation with marker *umc* 1627.

Centre: SKUAST Srinagar

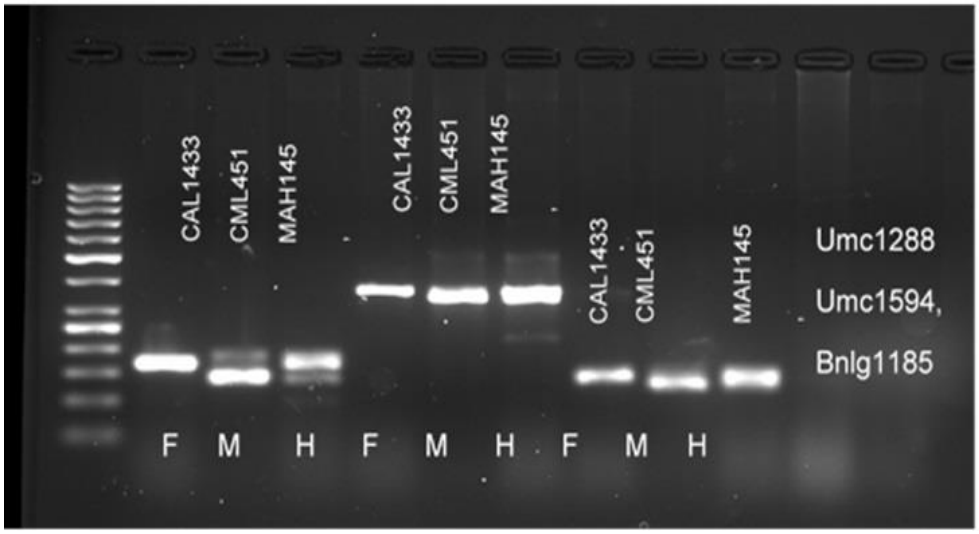
Three maize hybrids along with six inbred lines were received from two cooperating STR centers to validate the identified markers for establishing hybridity. Hybrid (MAH-145) and its two parents (inbred viz CML-1433 & CML-451) received from UAS, Bangalore for revalidation of hybrid purity testing. Two hybrids namely (PMH10) and its two parents (inbred lines *viz*. LM-23, LM-24) and (PH-1) and two parents (inbred viz LM13 & LM14) were received from PAU, Ludhiana for revalidation of hybrid purity testing.



Validation of four SSR markers (Umc2069, Umc2170, Bnlg1036, Bnlg1297) each against maize Hybrid (PH-1) and two parents (inbred viz LM13 & LM14)



Validation of four SSR markers (Umc1627, Umc1786, PHI080, Bnlg1297) each against hybrid (PMH10) and its two parents (inbred lines viz LM-23, LM-24)



Validation of 3 markers (Umc1288, Umc1594, and Bnlg1185) each against hybrid (MAH-145) and its two parents (inbred vizCML-1433&CML-451)

Crop: Paddy

The SSR marker RM 228 was successfully validated for establishing hybridity in the rice hybrid JRH 19. Referred validation was observed at AAU, Jorhat; ICAR-IISS, RS, Bengaluru; KAU RARS Pattambi; PJTSAU, Hyderabad; PAJANCOA, Karaikal; and TNAU, Coimbatore where marker RM 288 effectively confirmed hybridity in the same hybrid. Conducted a comparative analysis of the cost involved in genetic purity assessment using DNA fingerprinting with SSR markers and the Grow-Out Test method. It was found that the DNA fingerprinting method was relatively more expensive but offered quick, accurate, and reliable results, augmenting the entire process of genetic purity assessment.

Comparative analysis of molecular markers vs GOT for hybridity testing: TNAU, Coimbatore

Details for each crop	**Description**
Name of Crop	Paddy
Name of Hybrid	JRH 19
Name of Unique Primer validated	RM 228
Forward Primer Sequence	5'-GCTTGCGGCTCTGCTTAC-3
Reverse Primer Sequence	5'-CTGGCCATTAGTCCTTGG-3'
Name of Centre which identified Unique Primer and Protocol	JNKVV, Jabalpur
Name of Centre which Modified Protocol, if any	-
Cost of Conduct of Molecular Analysis: Cost of Conduct of GOT for each hybrid	Rs.6991/ for molecular analysis Rs.4200/- for GOT method

Crop: Pearl millet

MPKV, Rahuri

The PSMP-2089 SSR primer was successfully validated for establishing hybridity in the pearl millet hybrid Phule Adishakti and its parental lines DHLB 8 A (A line) and DHLBI 967 (R line). The cost analysis revealed that DNA fingerprinting using molecular markers incurred a lower cost (Rs. 325.00) compared to the GOT (Rs. 565.00), the experiment underscores the utility of molecular markers, specifically the PSMP-2089 SSR primer, in efficiently establishing hybridity and assessing hybrid purity in pearl millet hybrids.

Crop: Sunflower

AAU Jorhat

Markers ORS 513 and ORS 613 were validated for establishing hybridity in the sunflower hybrid KBSH 41, while ORS 716 was validated for hybrid KBSH 44. Additionally, markers ORS 621 and ORS 811 were validated for hybrid KBSH 53. These markers effectively distinguished between the CMS line, R Line, and the hybrids, confirming their utility in assessing hybridity.

PJTSAU Hyderabad

Marker ORS 613 was validated for hybridity confirmation of KBSH 41, and ORS 716 for hybrid KBSH 44.

Inference:

Crops	Center	Salient achievement
Castor	ICAR-IISS, Mau	No polymorphism was attained in Castor hybrid ICH-66 (with 8 primers).
	PJTSAU, Hyderabad	Marker mRcDOR-07 confirmed the hybridity of castor hybrid ICH-66.
Maize	ICAR-IISS, Mau	Hybrid purity of different maize hybrids was assessed with delineated markers earmarked by the developing centre; however, no polymorphism was observed.
	PAU, Ludhiana	SSR markers bnlg381, phi053, and umc 1066 can distinguish parental lines LM 17 and LM 27 of the maize hybrid PMH 13 and can be used to test the hybrid purity of PMH 13 seed lots. SSR marker bnlg 2122 could distinguish maize hybrid PMH 14 from its parental lines LM 28 and LM 29 and can be used for testing hybrid purity of PMH 14 seed lots.
	PJTSAU, Hyderabad	The marker *umc* 1627 confirmed the hybridity for maize hybrid PMH-10.
	SKUAST, Srinagar	Markers, namely Umc 1627, Umc 1786, PHI080, and Bnlg1297, confirmed the hybridity of PMH10 and its two parents (inbred lines LM-23 and LM-24). Markers namely Umc 2069, Umc 2170, Bnlg 1036, Bnlg1297 confirmed the hybridity for PH-1 and two parents (inbred viz LM13 & LM14). Markers Umc 1288, Umc 1594, Bnlg 1185 confirmed the hybridity for hybrid MAH-145 and its two parents (inbred viz CML-1433 & CML-451).
Paddy	AAU, Jorhat	The marker RM 228 confirmed the hybridity for paddy hybrid JRH-19.
	KAU, RARS, Pattambi	
	PJTSAU, Hyderabad	
	PAJANCOA & RI, Karaikal	
	TNAU, Coimbatore	
	ICAR-IISS, RS, Bengaluru	
Pearl millet	MPKV, Rahuri	The marker PSMP2089 for Phule Adishakti confirmed the hybridity.
Sorghum	JNKVV, Jabalpur	Not Reported any results
	PJTSAU, Hyderabad	Not Reported any results
Sunflower	AAU, Jorhat	Markers ORS 513 and ORS 613 were validated for establishing hybridity in the sunflower hybrid KBSH 41,

		while ORS 716 was validated for hybrid KBSH 44. Additionally, markers ORS 621 and ORS 811 were validated for hybrid KBSH 53
	PJTSAU, Hyderabad	Marker ORS 613 was validated for the sunflower hybrid KBSH 41 and ORS 716 for KBSH 44 hybrid

Experiment 3: Physiological studies and development of priming technologies for enhancing planting value of seed in field crops under optimal and sub-optimal conditions

Objective 1: Standardization of priming technologies for enhancing planting value of seed under optimal and sub-optimal conditions in selected field crops

Crop: Barley

CSKHPKV, Palampur

Prechilling: BHS 400 old seed lot was prechilled for 7 days at 5 °C. When evaluated at 20°C, showed significantly higher first count (97.67%), germination (97.67%), SVI-II (1.43), and higher field emergence (93.33%) under suboptimal conditions (low temperature). It also showed no incidence of seed-borne pathogens compared to the untreated control, which gave the highest values among untreated controls for first count (96.00%), germination (96.00%), SVI-I (2141.20), SVI-II (1.05), and field emergence (88.67%) under suboptimal conditions (low temperature).

Thermopriming: BHS 380 fresh lot thermoprimed for 6 hours at 35°C, when evaluated at 20°C, showed significantly higher first count (97.67%), germination (97.67%), SVI-I (2311.45), SVI-II (1.27), and field emergence (95.33%) under suboptimal conditions (low temperature). It also showed no incidence of seed-borne pathogens compared to the untreated control, which gave the highest values among untreated controls for first count (96.00%), germination (96.00%), SVI-I (2141.20), SVI-II (1.05), and field emergence (88.67%) under suboptimal conditions (low temperature).

Hydropriming: BHS 400 old seed lot hydroprimed for 6 hrs. using a 1:1 ratio, when tested at 20°C, showed significantly highest first count (98.00%), germination (98.00%), higher SVI-I (2328.91), SVI-II (1.54), and field emergence (83.33%) under suboptimal conditions (low soil moisture, i.e., 21.51%). It also showed no incidence of seed-borne pathogens compared to the untreated control, which gave the highest values among untreated controls for first count (96.00%), germination (96.00%), SVI-I (2141.20), SVI-II (1.05), and field emergence (80.67%) under suboptimal conditions (low soil moisture, i.e., 21.51%).

ICAR-IISS, Mau

Results achieved revealed that there was no significant effect of deployed priming treatments on referred seed lots of varieties (DWBR 101 and DWBR 123). However, among the priming

treatments, hydro-priming at 20°C for 11 hours and 19 hours, respectively, had an advantage with respect to vigour indices.

PAU, Ludhiana

Barley variety DWRUB 52; priming with 10 ppm ethrel at 25°C recorded the highest enhancement in seedling length and vigour index I compared to control. However, the highest enhancement in seedling length and vigour index I was recorded in hydroprimed seeds at 15°C compared to control.

RPCAU, Pusa

Hydropriming barley seeds resulted in significantly higher first count, germination, mean seedling length, dry weight, and vigour indices than the control and all the treatments followed by prechilling treatment. Thermopriming seeds for 24 hours at 35°C could not significantly improve seed quality parameters over the control.

Crop: Oats

CCSHAU, Hisar (2023-24)

Hormopriming enhanced seed quality parameters, with maximum enhancement in germination observed at a GA_3 concentration of 600ppm. Older seed lots showed more enhancement in germination compared to fresh seed lots. In variety OS 6 (old seed lot), GA_3@600ppm resulted in 16.96% enhancement in germination over control. In variety HFO 611, enhancement in seed germination of hormoprimed seeds with GA_3@600ppm over control was 16.26%.

CCSHAU, Hisar (2022-23)

Halo-priming $CaCl_2$@1.5% for 24 hours resulted in a 4.87% enhancement in seed germination over control in the fresh seed lot of variety HFO 611. In the old seed lot, 12.35% enhancement in germination was recorded in HFO 611 and 11.8% in OS 6.

JNKVV, Jabalpur

Thermo priming at 40°C for 36 hours exhibited superior performance in terms of first count, germination percentage, seed vigor, and seed-borne pathogen control. This treatment enhanced first count by 3.84%, germination by 2.70%, and seed vigor index I by 20.08% over control.

OUAT, Bhubaneswar

Hydropriming for 24 hours at 20°C resulted in the highest increase (6.0%) in seed germination over control.

PAU, Ludhiana

Hydropriming for 2 hours at optimal temperature recorded the highest enhancement in seedling length and vigour index I compared to the control. At sub-optimal temperatures, priming with 200 ppm gibberellic acid showed the highest enhancement in seedling length and vigour index I.

Crop: Pearl millet

CCSHAU, Hisar (2022-23)

Fresh seed lots of HHB-67 showed significantly higher seed quality parameters when primed for 12 hours, followed by 18 hours, and the least enhancement was observed in the 1 hour duration. Seeds primed with 1.5% KNO_3 exhibited significantly higher germination rates, with the highest germination observed at 12 hours (78.33%), followed by 18 hours (77.33%), and the least in untreated control (70.33%). Similar trends were noticed in fresh seeds of HHB-299. Old seeds of HHB-67 primed with 1.0% KNO_3 recorded significantly higher germination rates at 12 and 18 hours, while the least enhancement was noticed in seeds treated with 1.5% NaCl.

PDKV, Akola

Hydropriming for 8 hours in a 1:1.5 seed-to-water ratio resulted in a significantly higher first count, final count, vigour index I, and vigour index II in both Shraddha and Saburi genotypes. In the Shraddha genotype, hydropriming for 8 hours increased the first count from 89.00% to 91.50% and the final count from 79.67% to 85.17%. In the Saburi genotype, similar improvements were observed. Biopriming of pearl millet with *T. viride* on dry seeds significantly improved seed quality parameters, including first and final count, vigour index I, and vigour index II in both new and revalidated seed lots of both genotypes. Hydropriming for 8 hours combined with biopriming with *T. viride* showed potential for further enhancing seed quality parameters.

Sunflower

PDKV, Akola

Seeds hydroprimed for 10 hours showed the best results for seed quality parameters, including final count, vigour index I, and vigour index II. Biopriming with *T. viride* on dry seed significantly improved first count and final count, as well as vigour index I and II.

PJTSAU, Hyderabad

Thermopriming at 35°C for 6 hours showed the highest germination and vigour indices for DRSH-1 and GK-2002. Hydropriming: soaking seeds in water at a 1:1 ratio for 16 hours resulted in the highest germination and vigour indices for DRSH-1 and GK-2002.

OUAT, Bhubaneswar

Hydropriming for 24 hours at 20°C showed the highest seed germination and vigour indices, with a 12.7% increase over the control.

TNAU, Coimbatore

Hydropriming at a 1:1 seed-to-solution ratio for 8 hours increased germination, field emergence, and seedling vigour parameters. Thermopriming at 40°C for 12 hours and Prechilling treatment at 7°C for 7 days facilitated in seed quality enhancement.

Objective 2- Validation of standardized priming technologies for low-temperature stress during seedling establishment in Maize and Paddy

Crop: Maize (Low Temperature Stress)

GBPUAT, Pantnagar

Maize varieties DOP 339 and 9108 Plus used for seed priming treatment. Hydropriming followed by seed treatment with *Trichoderma harzianum* (@15 g/kg seed) showed the highest seed germination, seedling length, and SVI-I. Seedling dry weight and SVI II were highest in maize seeds coated with cold adaptive PGPB. Among the varieties, 9108 Plus exhibited significantly higher seedling length and SVI-I compared to DOP339. Field studies showed hydro-primed seeds followed by *Trichoderma harzianum* treatment resulted in the maximum plant population and grain yield.

RPCAU, Pusa

Priming with GA_3 followed by DAB + Biophos showed significant improvement in radicle emergence, first count %, germination %, vigour index-I, seedling length, field emergence (%), and plant establishment after 5 weeks. Seed coating on hydro-primed seeds with T. harzianum @ 15g/kg seed showed comparable results with cold adaptive PGPB.

Paddy (Low Temperature Stress)

SKUAST-K, Srinagar

Two varieties, SR-2 and SR-4, were chosen. Among the four treatments, Seed Coating with cold-adaptive PGPB exhibited superior performance in germination, first count, vigour index 1, and vigour index 2. Parameters such as 1000 seed weight, seed yield per hectare, and harvest index were also significantly better in delineated treatment.

AAU, Jorhat (Organic conditions)

Significant variation was observed between treatments and the control. Both treatments exhibited better performance across all the studied characters, indicating the efficacy of bio-priming in enhancing seed quality and field performance.

Objective 3- Demonstration of identified priming technologies in different field crops for sub-optimal/stress conditions

Crop: Chickpea

CCS HAU, Hisar

Recommended PoP-treated seeds with Rhizobium exhibited better seed quality parameters, followed by seed coating with Drought Alleviating Bacteria + Biogrow, while the control group performed the least. Higher seed yield was observed in Recommended PoP-treated seeds with Rhizobium, while the control group had the lowest yield.

UAS, Raichur

Seed coating with BioNPK + drought-alleviating bacteria on hydro-primed seeds showed the best results for physiological parameters like first and final-count germination. Seeds coated with BioNPK + drought-alleviating bacteria exhibited better field performance, including higher plant stand, plant height, number of pods per plant, seed yield per plant, and harvest index. Seed coating with BioNPK + Drought alleviating bacteria showed the highest benefit-cost ratio in both varieties, indicating its economic viability.

VNMKV, Parbhani

Seed coating with BioNPK + drought-alleviating bacteria and seed coating with T. harzianum were found effective in increasing seed yield compared to the control.

Crop: Mustard

Biophos-coated seeds resulted in enhancement of seed yield as well as yield attributing characters, but improvement was recorded more in RH 761. During the assessment of the seed quality of the produce, a non-significant effect was observed for seed quality parameters in both varieties.

Field pea

AAU, Jorhat

Significant variation was observed between dry seeding and seed priming for all seed quality and plant growth characters, except for seedling/meter square, seeds/pod, and 1000-seed weight.

CSKHPKV Palampur

Seed coating treatment on hydro-primed seeds with Biogrow exhibited the least time for 2mm radical emergence, highest first count, germination, SVI-I, and SVI-II. W.r.t field studies also showed the highest final plant stand, plant height, number of pods per plant, number of seeds per pod, 1000-seed weight, seed yield per plant, biological yield per plant, seed yield per plot, and seed yield.

ICAR-IISS, RS, Bengaluru

Validated priming technology increased seed yield and yield-contributing parameters in the field pea variety IPFD 12-12. Seed coating on hydro-primed seeds with DAB + Biogrow showed superiority in the number of pods/plant and seed yield.

JNKVV, Jabalpur

Seed coating on hydro-primed seeds with Bio-Grow exhibited maximum final plant stand establishment and seed yield per plant.

PAU, Ludhiana

Seed priming treatments significantly influence seed quality parameters, seed yield, and various other yield-contributing parameters in field pea variety IPFD-12-2, especially under low-temperature stress conditions.

Crop: Pigeon pea

PAJANCOA&RI, Karaikal

Hydro-primed seeds showed higher germination, shoot length, root length, seedling dry weight, vigour index I, and vigour index II compared to unprimed seeds and those treated with Regional PoP. Under field evaluation, Hydro-primed seeds exhibited higher final plant stand establishment, plant height, and yield-contributing traits such as number of pods per plant, number of seeds per pod, per plant yield, 1000-seed weight, plot yield, and harvest index. Nearly 38% higher seed yield was recorded in hydro-primed plots compared to unprimed plots.

PJTSAU, Hyderabad

Hydropriming improved seed quality parameters in two red gram varieties, Asha and TDRG-59, including germination percentage and seedling vigour index I and II. Primed seeds of both varieties exhibited higher seed yields than control and control (PoP) under both normal and moisture stress conditions. These findings suggest that the hydropriming technique enhances seed quality and improves yield performance, particularly under suboptimal conditions like moisture stress, in pigeon pea crops. It highlights the potential of hydropriming as a valuable tool for achieving higher yields and economic benefits in pigeon pea cultivation.

Inference:

Objective 1

Barley

Prechilling for 7 days at 5 °C	CSKHPKV, Palampur
Thermopriming for 6 h at 35°C	CSKHPKV, Palampur
Hydro priming for 6 h using a 1:1 ratio	CSKHPKV, Palampur
Priming with 10 ppm ethrel at 25°C	PAU, Ludhiana
Hydro-priming	PAU, Ludhiana
Hydropriming	RAU TCA Dholi

Oats

GA_3 @ 600ppm- for hormo-priming	CCSHAU, Hisar
Seed halo-priming with $CaCl_2$@1.5%for 24 hours	CCSHAU, Hisar
Thermo priming treatment of 40° C for 36 hours	JNKVV, Jabalpur
Hydropriming for 24 hours at 20°C	OUAT, Bhubaneswar
Priming with 200 ppm gibberellic acid.	PAU, Ludhiana
Hydro priming followed by pre-chilling treatment for 7 days @ 4^0C	RPCAU, Pusa

Pearl millet

0.5% NaCl for 12h;1.5 % KNO_3 for 12h and 1.0% KNO_3 for 12hr	CCSHAU, Hisar
Hydropriming for 8hr	PDKV, Akola
Biopriming with T. viride	PDKV, Akola

Sunflower

Hydro priming for 10 h	PDKV, Akola
Biopriming with *T. viride*	PDKV, Akola
Thermopriming at 35°C for 6 hours	PJTSAU, Hyderabad
Hydropriming at a 1:1 ratio for 16 hours	PJTSAU, Hyderabad
Hydropriming for 24 hours at 20°C	OUAT, Bhubaneswar
Hydropriming at a 1:1 ratio for 8 hours	TNAU, Coimbatore
Thermopriming at 40°C for 12 hours	TNAU, Coimbatore
Prechilling treatment at 7°C for 7 days	TNAU, Coimbatore

Objective 2

Maize (LTS)

Hydropriming followed by seed treatment with *Trichoderma harzianum* (@15 g/kg seed)	GBPUAT, Pant Nagar
Seed coating on hydro-primed seeds with *T. harzianum* @ 15g/kg or cold adaptive PGPB	RPCAU, Pusa
Seed priming with GA3 followed by DAB + Biophos	RPCAU, Pusa

Paddy (LTS)

Seed Coating with cold adaptive PGPB	SKUAST-K, Srinagar
Metajal and @5ml/kg seed and Trichojal @5ml/kg seed can enhance initial seed quality and field performance	AAU, Jorhat (Organic conditions)

Objective 3

Chickpea

Recommended PoP-treated seeds with Rhizobium	CCS HAU, Hisar
Seed coating with BioNPK + Drought alleviating bacteria on hydro-primed seeds	UAS, Raichur

Seed coating with BioNPK + Drought-alleviating bacteria and seed coating with T. harzianum,	VNMKV, Parbhani

Mustard

CCS HAU, Hisar - Biophos-coated seeds enhanced seed yield and yield-attributing characters, but improvement was recorded more in RH 761.

Field pea

Seed coating on hydro-primed (10h @ 20 ^{0}C) seeds with Biogrow	AAU, Jorhat
Hydro primed seeds with Biogrow	CSKHPKV Palampur
Seed coating on hydro-primed seeds with DAB + Biogrow	ICAR-IISS, Mau (RS, Bengaluru)
Seed coating on hydro primed seeds with Bio-Grow	JNKVV, Jabalpur
Seed coating on hydro primed seeds with Bio-Grow	PAU, Ludhiana

Pigeon pea

Hydro-primed seeds for 10h @ 25^{O}C	PAJANCOA&RI, Karaikal
Hydropriming for 10h @ 25^{O}C	PJTSAU, Hyderabad

Experiment 4: Influence of terminal heat stress on seed set, seed yield and quality in field crops

Objective 1: To standardize the treatments for mitigation of adverse effects of heat stress in soybean

NB: Cooperating centres are yet to report research findings under objective 1 of experiment 4 for the year 2023-24, which is due to the late harvesting of soybean.

Objective 2: To validate the standardized treatments for mitigations of adverse effects of heat stress in chickpea and finger millet

Chickpea

UAS, Raichur

Growth Attributes: Foliar spray with cycocel (1000 ppm) had a significant effect on plant height at 30 days, days to pod initiation, time taken to reach harvest maturity, and chlorophyll content index. Regarding seed yield attributes, significant enhancement was recorded in the number of pods per plant, 100 seed weight, seed yield per plot, and harvest index, resulting in the highest benefit-cost ratio.

Finger millet

ICAR-IISS, RS Bengaluru

Normal Sowing (1st Set): No significant difference was observed between treatments and spray levels. Normal sowing obtained maximum yield and related traits. Late Sowing (2nd

Set): Wide fluctuations in weather conditions led to lower values for most traits compared to normal sowing. However, significant differences were observed among treatments for yield and root length. Very Late Sowing (3rd Set): High heat stress resulted in lower values for most traits compared to other sowings. However, significant increases were noticed in shoot length, root length, and thousand seed weight compared to late sowing.

Pooled Analysis: Significant differences were observed among sowings for most traits, indicating the impact of heat stress on finger millet productivity. Treatments significantly influenced plant height and dry weight, but spray schedules were found to be non-significant. Treatments, C1 (salicylic acid 800 ppm), C2 (salicylic acid 400 ppm) and C4 (KCl 1%) were effective in mitigating the heat stress in finger millet through traits such as germination percentage, plant height, shoot length, dry weight, Finger length and number of seeds per panicle.

PDKV Akola

Salicylic acid @ 400 ppm sprayed at vegetative and anthesis stages resulted in higher values for various traits than other treatments, indicating effective mitigation of heat stress.

Effect of Sowing Dates: Finger millet sown on September 29th showed higher values for various traits than other sowing dates, indicating better performance under late sowing conditions.

PJTSAU Hyderabad

Thiourea (400 ppm) sprayed at the vegetative phase resulted in the highest seed yield in both late and very late sown crops, with significant increases compared to controls. Effect of Sowing Dates: Finger millet sown during very late dates showed delayed flowering but still achieved higher yields compared to late sown crops. Cost-Benefit Ratio: Treatments sprayed with ascorbic acid (10 ppm) showed the lowest cost-benefit ratio, indicating their inefficiency in improving yield compared to other treatments. The findings suggest that certain treatments, such as salicylic acid and thiourea, effectively mitigate the adverse effects of heat stress in finger millet, leading to improved yield and quality.

Objective 3: To demonstrate the most efficient treatment validated for mitigating heat stress in mustard

CCSHAU, Hisar

Salicylic Acid Treatment: The plot sprayed with salicylic acid @ 400 ppm showed a significant effect on seed yield and yield attributing parameters in both normal and late sowing conditions. Seed Yield: Normal sowing crop recorded higher seed yield compared to late sowing, indicating the importance of optimal sowing timing. The treatment with salicylic acid @ 400 ppm resulted in increased seed yield in both normal and late sowing conditions. Seed Quality Parameters: No significant effect was found on seed quality parameters, suggesting that the treatment primarily influenced seed yield rather than seed quality. Benefit-Cost Ratio

(BC Ratio): The BC ratio was highest (2.77 and 2.22) in the plot treated with salicylic acid @ 400 ppm (T3) compared to the control (2.64 and 2.08) in normal and late sowing conditions, respectively. The results indicate that the treatment with salicylic acid @ 400 ppm effectively mitigated the adverse effects of terminal heat stress in mustard, leading to increased seed yield and improved economic returns, particularly in normal sowing conditions.

Inference:

	Crops	**Center**	**Salient achievement**
4.1	Soybean	MPKV, Rahuri	Rabi 2023-24 experimentation is in progress and seed crop is yet to be harvested.
		PDKV, Akola	
		VNMKV, Parbhani	
		JNKVV, Jabalpur	
		ICAR-IISS, RS, Bengaluru	
4.2	Chickpea	UAS Raichur	Heat stress was found to be mitigated by spraying the Cycocel @ 1000 ppm at vegetative followed by the anthesis stage, which improved the plant growth, seed yield and quality, resulting in more economic returns
	Finger millet	ICAR-IISS, RS,Bengaluru	C1 (salicylic acid 800 ppm), C2 (salicylic acid 400ppm) and C4 (KCl 1%) were effective in mitigating the heat stress in finger millet.
		PDKV, Akola	Salicylic acid 400ppm was effective in mitigating the heat stress in finger millet.
		OUAT, Bhubaneswar	Experiment in progress
		PJTSAU, Hyderabad	Thiourea (@ 400 ppm was effective in mitigating the heat stress in finger millet.
4.3	Mustard	CCS HAU Hisar;	Salicylic acid @ 400 ppm was effective in mitigating the heat stress in mustard.

Experiment 5: Development of Digital Weed Seed Atlas: Ready Reckoner for Weed Seed Identification

The digital weed seed atlas aims to develop a catalogue consisting of digital seed images and descriptions of species based on morphological keys, which will effectively supplement seed analysis.

Cooperating centres catalogued weed seeds as per the details given below in the table.

S. No.	**Crop**	**Center**	**Weed Seed: Description with images**
1	Barley	CCSHAU, Hisar	*Convolvulus arvensis; Phalaris minor; Avena fatua; Argemone maxicana;*

2	Paddy	JNKVV, Jabalpur	*Echinochloa crusgalli; Cassia tora;*
3	Paddy	PAJANCOA & RI, Karaikal	*Cleome viscos; Echinochloa colona; Chloris barbata; Dactyloctenium aegyptium; Tridax procumbens; Aerva lanata; Heteropogon contortus; Heliotropium indicum; Eragostris amabilis; Euphorbia heterophylla; Panicum virgatum; Cyperus iria; Ludwigia parviflora; Amaranthus; Aerva javanica; Physalis minima; Amaranthus deflexus; Malvastrum coromandelicinum; Chenopodium rubrum; Solanum virginianum; Abutilon indicum; Leptochloa chinensis; Tephrosia purpuria; Phyllanthus niruri*
4	Paddy	PAU, Ludhiana	*Echinochloa crus-galli, Echinochloa colona;*
5	Paddy	AAU, Jorhat	*Cyperus iria Linn; Echinochloa crus-galli; Eleusine indica; Setaria pumila; Cyperus distans; Fimbristylis littoralis; Monochoria hastata; Cyperus rotundus*
6	Wheat	CCSHAU, Hisar	*Dactyloctenium aegyptium; Trianthema portulacastrum*
7	Sorghum	TNAU, Coimbatore	*Acalypha indica; Digera arvensis; Parthenium hysterophorus*
8	Black gram	TNAU, Coimbatore	*Trianthema portulacastrum* L.; *Cyprus rotundus; Digera* arvensis Forssk.; *Parthenium hysterophorus* L. and *Urochloa panicoides* P. Beauv
9	Black gram	MPKV, Rahuri	*Cynotis culcullata; Brachiaria erusiformis; Launaea nudicaulis; Sonchus oleraceus; Acalypha indica; Amaranthus viridis; Chloris barbata; Digera arvensis; Euphorbia geniculate; Amaranthus spinosus; Bidens pilosa etc.*
10	Green gram	GBPUAT, Pantnagar	*Eclipta alba; Cleome viscosa; Dactyloctenium aegyptium; Echinochloa crusgalli; Elusine indica; Echinocloa colona*
11	Groundnut	TNAU, Coimbatore	*Trianthema portulacastrum* L.; *Cyprus rotundus; Digera muricata* (L.) Mart; *Urochloa panicoides* P. Beauv.; & *Dactyloctenium aegyptium* (L.)
12	Soybean	ICAR-IISS, RS, Bengaluru	*Achyranthes aspera; Ageratum conyzoides; Amaranthus spinosus; Bidens pilosa; Parthenium hysterophorus;*
13	Cotton	MPKV, Rahuri	*Launaea nudicaulis; Sonchus oleraceus; Chloris barbata; Digera arvensis; Desmodium triflorum; Ischaemum rugosum; Cynodon dactylon; Cyperus esculentus;* Portulaca oleracea; *Euphorbia hypericifolia*

Experiment 6: Evaluation of seed quality attributes and storage potential of bio-fortified varieties in major field crops

Crop: Rice

PAJANKOARI Karaikal

Seeds stored in HDPE bags showed significantly better seed quality attributes compared to Jute bags. Among the biofortified varieties, CR Dhan 310 (Rich in protein @ 10.3%) stored in HDPE bags exhibited significant maximum seed germination, seedling length, vigour index, and minimum seed infection during six months of storage.CR Dhan 310 stored in HDPE bags and DRR Dhan 48 and DRR Dhan 63 stored in HDPE bags-maintained seed germination as per IMSCS (80%) even after six months of storage. CR Dhan 311 (High protein - 10.1% and Zinc - 20 ppm) and CR Dhan 315 (High Zinc content - 25ppm) showed poor storability. Higher insect infestation was noticed in CR Dhan 311.

PJTSAU Hyderabad

Two biofortified varieties, CR DHAN-310 and CR DHAN-311, showed seed germination above IMSCS till January 2024 and experiment is in progress.

PAU Ludhiana

Biofortified rice variety CR Dhan 310 and non-biofortified variety PR 126 stored in cloth as well as HDPE bags complied with IMSCS (80%) after 6 months of seed storage. CR Dhan 311 failed to comply with IMSCS after 6 months of seed storage in both cloth bags and HDPE bags.

Crop: Wheat

PAU Ludhiana

Seeds of bio-fortified wheat varieties PBW 1 Zn, WB02, and PBW Zinc 2, along with non-biofortified variety PBW 826, maintained germination higher than 90% and complied with IMSCS (85%) after 5 months of seed storage in both cloth and HDPE bags.

PDKV Akola

The germination percentage of all four wheat genotypes supplied by PAU Ludhiana was above IMSCS standards in February, and the experiment is in progress.

JNKVV Jabalpur

Biofortified varieties did not significantly affect seed germination percentages, which remained above IMSCS (>85%) throughout the storage period. HDPE bags were superior to Jute bags in maintaining high germination percentages. Biofortified varieties exhibited higher

seedling length, seedling dry weight, Seed Vigour Index-I, and Seed Vigour Index-II compared to the non-biofortified variety PBW-826.

Crop: Maize

MPKV, Rahuri

Significant differences were observed in the first count and seed germination due to variety, with HQPM-1 showing superiority over HQPM-5. HDPE bags exhibited higher germination than cloth bags.

CSKHPAU Palampur

Hybrid VLQPM Hybrid-59 exhibited higher first count, germination, and vigour indices compared to Pusa HQPM 1 Improved and HQPM-5. HDPE bags generally maintained better seed quality attributes compared to other packaging materials. Biofortified maize hybrids generally exhibited higher seed quality attributes compared to non-biofortified varieties across different storage conditions and treatments at various centers. HDPE bags tended to maintain better seed quality, and seed quality deteriorated with increased storage duration.

Crop: Pearl millet

JAU Junagadh

Bio-fortified varieties Dhanshakti and AHB 1269 exhibited germination above Indian Minimum Seed Certification Standards (IMSCS) up to 6 months of storage in HDPE and cloth bags. In contrast, other varieties showed germination below IMSCS after six months of storage.

Crop: Mustard

ICAR-IARI, New Delhi

PM 32 exhibited significantly higher germination (95%), while PM 30 and PM 33 showed lower germination (84% and 85%, respectively). Maximum seed vigour index-I (1404 and 1374) was observed at 6 and 8 months, declining to 743 at 12 months. PM 32 exhibited the highest vigour index-I (1225), while PM 30 had the lowest (1070). Maximum seed vigour index-II (1.60) was observed at 6 months, declining to 0.76 at 12 months. PM 30 exhibited the highest vigour index-II (1.74), while PM 32 and PM 33 showed the lowest.PM 32 demonstrated the best seed quality parameters after 12 months of storage. All varieties were viable for up to 10 months of storage.

UBKV Pundibari

Germination percentages reduced with the storage period, with PDZM 31 and PM 32 declining below IMSCS recommendation by January and February 2024, respectively. Seeds kept in both control and HDPE bags showed increased moisture content, with cotton bag

seeds showing significantly higher moisture content than HDPE bag seeds. Seed vigour index-I and seed vigour index-II decreased during storage, with HDPE bags proving to be better for maintaining seed vigour. HDPE bags showed numerically higher field emergence compared to control, although the difference was non-significant. The results suggest that both storage duration and variety significantly impact seed quality attributes in mustard. While some varieties show better storability and maintain higher seed quality parameters, using HDPE bags appears to be beneficial for preserving seed vigour during storage.

Inference:

Evaluation of seed quality attributes and storage potential of bio-fortified varieties in major field crops

Centres	**CR Dhan 310**		**CR Dhan 311**		**(Check)**	
Rice	Jute Bag (months of storage)	HDPE Bag (months of storage)	Jute Bag (months of storage)	HDPE Bag (months of storage)	Jute Bag (months of storage)	HDPE Bag (months of storage)
PAJANKOARI Karaikal from 10.07.23	06	06	04	04	04 (BPT 5204)	04 (BPT 5204)
PJTSAU Hyderabad	06	06	06	06		
PAU, Ludhiana from July,2023	06	06	05	05	06 (PR126)	06 (PR126)
OUAT Bhubaneswar July, 2023	07	07	07	07	07	07
UAS, Dharwad July, 2023	07	07	07	07		

Wheat	**PBW 1 Zn**		**WB 02**		**PBW 2 Zn**		**PBW 826**	
	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag
PAU Ludhiana from August, 2023	05	05	05	05	05	05	05	05
PDKV Akola Aug, 2023	06	06	06	06	06	06	06	06
GBPUAT Pantnagar	06	06	06	06	06	06	06	06
JNKVV Jabalpur	06	06	06	06	06	06	06	06

Maize	**HQPM-1**		**HQPM-5**		**African Tall**	
	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag

MPKV Rahuri from July, 2023	06	06	06	06	06	06
TNAU Coimbatore	03	03	03	03	03 COH (M) 5	03 COH (M) 5
CSKHPAU Palampur	06	06	06	06	06	06
UAS Bengaluru	05	05	05	05	04 (MAH 14-5)	04 (MAH 14-5)

Pearl millet	**HHB-299**		**AHB 1200**		**AHB 1269**		**-**	
	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag
VNMKV Parbhani from July, 2023	07	07	07	07	07	07		
SKNAU Jobner	Dhanshakti	RHB 233	HHB 299	RHB 223				
	06	06	06	06				
JAU Junagadh	GHB 732	Dhanshakti	AHB 1269	HHB 299	GHB 1129	GHB 1225	RHB 233	RHB 234
	05	06	06	05	05	05	05	05

Mustard	**PM 30**		**PM 31**		**PM 32**		**PM 33**	
	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag	Jute Bag	HDPE Bag
ICAR-IARI, New Delhi	10	10	10	10	12	12	08	08
UBKV Pundibari								
			10	10	10	11		

Note: Referred experimentation on delineated crops is in progress with the cooperating Centres

C. Seed Pathology

Under seed Pathology, following experiments were conducted with the active participation of different centres under AICRP on seed (Crops) during 2023-24. Monitoring and detection of seed-borne diseases of significance in major crops; studies on seed health status of farmers saved seeds; standardization of detection methods for seed-borne pathogens of significance; exploring new generation systemic fungicide molecules for false smut free seed production in rice and development of eco-friendly low-cost input / indigenous technology for the production of disease-free soybean, chickpea and groundnut seeds; development of seed health standards for important seed-borne diseases; and systematic studies for evaluation of alternative chemicals and microbial consortia for effective management of seed-borne pathogens of major crops**.** The highlights of achievements have been summarized for a quick inference from various experiments.

❖ **Experiment 1: Monitoring and detection of seed-borne diseases of significance in major crops**

Crop (a) Paddy: Bunt, Bacterial Leaf Blight, False smut, Dirty Panicle/Grain discolouration, Bakanae/ Foot rot, Bacterial Panicle Blight, Brown spot, Udbatta and Blast

The objective of the study were identification and documentation of important seed- borne diseases, monitoring of emerging diseases of seed borne nature and identification of disease-free areas.

At PAU, Ludhiana, the incidence of bacterial leaf blight (BLB) was observed in low to moderate severity on varieties Pusa 44, Pusa 1121and PR 114. The incidence of false smut disease was recorded in varieties PR 121, 122, PR 124, PR 126, PR 114 and Pusa 44 with a disease score of 1-3 grown in eight different districts. Grain discoloration (dirty panicle disease) was recorded in all the surveyed districts on all the cultivated varieties with a disease score of 3-7. The maximum disease score was observed on varieties PR 114, Pusa 44 and PR122. Whereas, the incidence of bakanae disease was recorded on the varieties Pusa Basmati 1121, Pusa Basmati 1509, Pusa Basmati 1718 and Pusa 1847 from all the districts. The incidence of bunt was observed in all districts of Punjab. However, the bunt incidence remained less than the minimum seed certification standards in most of the varieties under cultivation in Punjab.

At CSKHPKV, Palampur, among the various diseases of rice, false smut occurrence (1-5%) was regularly observed in different rice growing areas representing different districts of Himachal Pradesh. The incidence of BLB was recorded in Sirmour and Kangra districts. Brown spot and narrow brown spot were prevalent in all the districts surveyed. The incidence of blast was negligible this year, however in some areas of Kangra and Sirmour districts, the neck blast was observed in patches to an extent of 5% distribution. The incidence of leaf scald disease was observed in a few pockets in the surveyed areas of Kangra district in Basmati varieties. At ICAR-IISS (RS), Bengaluru, the incidence of brown spot disease was observed in

Bengaluru and other parts of Karnataka and in all ruling varieties. The disease severity was within the range of 0 - 22%.

At GBPUA&T, Pantnagar, most of the samples were free from bunt infection. However, the samples of variety VL Dhan 88 collected from Dehradun and PB 1509 from Udham Singh Nagar and Dehradun areas exhibited bunt infection that too below certification standards. Across the field visited in Udham Singh Nagar; Nainital; Dehradun and Dehradun and Champawat districts, BLB was observed with 0-5% disease incidence. Incidence of false smut was observed maximum up to 20% in Halduchaur area. Grain discolouration was observed in almost all the fields. High incidence of discolouration was observed in almost all the fields ranging from 1- 30%. When these discoloured seeds were subjected to seed health studies, *Alternaria, Aspergillus* spp., *Curvularia, Fusarium, Helminthosporium* were the major mycoflora observed from the discoloured grains. Mild incidence of panicle blight was observed in the farmers' fields during the surveys. Incidence of panicle blight was the maximum up to 5% at Gadarpur and Jaspur areas. Sheath rot disease was observed in some of the fields of Dineshpur, Bajpur, Kashipur, Kichchha and Pantnagar areas and the incidence was in a range of 0-10%.

At TNAU, Coimbatore, a total of 230 rice seed samples comprising of 24 varieties were collected from farmers' field, seed production plots and private seed companies from nine major rice growing districts. The results revealed that all the rice seed samples collected from different locations were free from bunt infection except one sample (var. ASD16) collected from Palani, Tiruppur district of Tamil Nadu and the range of infection was 0.0 to 0.10%. The incidence of BLB was recorded in all popular rice varieties and in all major rice growing districts of Tamil Nadu. The infection of BLB was ranged from 1 to 5 rating scale. The incidence of false smut was recorded in most of the rice growing districts of Tamil Nadu except Krishnagiri and Tiruppur and observed in many popularly grown rice varieties like CO 43, CO 51, ADT 52, CR1009, ASD16 and BPT 5204 which ranged from 0 to 3 rating scale. The brown spot incidence was high in many rice growing districts of Tamil Nadu and observed in all popularly grown rice varieties with a rating scale of 2-5. The incidence of grain discoloration was recorded in Cuddalore, Tanjore, Trichy and Nagapattinam districts (0-5 rating scale), whereas blast disease was recorded in majority of rice growing districts of Tamil Nadu with 0 to 3 rating scale. The districts like Erode and Krishnagiri were completely free from grain discoloration, whereas Tiruppur district was completely free from both grain discolouration and blast disease.

At AAU, Anand, out of 147 samples, only 21 samples (14.28%) recorded bunt infection in the range of 0.0 to 0.5%. Out of 147 fields, only 28 fields (19.04%) were found infected with false smut on a scale of 0-5. Out of 147 samples, 39 samples (26.53%) had discoloured grains on a scale of 0 to 5. The pathogens *viz.*, *Fusarium* sp., *Aspergillus* sp. and *Curvularia* sp. were found responsible for grain discolouration. At PJTSAU, Hyderabad, out of 315 paddy seed samples analyzed, 85 seed samples (26.98%) were found infected with bunt infection with a range of 0.02 to 1.03%. Of the 54 processed seed samples nine seed samples recorded bunt infection with a range of 0.01% to 0.13%. With regard to other seed-borne diseases of rice,

the incidence of BLB ranged from 0-3 rating scale, sheath rot from 0-1 rating scale *i.e.,* no infection to lesions limited to lower 20% of the plant height was observed in the surveyed districts. At CCSHAU, Hisar, unprocessed seed samples (850) from 11 districts of Haryana were collected during *kharif* 2023. Only 137 samples (16.1%) were found to be infected with bunt with a range of 0.05-0.15 per cent. In farmers' field at 50 locations in eight districts *viz*. Hisar, Kaithal, Jind, Kurukshetra, Yamuna Nagar, Karnal, Fatehabad and Sirsa, the infection of BLB was recorded at 30 locations having 1-5 per cent of lesion area (incidence range) with the disease rating of 2.12. The infection of false smut was found at 26 locations having 1-5 per cent of infected florets (incidence range) with disease rating of 3.

BLB

False smut

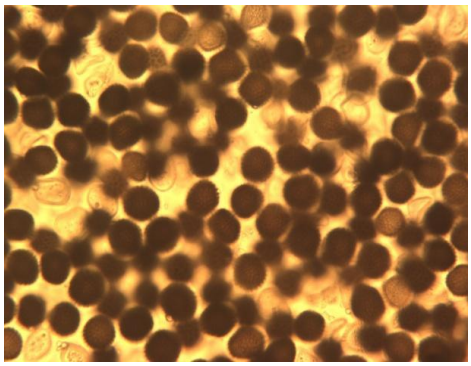
Brown spot

Grain discolouration

At OUAT, Bhubneshwar, major seed borne diseases like brown spot, sheath rot and false smut have been reported at harvesting stages of rice. A total of 161 seed samples were collected from farmers from eight districts of Odisha. Incidence of bunt varied from samples collected from farmers of different districts with 0 to 1.4% infections in individual samples. Incidence of false smut in farmers' field varied from low to moderate. Brown spot incidence in farmers' field ranged from 4 to 7 in 0-9 rating scale in variety Sarala. The sheath rot incidence in seed production plots ranged from 1 to 5.0 and the maximum incidence was in paddy variety Sarala. Seed-borne pathogens responsible for discolouration, observed in this experiment were *Curvularia* sp*. Fusarium* sp*., Penicillium* sp. and *Aspergillus* sp. At IARI, New Delhi, out of 210 seed samples collected from various places, none of the sample showed the incidence of bunt. BLB was observed in moderate severity in Pusa 1121 while in other varieties it was not so severe. At DRPCAU, Pusa, a total of 24 seed production plots, 28 % samples were found to be infected with BLB in the range of 0-3 on disease rating scale of 0-9. Among 105 farmers' fields having 09 varieties surveyed, revealed 42% BLB infection with disease rating

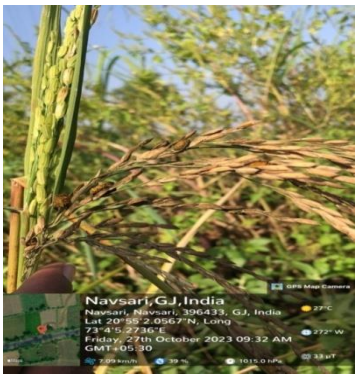
of 0-3. Total 102 processed samples belonging to 12 varieties were observed for bunt infection. All the observed samples were free from bunt infection.

Bunt infected shiny jet-black paddy seed



Bunt spores

At SKUAST, Kashmir, none of the sample was found infected with bunt disease. The disease is hitherto unreported from the region. At PAJANCOA & RI, Karaikal, BLB recorded maximum mean disease incidence of 85.3% with severity of 39.8% followed by grain discoloration (81.35% incidence; 33.55% severity), brown spot (38.15% incidence; 15.2% severity) and leaf blast (22.85% incidence; 8.7% severity). At MPKV, Rahuri, Western Maharashtra and Konkan region found free from bunt disease of paddy. Total 1007 fields were monitored from Nashik, Ahmednagar and Pune district in which the incidence of false smut, bacterial blight, grain discolouration, brown spot, udbatta and blast disease of paddy was found in the range of 0.67 to 3.67, 1.00 to 3.00, 0.50 to 4.00, 0.50 to 5.33, 0.50 to 1.00 and 1.00 to 15.00 per cent, respectively. Whereas, bacterial panicle blight and bakanae/ foot rot of paddy was not observed during the survey in Kharif 2023. At AAU, Jorhat, all the tested paddy samples were free from bunt infection. A total of 53 rice fields of Golaghat, Sibsagar, Jorhat, Karbi Anglong, Dibrugarh and Hojai districts covering seven different blocks with nine different varieties were evaluated for various diseases of paddy, *viz.*, BLB, false smut, dirty panicle/grain discoloration, brown spot. BLB was observed in the variety Ranjit sub-1, Ranjit, Swarna sub-1, Bahadur sub-1 in the rating scale of 1 to 2. At IARI (RS), Karnal, bakanae and brown spot diseases were observed in PB 1121, PB 1509 and PB 1692 in farmer's fields in low severity. False smut and sheath rot was observed in Pusa Sugandh-5 in farmer's fields while bacterial leaf blight was only observed in PB 1509. None of the samples tested showed presence of bunt.



Survey and detection of seed-borne diseases in rice

Crop (b) Wheat: Karnal bunt, Loose smut, Spot Blotch and Head Blight

At PAU, Ludhiana, the incidence of spot blotch and head blight of wheat was recorded in low to moderate severity at all places surveyed in Punjab. At MPKV, Rahuri, total 850 wheat seed samples were collected from Nashik Pune and Ahmednagar distract of Western Maharashtra were free from the karnal bunt disease of wheat. At HPKV, Palampur, the incidence of loose smut was seen in districts *viz.,* Bilaspur, Sirmour, Hamirpur and Kangra in a range of 0-2% on variety HPW 368. At GBPUA&T, Pantnagar, spot blotch was observed as emerging in the fields with 10% incidence up to 1-3 rating in Bajpur, Gadarpur, Kashipur, Kichha, Rudrapur, Pantnagar, Haridwar, Dehradun, Halduchaur and Gaolapar areas. Loose smut was observed in traces less than 0.5% which is below maximum permitted limit. At CCSHAU, Hisar, unprocessed seed samples (300) from all sources in 13 different locations comprising of three districts were collected during *rabi* 2022-23 and analyzed for karnal bunt. Only 82 samples (27.00%) were found infected with karnal bunt with range of 0.05-0.45 per cent. At IARI, New Delhi, spot blotch was observed in the fields with 5% incidence up to 1-3 rating in experimental farm areas while it was up to 15% incidence in farmers' fields surveyed. At IARI (RS), Karnal, karnal bunt was observed in very low severity in samples tested. Average infection varied from 0.062 – 0.342%. At RARI, Durgapura, out of 64 samples, 56 samples had germination above MSCS (76-90%). 12 samples showed karnal bunt infection in the range of 0.01-0.15%. Ear cockle infection was observed in only 3 samples of Dausa district.

Crop (c) Soybean: Purple seed stain, Pod rot, Anthracnose, Phomopsis blight, Downy mildew

At MPKV, Rahuri, out of 1570 farmer's field surveyed from Ahmednagar, Solapur, Sangli, Kolhapur, Satara, Pune and Nashik district, none of the field was infected with the downy mildew disease of soybean, whereas pod blight, soybean mosaic virus, anthracnose, yellow mosaic disease and purple seed stain diseases were found in the range of 0.50-7.33, 0.50-4.57, 0.50-6.66, 0.50-5.33 and 0.50-2.66 per cent, respectively. At VNMKV, Parbhani, out of 89 soybean seed samples tested, very low incidence of anthracnose, pod blight, purple stain and charcoal rot was observed. The per cent incidence of anthracnose, charcoal rot, pod blight and purple seed stain was in the range of 0.74 to 4.95, 0.00 to 7.21, 0.00 to 2.41 and 0.77 to 4.71 per cent, respectively. At PJTSAU, Hyderabad, the incidence of anthracnose ranged from 1 to 5 rating scale in Nizamabad and Sanga Reddy districts. The incidence of pod rot recorded was ranged from 1-5 rating scale in Nizamabad district. While, the incidence of purple stained seed ranged between rating scale 1-5 (1 with 1% area covered with lesions/ spots/ discoloration) to 3 (with 1.1 -10% area covered with lesions/ spots/ discoloration) was observed in the districts surveyed.

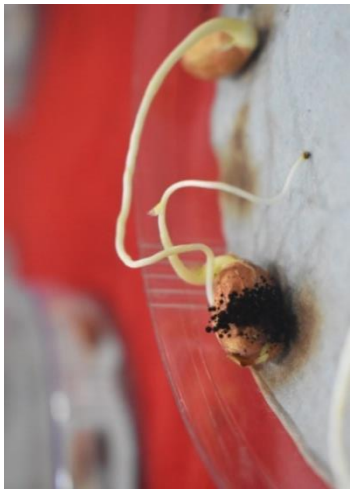
At JNKVV, Jabalpur, a total of 161 seed samples from five districts were scrutinized. It was observed that maximum infection of purple stained seeds was in the range of 0-5% each from Jabalpur and Narsimhapur locations followed by 0-3% in Damoh district. The anthracnose and pod rot were present in all the surveyed districts. However, maximum incidence of pod blight was recorded from Jabalpur (10-24%) followed by Narsimhapur (08-

23%). The minimum incidence of pod blight was recorded from Sagar district. The maximum incidence of anthracnose of 14-26% was recorded in Jabalpur followed by Narsimhapur (05-23%). At RARI, Durgapura, out of 19 samples, all had germination above 85%. Cumulative assessment of all samples showed that 0.59 – 0.67 % purple seed stain, up to 1% anthracnose, around 0.9% incidence of *Phomopsis* blight. Incidence of downy mildew was in the range of 0.19 - 0.3% and some trace incidence of pod rot was also reported.

Crop (d) Groundnut: Collar Rot, Seed rot

At TNAU, Coimbatore, the incidence of collar rot disease was recorded in all ruling varieties of groundnut and in all four major groundnut growing districts of Tamil Nadu. The average per cent incidence of collar rot disease was varied from 3.52 to 15.33% in farmers and seed production field of Cuddalore, Villupuram, Thiruvannamalai and Tirupathur districts. The average incidence of collar rot (%) was a maximum in Cuddalore district both in farmers field (15.33%) and seed production plots (10.77%) and a minimum in Tirupathur district (6.75 and 3.52%) of Tamil Nadu. At AAU, Anand, a total of 132 samples were collected from 63 farmers' fields. None of the seed samples was found free from *Aspergillus* seed rot. A predominant association of *A. niger* and *A. flavus* was found with seed samples in the range of 0-20% and 0-24%, respectively. At OUAT, Bhubneshwar, a total of 30 seed samples were collected from farmer's field. The germination % was recorded in the range of 29-74%. The incidence of seed and collar rot was recorded in the range of 2-14% and 2-18%, respectively. At MPKV, Rahuri, total 1180 fields were surveyed, collar rot, stem rot, seed rot and bud necrosis disease of groundnut were found in the range of 1.00-5.66, 1.00-12.34, 0.50-7.55 and 0.50-5.66 per cent, respectively.

Collar rot of groundnut



Groundnut seed infected with *Aspergillus niger*

At JNKVV, Jabalpur, in total 21 fields were surveyed from two districts namely Jabalpur, and Chhindwara. It was observed that both collar rot and seed rot were present in all the three districts but not in severe form. The maximum incidence of collar rot and seed rot of respectively 03-11% and 02-09% were recorded from different locations of Chhindwara

district. At RARI, Durgapura, 27 samples of different varieties were collected for the detection of seed and collar rot. Seed rot incidence varied from 0.19% in Jaipur samples to 0.33% in samples. Collar rot incidence ranged between 0.9% in samples from Jaipur to 1.43% in samples from Dausa district.

Crop (e) Chickpea: Wilt, Grey Mould

At MPKV, Rahuri, total 900 fields were surveyed, *Ascochyta* blight, grey mould and stemphylium blight diseases were not observed, while wilt incidence was noticed from 1 to 15 per cent, whereas dry root rot and wet root rot incidence were 1 to 8.0 and 1 to 4.0 per cent, respectively. At JNKVV, Jabalpur, instances of wilt and dry root rot emerged prominently during the pre-flowering stage and persisted thereafter. The range of collar rot incidence varied from 11 to 26%, with the highest occurrences noted in the fields of Panagar. Additionally, wilt and dry root rot exhibited prevalence rates spanning from 10 to 16% and 5 to 13%, respectively. Notably, Panagar, Sihora and Jabalpur registered the highest incidences of wilt, while Panagar stood out for its elevated levels of dry root rot. Conversely, ascochyta blight was completely absent across all surveyed fields. At IARI, New Delhi, fifty farmer's fields of chickpea were surveyed from Noida, Ghaziabad and Gurgaon. Wilt incidence in the range of 1- 5% was seen in various fields surveyed. At RARI, Durgapura, observations for wilt were taken during field surveys and 13 field showed incidence of wilt in the ranges of 0.5 – 8.5%. None of the field showed grey mould or Ascochyta blight infection.

Collar rot of chickpea

Wilt of chickpea

Dry root rot of chickpea

Crop (f) Ragi– Blast and other seed borne diseases/mycoflora

At TNAU, Coimbatore, the incidence of blast disease was recorded in many popularly grown finger millet varieties. The incidence of leaf blast, neck blast and finger blast were ranged from grade 1 to 3, 0.00 to 12.65% and 0.00 to 15.50%, respectively. At PJTSAU, Hyderabad, the incidence of blast ranged from 1 -2 rating scale *i.e.,* very low (rating scale 1 with no lesions, or small brown specks of pinhead size (0.1-1.0 mm), less than 1% leaf area affected) to 2 (rating scale 1 with typical blast lesions covering 1-5% leaf area covered) was observed in Mahaboobnagar district. At MPKV, Rahuri, total 467 fields were surveyed, leaf blast incidence was noticed from 0.5 to 11.00 per cent, whereas neck blast, finger blast and downy mildew incidence were 0.3 to 2.0, 0.2 to 3.0 and 0.5 to 1.0 per cent, respectively. At JNKVV, Jabalpur, observations were conducted in various fields across two districts, Dindori and Rewa, to

assess the occurrence of blast diseases (leaf, neck, and finger blast) as well as Helminthosporium leaf spot. Blast diseases (neck, finger, and leaf) were identified in both surveyed locations, Rewa and Dindori, albeit in varying degrees. Dindori district exhibited a higher incidence of all three types of blast compared to Rewa. Moreover, Helminthosporium leaf spot was absent in Rewa district, while a notable infection rate of 21-26% was recorded in Dindori district.

Symptoms of seed-borne finger millet diseases in farmers field

Molecular detection of *Soybean mosaic virus* (SMV) infesting soybean seeds through Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)

The seed samples of soybean were collected during *Kharif* 2023 from SMV-infected plants by cooperating centres *i.e.*, JNKVV, Jabalpur; GBPUAT, Pantnagar and VNMKV, Parbhani and sent to AAU, Anand centre for its molecular detection from seed samples for the presence of SMV.

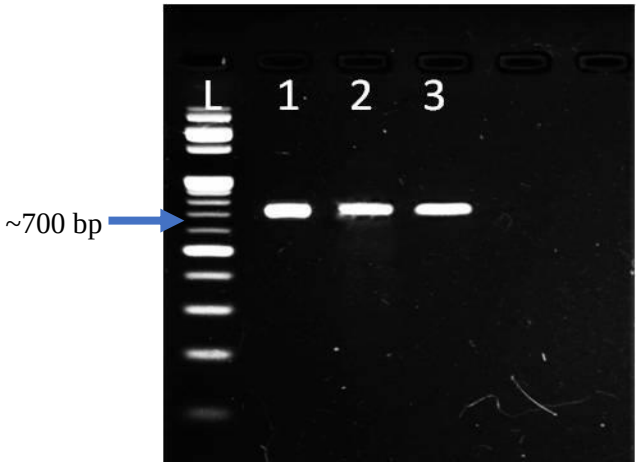


Fig. 1: RT-PCR amplification of CP- gene of SMV from infected seed samples (L=Ladder, 1=Jabalpur, 2=Pantnagar and 3=Parbhani

The total genomic RNA of virus-infected seed samples was extracted by LiCl-based method. RNA was stabilized by the addition of RNase inhibitor and stored at -80 °C. After the extraction of RNA, cDNA was synthesized using HiGenoMB cDNA synthesis kit. A single-stranded cDNA template was observed when cDNA was run on 1.5 per cent agarose gel to check the integrity of cDNA, which specified that the cDNA prepared was solely from mRNA

and free of any contamination. Synthesized cDNA was used for amplifying viral CP-gene through RT-PCR. The samples were subjected to RT-PCR analysis using 2 pairs of CP-gene-specific primers *viz*., SMV-CPf and SMV-CPr which generated an amplicon of ~700 bp (Fig. 1) corresponding to the CP gene in all the tested samples. Amplicon size was compared by using a 100 bp DNA ladder. Virus amplification was found in infected seed samples of soybean through RT-PCR which confirmed the presence of SMV in all the seed samples.

At IARI, New Delhi, soybean seeds were tested for soybean mosaic, bean pod mottle virus and cucumber mosaic virus. Soybean leaf samples showing crinkling, mosaic and mottling symptoms of various genotypes were collected and subjected to direct antigen coating enzyme linked immunosorbent assay (DAC-ELISA) using SMV and BPMV polyclonal antibodies. RT-PCR with the primers designed against to the above viruses also resulted in no amplification. So, we are in the process of finding out the casual organism for veinal necrosis and death of the seedlings. Further, a total of 150 soybean leaf samples showing crinkling, mosaic and mottling symptoms of various soybean lines were collected and subjected to direct antigen coating enzyme linked immunosorbent assay (DAC-ELISA) using SMV, BPMV, CPMMV and TRSV polyclonal antibodies. Samples were found negative for SMV and BPMV, whereas 30 samples showed positive value in the range of 0.5299 to 1.4742 for CPMMV at OD_{405nm}. For TRSV, four samples out of 150 showed positive values of 0.622 to 0.858 in DAC-ELISA. CPMMV was the only virus observed mostly with the soybean mosaic and puckering symptoms under Delhi conditions, whereas SMV was not found to be associated with the mosaic symptoms**.**

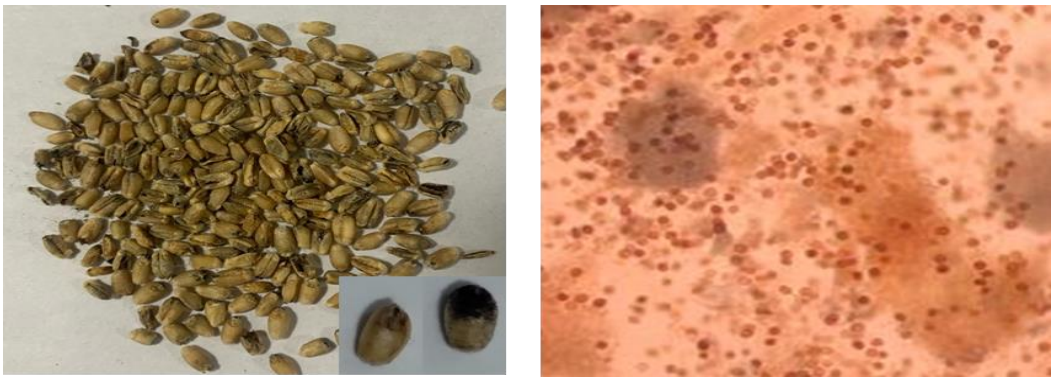
❖ **Experiment 2: Studies on seed health status of farmers saved seeds**

Experiment conducted to know the health status of farmers' own saved seed revealed that seed health status of farmers' own seed samples was comparatively poor.

Crop (a) Wheat

At IISS, Mau, a total of 264 seed samples of wheat were collected, 9% samples were infected with karnal bunt pathogen (1-3%). Data showed that 1.5% samples had germination per cent below the ISTA standards (<85%). At DRPCAU, Pusa, out of 110 seed samples, none of the samples were recorded infected with loose smut, karnal bunt and ear cockle. The main fungi observed in farmer's seed samples were *Aspergillus* spp*., Penicillium* spp*., Alternaria triticiana* and the grain discolouration was recorded in the range of 6 – 15%. At PAU, Ludhiana, the incidence of karnal bunt remained below IMSCS in the seed samples (383) from all the 12 districts under survey. At MPKV, Rahuri, seed germination ranged from 70-99 per cent, while the seed mycoflora associated with the seed ranged from 1.0-11.6 per cent and 46 samples showed seed germination below MSCS (85%). At CSKHPKV, Palampur, though the farmer saved seed was found to be free from loose smut, the incidence of common bunt was observed in the farmer saved seed samples of district bilaspur to the extent of 37 per cent. Fusarium head blight (0-69%) and black point disease (0-41%) in farmers own saved wheat samples collected from different locations of Hamirpur district. At CCSHAU, Hisar, Karnal bunt

infected sample percentage was 25.83 and range was 0.05-0.25 per cent (with in prescribed limit *i.e.* 0.25 %) in farmers own saved seed. At GBPUA&T, Pantnagar, all samples showed germination above IMSCS level ranging from 85-90 per cent. Disease causing pathogen *Tilletia indica* was detected in 7 samples from Champawat, 3 samples from Bageshwer and 5 samples from Nainital. Maximum karnal bunt infection (0.25 %) was detected in the sample collected from Sui village of Champawat and Golapar area of Nainital districts. However, the infection in all the samples was below IMSCS. The mycoflora *Alternaria, Aspergillus, Curvularia* and *Fusarium* were observed during the study. At RARI, Durgapura, out of 60 samples, 55 samples showed germination above IMSCS level. Disease causing pathogen *Tilletia indica* was detected in nine samples. Maximum (0.15%) karnal bunt infection was detected in the sample collected from Aandhi village of Dausa district. Four samples also showed ear cockle infection in the range of 0.25-0.5%. The mycoflora *Alternaria, Aspergillus, Curvularia* and *Fusarium* were observed during the study.

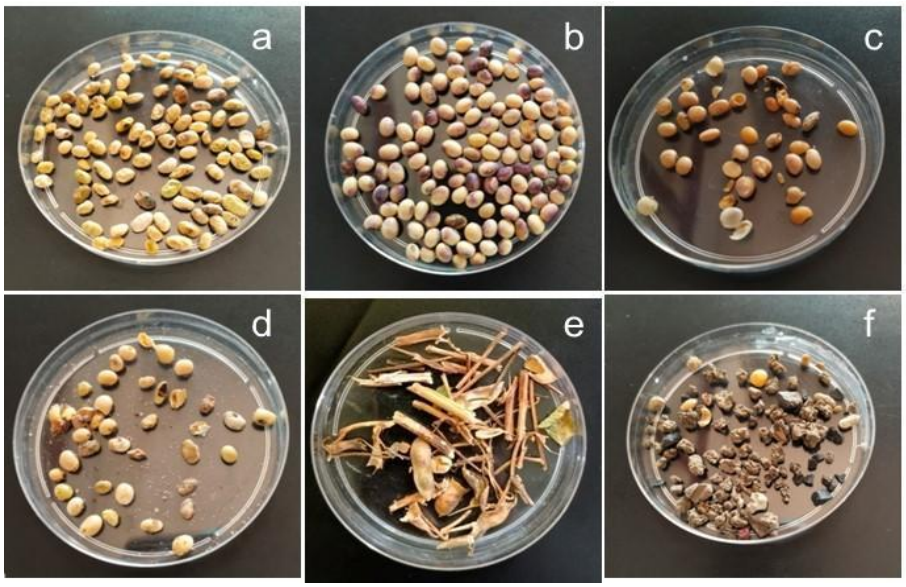


Karnal bunt infection in farmers saved wheat sample

Crop (b) Soybean

At MPKV, Rahuri, 915 seed samples of soybean were collected from 10 districts. The seed germination of these samples ranged from 51-92 %, while the total seed mycoflora associated with the seeds ranged from 0.3 to 9.7 %. 142 seed samples showed the germination below the minimum seed certification standard. At VNMKV, Parbhani, a total of 118 soybean seeds samples were tested. The per cent incidence of soybean mosaic virus were observed in the range of 0.4 to 3.2 per cent, Purple seed stain was in the range of 0.0 to 6.1 per cent, *Colletotrichum dematium* was in the range of 0.0 to 7.7 per cent, *Macrophomina phaseolina* was in the range of 0.0 to 6.5 per cent, *Fusarium moniliforme* was in the range of 0.0 to 5.3 per cent, *Diaporthe* sp. was in the range of 0.0 to 4.6 per cent, whereas, *Fusarium oxysporum* was in the range of 0.0 to 7.2 per cent and *Alternaria alternata* was in the range of 0.0 to 7.1 per cent. At JNKVV, Jabalpur, a total of 161 samples were collected. the range of association percentages for *M. phaseolina* and *C. dematium* spanned from 02 to 13% and 02 to 10%, respectively. Similarly, the range of association for *F. oxysporum* extended from 03 to 20%. AT PJTSAU, Hyderabad, a total of 96 soybean seed samples were collected. The results stated that the seed samples of Nizamabad and Sanga Reddy districts have recorded germination per cent below IMSCS. Across the samples tested the seed mycoflora found associated were *Colletotrichum* sp., *Macrophomina* sp., *Fusarium*sp., *Alternaria* sp. and *Aspergillus* sp.

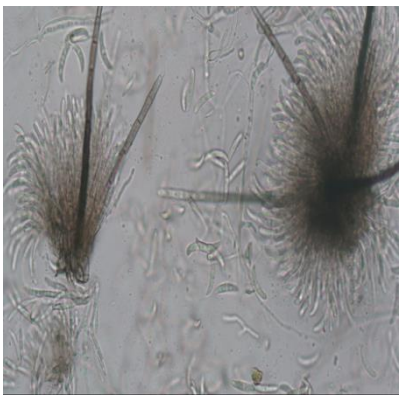
Recovery of *Macrophomina* sp. (6.64%) followed by *Colletotrichum* sp. (3.48%) were found high in analyzed seed samples. Visual examination of seed samples revealed presence of purple stain seed discolouration with a range of 0.21% to 0.38%.



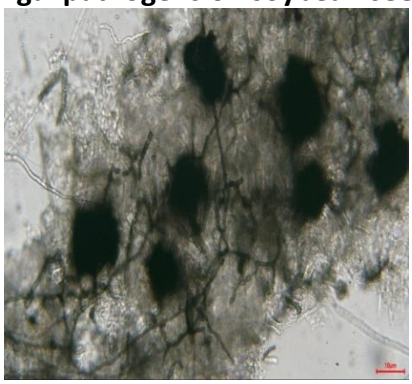
Different seed-borne fungi infected soybean seeds

At RARI, Durgapura, Ninety percent samples showed germination above IMSCS level. With regard to seed infection, 0.2-0.5% infection of *Macrophomina phaseolina* in 16 samples, 0.01 – 2.5% infection of *Colletotrichum* in 7 samples was found. Trace amount of infection (0.01 – 0.1%) of *Cercospora, Fusarium* and *Diaporthe* was also found in some samples.

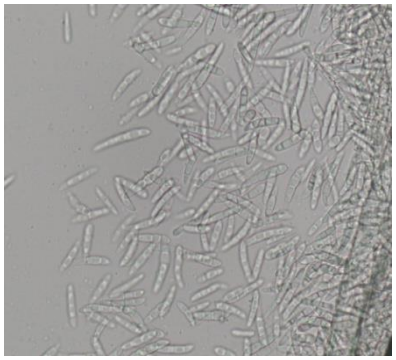
Fungal pathogens on soybean seeds



***Colletotrichum* sp.**



***Macrophomina* sp.**



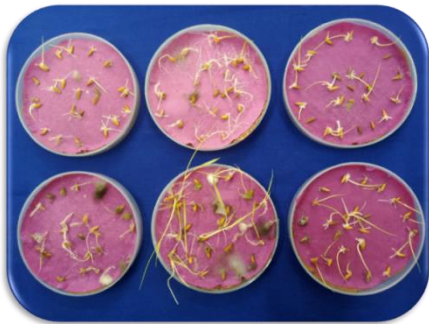
***Fusarium* sp.**

Crop (c) Rice

At DRPCAU, Pusa, a total of 107 paddy seed samples comprising of 52 varieties/entries were collected. None of the samples were found infected by rice bunt. However, grain discolouration ranged from 13-29%. At TNAU, Coimbatore, the moisture percent ranged from 10.1 to 15.6% and the germination per cent ranged from 60 to 95%. All the observed samples were free from bunt infection except one sample collected from Tiruppur Dt. and the range of infection was 0.0 to 0.10%. Among 115 rice seed samples collected from nine districts of Tamil Nadu, 9 samples (7.83%) failed to fulfill the minimum germination percentage (80%). The per cent discolouration of the paddy seed samples ranged from 0.0 to 28%. The detection of mycoflora in the discoloured paddy seeds by blotter method revealed that the discolouration of seeds was mainly associated with *Bipolaris* followed by *Fusarium, Curvularia, Aspergillus* and *Rhizopus***.** At AAU, Anand**,** a total of 106 farmers' saved seed samples were collected. Overall germination per cent ranged from 65-98%, Seed discolouration ranged from 0-15%, highest with Navsari (2-15%) and lowest with Dang (0-5%) districts. Seed and seedling rot ranged from 5-25% and 2-20%, respectively. Seed mycoflora *viz*., *Fusarium* sp., *Curvularia* sp. and *Aspergillus* sp. found associated with the seeds of different varieties of all the locations in varying proportions. Out of 106 samples, 19 samples (17.92%) had discoloured grains on a scale of 0 to 5. At IARI, New Delhi, the seed health status of 125 samples were tested. The seed germination ranged from 80 to 86 per cent, while the seed mycoflora associated with seeds was ranged from 0 to 0.25 per cent. Grain discolouration was observed in a range of 12-20% in samples screened.

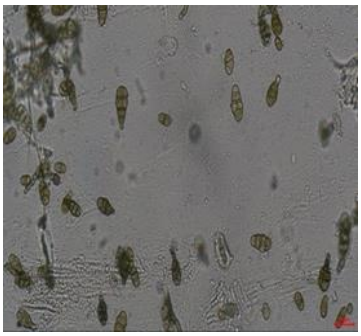
At CSKHPKV, Palampur, percent discolouration of the seeds ranged from 0-13%. The mycoflora associated with the discoloured samples belonged to fungal species *viz*., *Bipolaris, Aspergillus, Fusarium* and *Pyricularia.* At OUAT, Bhubneshwar, out of 161, 74 samples showed germination below IMSCS. Bunt incidence occurred in all the eight districts from where seeds have been collected. The highest number of discoloured seeds was observed in paddy seeds of Puri district (19 %) and in Sundargarh district (18%). The pathogens like *Aspergillus* sp., *Fusarium* sp., *Penicillium* sp., *Rhizopus* sp. and *Curvularia* sp. were observed at the time of germination. At PAU, Ludhiana, a total of 1304 seed samples of rice were evaluated. More than 80% of samples were found infected with bunt. Maximum incidence of bunt (2.25%) was observed on variety PUSA 44 in district Barnala followed by 1.25 on PR 126 from district Bathinda. However, an average bunt incidence in all districts remained below IMSCS (0.5%). At PJTSAU, Hyderabad, a total of 239 paddy seed samples were collected. All the paddy seed samples tested have recorded germination per cent above IMSCS (>80%). Among the seed mycoflora observed *Fusarium* sp. (1.37%) and *Helminthosporium* sp. (0.66%) were predominant. However, storage fungi, *Aspergillus* spp. (1.08%) were also found associated with the seed samples**.** Further the visual observation revealed that seed discolouration ranging from 0.43 to 1.37%. At PAJANCOA & RI, Karaikal, a total of 102 seed samples of paddy were collected. The moisture content of the seed samples was ranged from 9.2 to 16.5 per cent. The seed germination of the samples was ranging from 0.0 to 99.0 per cent. Of which, only 39.2 per cent of the samples had fulfilled IMSCS for germination (80%). None of the

seed samples had bunt infection. The percentage seed discolouration was ranging from 4.0 to 70.0. All the 102 samples had seed infection ranging from 1.7 – 75.0 per cent. At CCSHAU, Hisar, the samples from farmers own saved paddy seed (100) were collected. Paddy bunt infected sample percentage was 13.00 and range was 0.05-0.15 per cent. At MPKV, Rahuri, seed health status of 781 samples of paddy collected were tested. The seed germination ranged from 73 to 92 per cent, while the seed mycoflora associated with seeds ranged from 0.5 to 9.8 per cent. A total of 8.17% samples were discoloured with seed-borne pathogens. None of the samples showed the infection of bunt. Only ten seed samples showed seed germination below IMSCS. At IARI (RS), Karnal, out of 55 samples collected, seed germination ranged from 81 to 88 per cent, while the seed mycoflora associated with seeds ranged from 0 to 1.5 per cent. Grain discolouration was observed in range of 8-17% in samples analyzed. At AAU, Jorhat, twenty-eight (28.43%) seed samples out of one hundred two (102) samples showed germination below IMSCS and the range was 69-86 per cent. Seed moisture varied in the range of 9.8-13.8 per cent. The pathogens associated were *Aspergillus* spp., *Alternaria* spp., *Bipolaris oryzae*, *Curvularia* spp., *Drechslera oryzae*, *Fusarium* spp., *Penicillium* spp., *Rhizopus* spp.



Seed-borne fungi on rice seeds

Conidia of *Bipolaris oryzae*



Conidia of *Alternaria* sp.

Crop (d) Groundnut

At TNAU, Coimbatore, farmers stored the groundnut pods in poly bags/ gunny bags. The moisture content ranged from 6.1 to 9.7% and the germination per cent ranged from 57.0 to 92.0%. The germination percentage of 7 farmers saved groundnut seed samples (6.67%) was below IMSCS (70%). The seed infection of *Aspergillus flavus* was highest (1.00 to 29.25%) followed by *A. niger* (0.50 to 19.00%), *Sclerotium* (0.0 to 0.0-2.25%) and *Rhizopus* sp. (0.0-3.0%). At AAU, Anand**,** a total of 141 seed samples were collected had overall good germinability ranging from 80 to 95% germination. None of the seed samples was found free from Aspergillus seed rot. Overall Aspergillus seed rot ranged from 5-15%. At OUAT, Bhubaneswar, per cent seed germination was recorded in the range of 29-74%. Seed rot incidence percentage range was 6-16%, collar rot percentage range was from 2-14%. At MPKV, Rahuri, out of 352 samples, seed germination ranged from 53-88 per cent, while the seed mycoflora associated with the seed was ranged from 1.0-11.7 per cent. Thirty-two samples showed seed germination below IMSCS. All the farmers saved groundnut seed samples were infected with *A. niger* and *A. flavus*. At JNKVV, Jabalpur, out of 30 samples

collected, prevalence of *A. flavus* exhibited a range from 1.0 to 12%, while *A. niger* displayed a narrower range, falling between 1.0 and 3.0%. At RARI, Durgapura, 32 out of total 34 samples showed germination above IMSCS level. The seed pathogen *Aspergillus* spp. was found associated with 16 out of 34 samples with the infection ranging from 5 to 10 per cent. Therefore, these findings underscore the critical importance of vigilance and proactive measures in managing fungal infections within groundnut seed stocks, not only to safeguard agricultural productivity but also to mitigate risks associated with toxin exposure in the food and feed supply chains.

Seed-borne fungi associated with farmers saved groundnut seeds

Crop (e): Chickpea

At MPKV, Rahuri, seed health status of 522 samples were tested. The seed germination ranged from 77 to 96 per cent, while the seed mycoflora associated with seeds ranged from 1.0 to 6.7 per cent. 29 samples showed seed germination below IMSCS (85%). At JNKVV, Jabalpur, 61 seed samples were sourced from farmers. The prevalence of *Fusarium oxysporum* ranged from 1.0 to 9.0%, indicating variability in infection rates across the surveyed samples. Similarly, *Botrytis cinerea* and *A. flavus* exhibited association ranges between 1.0 and 3.0% and 1.0 and 8.0%, respectively. At RARI, Durgapura, out of 53 samples, 50 samples showed germination above IMSCS level. Seed rotting was reported in 12 samples showing infection in the range of 0.01-1.6% for *Botrytis* and 0.02-4.8% for *Fusarium*. *Cercospora, Stemphylium* and *Cladosporium* fungi were also found associated with seed samples. At IARI, New Delhi, farmers saved seeds of chickpea were collected from 40 farmers. None of the samples showed germination below IMSCS level. Only *Fusarium* sp. was observed in range of 0.3-1.8%.

Crop (f) Finger millet

At TNAU, Coimbatore, moisture content ranged from 10.0 to 14.8% and the germination per cent ranged from 65 to 97%. Five numbers of farmers saved finger millet seed samples (4.85%) failed to fulfill the minimum seed germination (75%). The pathogens associated with farmers saved finger millet seeds were *Curvularia*, *Alternaria* and *Aspergillus* and the infection ranged from 0.0 to 6.25, 0.25 to 2.50, 0.0 to 3.0%, respectively. At PJTSAU, Hyderabad, a total of 68 finger millet seed samples were collected. All the seed samples tested have showed germination in a range of 88.86 to 92.41 per cent. Among the seed mycoflora, *Fusarium* sp. was predominant (5.50%) followed by *Curvularia* sp. (0.77%). The seed samples were also detected with storage fungi *viz., Aspergillus* sp. (0.59%). At MPKV, Rahuri, seed health status of 298 samples were tested. The seed germination ranged from 65 to 90 per cent, while the seed mycoflora associated with seeds ranged from 0.50 to 7.1 per cent. Eleven seed samples showed seed germination below IMSCS (75%). At JNKVV, Jabalpur, 33 seed samples were sourced from farmers. The association of *A. alternata* within the sampled seeds ranged from 2 to 6%, whereas the prevalence of *A. flavus* spanned from 2.0 to 16.0%, indicating variability in infection rates across the surveyed samples. Similarly, the range for *A. niger* was recorded between 1.0 and 7.0%.

❖ **Experiment 3: Standardization of detection methods for seed-borne pathogens of significance**

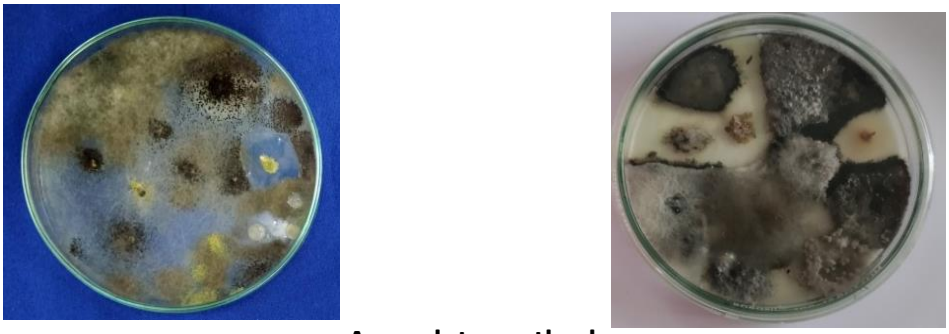
Crop: Sesame

At TNAU, Coimbatore, among the different methods tested for the detection of seed-borne pathogens of significance, potato dextrose agar plate method was found to be good for the detection of *Alternaria* (8.3%) and *Macrophomina* (12.8%) and was found significantly superior over other detection methods. However, in the present study the overall per cent recovery of mycoflora was maximum in standard blotter method (40.5%) followed by potato dextrose agar plate method (37.3%) and 2, 4 - D blotter method (30.4%). Deep freezing method was found to be least effective for the detection of seed-borne pathogens as it recorded the overall per cent recovery of 15.7 and 16.1 per cent, respectively. At PJTSAU, Hyderabad, among the methods tested highest per cent recovery of *Alternaria* sp. was observed in Agar plate method (8.87%) followed by NaOH (0.2%) blotter soak method with7.53 per cent.

Crop: Mustard

At PJTSAU, Hyderabad among the different methods tested maximum per cent recovery of *Alternaria* sp. was observed in Seed Extract agar Method (Modified Agar Plate method) (1.91%) followed by 2,4 D blotter method (1.47%).

Standardization of seed health testing methods for the detection of seed-borne fungi in sesame



Agar plate method

Blotter method **NaOH blotter soak method (0.2%)**

Crop: Mung bean

At SKUAST, Kashmir, RT-LAMP was standardized for the detection of BCMV. LAMP *i.e* loop mediated isothermal amplification is a single tube technique that amplifies nucleic acid with high specificity, efficiency, and rapidity under isothermal conditions with a set of six specially designed primers that recognize six-eight distinct sequences of the target DNA. The whole isothermal amplification was carried at 60-65°C.

❖ **Experiment 4(a): Exploring new generation systemic fungicide molecules for false smut-free seed production in rice:**

Second year (2023-24): Efficacy of novel systemic fungicide molecules on the incidence of false smut disease and rice grain yield under field conditions.

At TNAU, Coimbatore, all the systemic fungicide molecules were significantly superior in reducing the incidence and severity of false smut disease in rice and increasing grain yield compared to untreated control. Among the fungicide molecules, fluopyram 17.7% + tebuconazole 17.7% SC (1.0 ml/lit) treated plots recorded lesser incidence of false smut in terms of per cent infected panicle /m^2 (1.00%), per cent infected spikelets/ panicle (0.55%), disease severity (0.55%) and higher grain yield (5230 kg/ha). Untreated control plots recorded higher per cent infected panicle /m^2 (6.50%), per cent infected spikelets/ panicle (3.00%), disease severity (19.50%) and lesser grain yield (4708 kg/ha). At IARI, New Delhi, Trifloxystrobin 25% + Tebuconazole 50%WG (0.4 g/lit) and Propiconazole 25EC (1ml/lit) treated plots recorded lower false smut infected panicle/ m^2, infected spikelets / panicle with disease severity and higher grain yield.

At OUAT, Bhubneshwar, among the five different fungicides tested, Trifloxystrobin 25% + Tebuconazole 50% WG (0.4 g/lit) and Fluopyram 17.7% + Tebuconazole 17.7% (1.0 ml/lit) recorded the least disease severity of 1.83 and 2.52 per cent, respectively. At PAU, Ludhiana, minimum incidence of false smut was observed in fluopyram 17.7% + tebuconazole 17.7% SC (1.0 ml/lit) treated plots. At PAJANCOA & RI, Karaikal, the results demonstrated that Trifloxystrobin @25% + Tebuconazole 50%WG (0.4 g/lit) and Propiconazole 25EC (1.0 ml/lit) treated plots recorded lower false smut infected panicle/ m^2, infected spikelets/ panicle with disease severity and higher grain yield. At PJTSAU, Hyderabad, the fungicide Trifloxystrobin 25% + Tebuconazole 50% WG recorded maximum (92.75%) per cent seed germination followed by Fluopyram 17.7% + Tebuconazole 17.7% SC with 91.75 per cent at ten days after sowing.

Effect of different systemic fungicide molecules on the incidence of rice false smut disease under field conditions

Field view

Fluopyram 17.7% + Tebuconazole 17.7% SC

Trifloxystrobin 25% + Tebuconazole 50% WG

Untreated control plot

Experiment 4(b): Development of eco-friendly low-cost input / indigenous technology for the production of disease-free soybean, chickpea and groundnut seeds.

Soybean: At JNKVV, Jabalpur, the efficacy of bioformulations containing biocontrol agents *Trichoderma asperellum* and *Pseudomonas fluorescens*, as well as organic products namely Beejamrit, Jeevamrit, and Herbal kunapjal, in enhancing seed quality parameters and frequency distribution of different seed associated mycoflora was investigated. Seeds were treated with *T. asperellum* and *P. fluorescens* at a concentration of 10%, and with Beejamrit, Jeevamrit, and Herbal kunapjal at a concentration of 5%, alongside Carboxin 37.5% WS +

Thiram 37.5% WS as a chemical check. Sterilized water-treated seeds served as the control. A comprehensive analysis of the effect of seed treatment on seed-associated mycoflora (*Colletotrichum* spp., *Macrophomina phaseolina, Fusarium oxysporum, Aspergillus niger* and *Aspergillus flavus)*, focusing on infection percentages and the frequency of above-mentioned fungi observed after seed treatment with different agents. Seeds treated with *T. asperellum* exhibited a 17.33% infection rate, indicating a moderate reduction compared to the control group. Similar to *T. asperellum*, seeds treated with *P. fluorescens* showed a reduction in infection percentage, with a rate of 16.00%. Organic products namely Beejamrit, Jeevamrit, and Kunapjal also demonstrated efficacy in reducing seed infection, with infection rates ranging from 12.00% to 16.00%. Notably, seeds treated with Carboxin 37.5% + Thiram 37.5% chemical formulation exhibited the lowest infection rate at 8.00%. Across all treatments, there were variations in the frequency of different fungi observed on the seeds.

At MPKV, Rahuri, among the bioagents seed treatment to soybean seed with Herbal kunapjal @ 5 % found effective for increasing seed germination, seedling vigour and decreasing seed mycoflora by 59.12, 357.67 and 76.92%, respectively. Which were at par with *P. fluorescens* @ 0.5% and *T. asperellum* @ 0.5%. At VNMKV, Parbhani, among all the individual treatments, T_1 (seed treatment with *T. asperellum* 2%) recorded maximum seed germination (93.30%), seedling vigour index (1790.7) and seed infection (7.66%), which is followed by treatment T_4 (seed treatment with Beejamrit (5%) which recorded the seed germination of 92.32%, seedling vigour index of 1554.34 and seed infection of 10.64%. At GBPUA&T, Pantnagar, among the organic products germination was high in beejamrit followed by Herbal kunapjal and Jeevamrit. Germination of the seeds treated with these organic products was recorded even higher than the chemical check. Minimum seed infection was observed in Herbal kunapjal and Carboxin 37.5% WS + Thiram 37.5% WS followed by *P. fluorescens, T. asperellum* and Beejamrit. Reduced recovery of *Aspergillus, Colletotrichum, Fusarium* and *Macrophomina* was recorded in all the treatments as compare to check.

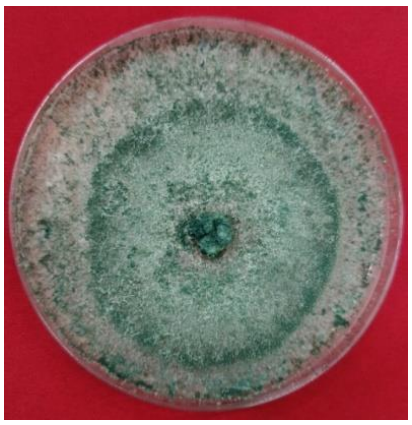
Chickpea: At JNKVV Jabalpur, organic products such as Beejamrit, and Kunapjal displayed relatively lower frequencies of fungal presence compared to the control group and bioagents. Carboxin 37.5% + Thiram 37.5% exhibited the lowest infection rate, indicating its highest efficacy in controlling seed-borne pathogens. The study highlights the potential of *P. fluorescens* and organic products namely Beejamrit, and Herbal kunapjal as effective alternatives to chemical treatments for seed quality enhancement and disease management. At MPKV, Rahuri, the same results were found in chickpea where seed treatment to seed treatment with Herbal kunapjal @ 5% found effective for increasing seed germination, seed vigour and decreasing seed mycoflora by 40.01, 149.08 and 85.18%, respectively, which were at par with *P. fluorescens* @ 0.5% and *T. asperellum* @ 0.5%. At PAU, Ludhiana, maximum seed germination of chickpea (88.0%) was observed in seeds treated with Carboxin 37.5% WS + Thiram 37.5%WS @ 0.3% followed by *Trichoderma* (72.5%) and *Pseudomonas* (65.5%) treated seeds. Efficacy of Herbal kunapjal was better than Beejamrit and Jeevamrit.

At GBPUA&T, Pantnagar, seed infection was also reduced in all the treatments minimum in beejamrit which was at par with chemical check followed by herbal kunapjal being at par with beejamrit. At RARI, Durgapura, *Trichoderma asperellum* was found as the best eco-friendly management treatment giving 77.3% seed germination along with 6.6 cm average root length and 8.7 cm average shoot length. This was followed by *P. fluorescens* which was statistically at par in promoting root and shoot growth of the seedlings as *Trichoderma*. Among the prepared concoctions, Beejamrit was found effective seed treatment option for increasing seed germination and seedling growth, giving 73.67% germination followed by Herbal kunapjal and jeevamrit which were at par with each other. All treatments were found statistically at par when comparing the number of infected seeds, other than chemical check, and the recovery of both inoculated pathogens was not much different among the treatments, however all were significantly found superior to untreated check in the reducing the number of infected seeds.

Groundnut: At PJTSAU, Hyderabad, pre-sowing seed treatment with test pathogen *S. rolfsii* followed by test treatments revealed that among the bioagents, *T. asperellum* recorded highest per cent germination of 80.75 per cent followed by *P. fluorescens* (74.75%). Of the organic formulations Jeevamrit @5%recorded maximum of 67.00 per cent seed germination compared to the pathogen control (57.00%). However, among the treatments evaluated, minimum per cent seed infection and seedling vigour was observed in bioagents over the organic formulations. In case of *A. flavus* seed treatment with *T. asperellum* has recorded germination per cent of above IMSCS (>70%) *i.e.,* 79.50 per cent compared the other treatments including pathogen control (47.50%). The same treatment has showed minimum seed infection (4.25%) and highest SV-I (1617). At AAU, Anand, seed treated with Kunab Jal at 5% concentration and *T. asperellum* has been shown to significantly enhance the seed quality parameters of groundnut seeds. Additionally, this treatment has proven effective in managing *A. niger* and *S. rolfsii*, two common pathogens affecting groundnut crops. At MPKV, Rahuri, in groundnut were seed treatment with Herbal Kunab jal @ 5% found effective for increasing seed germination, seed vigour and decreasing seed mycoflora by 106.65, 375.33 and 64.25%, respectively. Which were at par with *P. fluorescens* @ 0.5% and *T. asperellum* @ 0.5%.

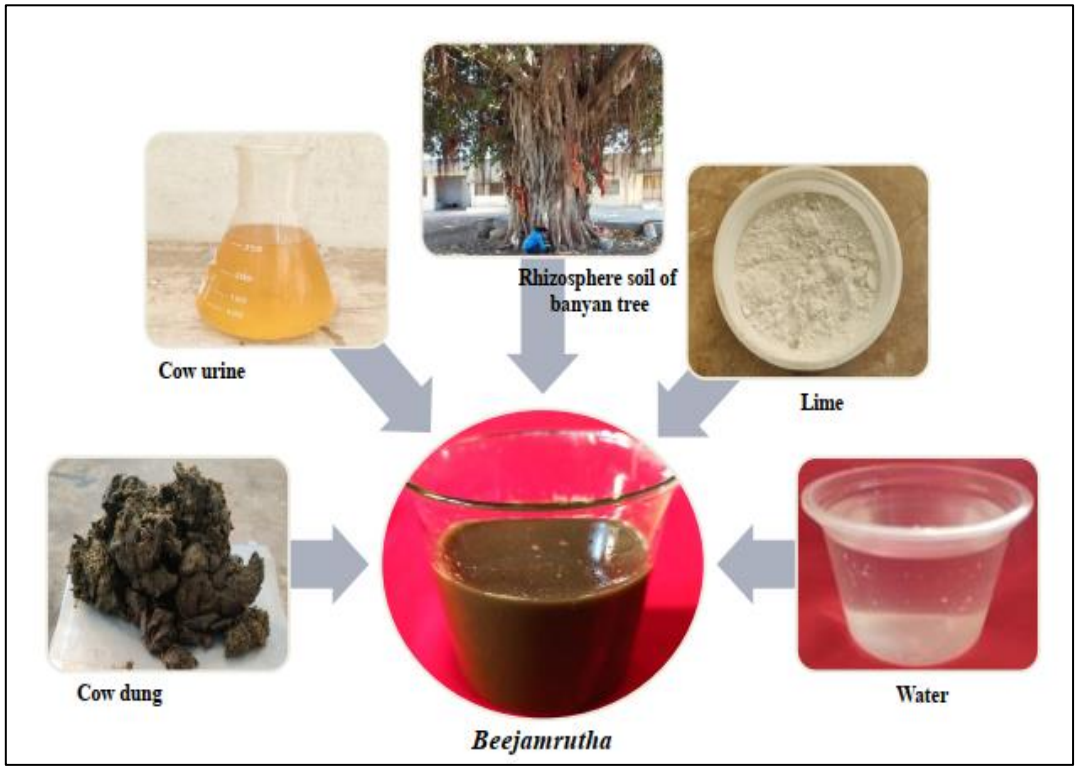
At OUAT, Bhubneshwar, seeds treated with *T. asperellum* was significantly superior in recording higher seed germination (94.25%), seedling length (20.02cm) followed by Carboxin 37.5% + Thiram 37.5%, which recorded seed germination of 93.5% and seedling length of 22.88cm. The remaining seed treatments with Beejamrit, Jeevamrit and Herbal KunapJal were found less effective in improving seed germination, seedling length, which recorded only 77.75, 74.75, 71.5% seed germination and 17.56, 16.67 and 18. 40cm.The seed treatment with *T. asperellum* recorded minimum number of infected seeds (2.75) and frequency of mycoflora (2.25), whereas pathogen treated seeds (Control) showed maximum number of infected seed (24.50) and frequency of mycoflora (25.50). At RARI, Durgapura, all the treatments were found significantly superior over check in enhancing germination as well as promoting seedling growth of the seeds inoculated with *S. rolfsii* and *A. niger*. *Trichoderma*

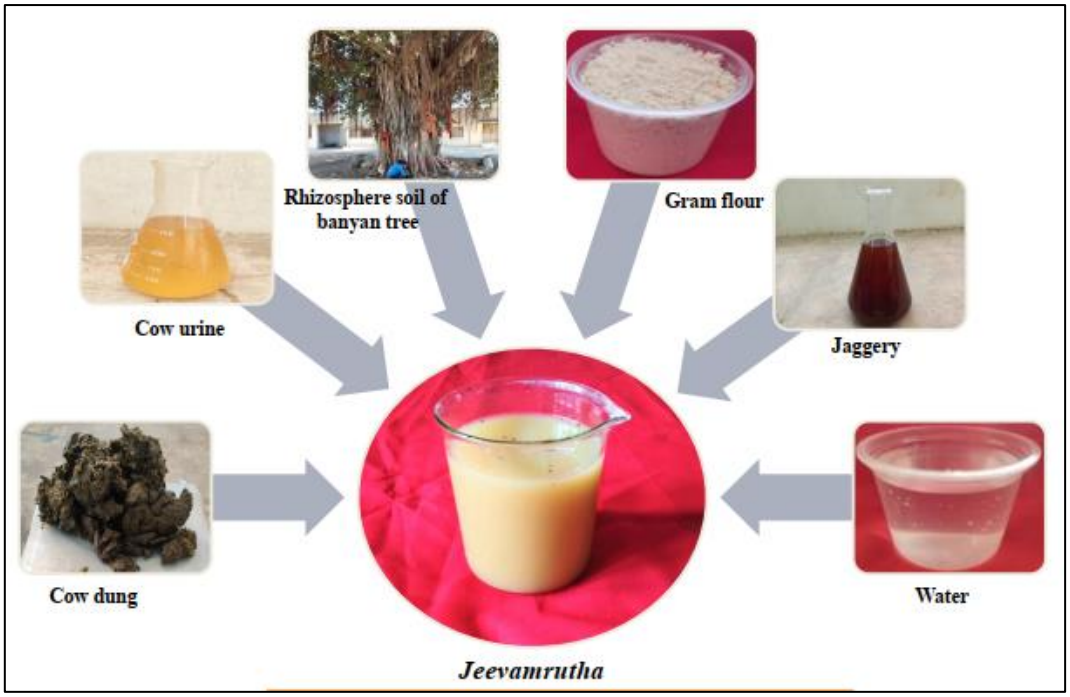
asperellum was found most effective giving 87.33% germination and better seedling growth parameters 7.13 cm root length and 13.77 cm shoot length, followed by *P. fluorescens* which was statistically at par with *Trichoderma*. Among the eco-friendly prepared concoctions, Beejamrtit was found to give 82.67% germination as well as 6.87 cm root length and 11.77 cm shoot length which is significantly better over check, followed by jeevamrit which was statistically at par with beejamrit in promoting germination of the inoculated seeds.



Trichoderma asperellum

Pseudomonas fluorescens





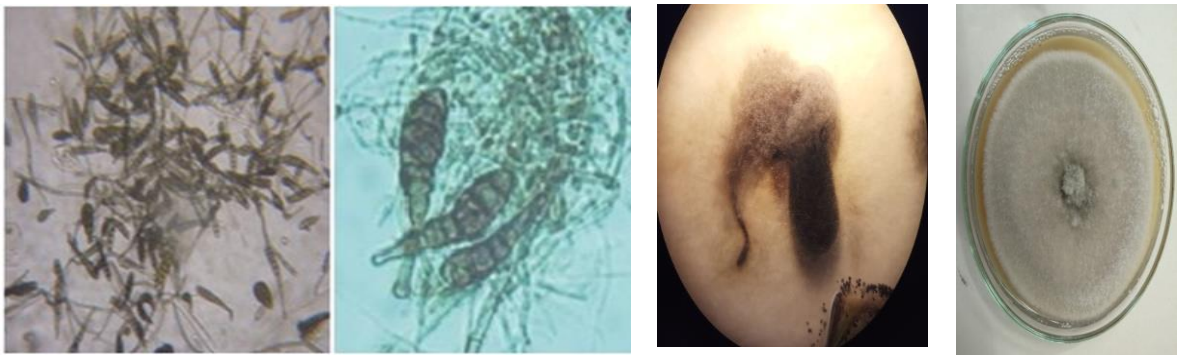
❖ **Experiment 5: Development of seed health standards for important seed borne diseases in crops**

At MPKV, Rahuri, to address the need for standardized seed health standards for important seed-associated diseases in crops, particularly *Alternaria* leaf spot in safflower, a pilot study has been initiated last year. This study focuses on evaluating the development of seed health standards for *Alternaria carthami*, the causal agent of *Alternaria* leaf spot, which is a significant concern for safflower cultivation.

Tr. No	Treatments	Infected seed %	Mean of four replications				
			Incidence of *A. carthami* by blotter test	Intensity of *A. carthami* in field	Yield qt/ha	Per cent yield loss /ha	Incidence of *A. carthami* by blotter test from harvested seeds
1	1000 Breeder seeds + 00 Inoculated seed with *Alternaria carthami*	0.0	0.0	1.05	14.50	0.0	0.04
2	999 Breeder seeds + 01 Inoculated seed with *Alternaria carthami*	0.1	0.05	1.65	14.50	0.0	**0.05**
3	998 Breeder seeds + 02 Inoculated seed	0.2	0.15	3.85	14.00	3.44	0.63

	with *Alternaria carthami*						
4	995 Breeder seeds + 05 Inoculated seed with *Alternaria carthami*	0.5	0.33	1156	12.63	12.89	2.66
5	990 Breeder seeds + 10 Inoculated seed with *Alternaria carthami*	1.0	1.10	27.58	11.38	21.51	11.09
6	1000 Breeder seeds +1000 Inoculated seed with *Alternaria carthami*	100	95.06	85.72	4.74	67.31	62.00

Conclusion- Seed standard for foundation seed based on maximum per cent seed infection of *Alternaria carthami* in safflower may be 0.1 per cent



***Alternaria carthami* culture and conidia**

At PJTSAU, Hyderabad, freshly harvested healthy sesame seed was evaluated at different levels of infection on germination under artificially treated test pathogen *Alternaria sesami* to the seed under net house conditions. Healthy sesame seeds were blended with pathogen treated seed at different levels of infection and were sown in pots for evaluation. The studies stated that at two weeks after sowing, highest infection levels resulted in increased level of per cent infection (5.03) by the test pathogen. While, the low infection levels had no impact on per cent seed infection.

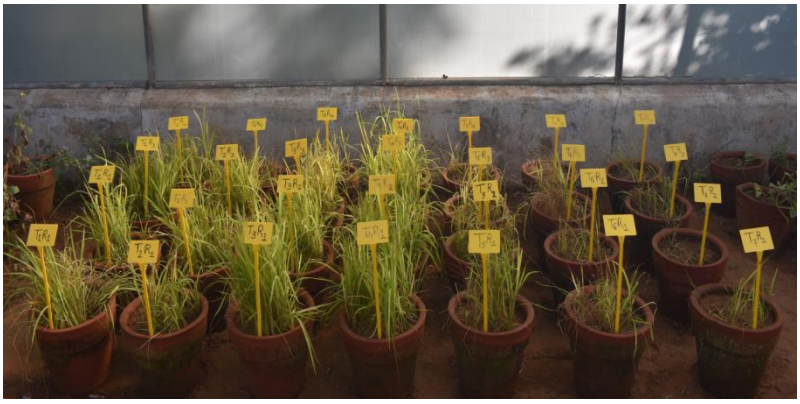
Given the importance of precision and reliability in seed health assessment, this experiment requires a controlled environment and a standardized protocol, which are currently not available at any center. In 24-25 the harvested seed samples after careful labelling (to maintain traceability throughout the experiment) shall be analyzed at JNKVV, Jabalpur, GBPUAT, Pantnagar and PAU Ludhiana to reconfirm the findings.

❖ **Experiment 6: Systematic studies for evaluation of alternative chemicals and microbial consortia for effective management of seed borne pathogens of major crops**

I. Project title: Effect of seed dressing fungicides on seed and seedling associated pathogens of Paddy (Blast, Brown spot, False smut, Sheath rot, Bakanae as per disease severity at centres)

At PJTSAU, Hyderabad, the pretreated seeds with test pathogen *Pyricularia oryzae* revealed that among the fungicides, Picoxystrobin 6.78% + Tricylcazole 20.33% SC @ 1ml/kg (97.75; 0.50) followed by Propiconazole 13.9%+ Difenconazole 13.9% EC @ 1 ml/kg (97.50; 0.50) has recorded highest germination and lowest seedling mortality at 15 DAS. Field emergence stated that among the evaluated fungicides, Propiconazole 13.9%+ Difenconazole 13.9% EC @ 1ml/kg has recorded highest germination per cent of 98.50 per cent followed by Azoxystrobin 18.2% + Difenconazole 11.4% C @ 2g/kg with 96.75 per cent. The test fungicide Propiconazole 13.9%+ Difenconazole 13.9% EC which recorded highest germination showed 4.56 per cent improvement over the check fungicide and 7.10 per cent over pathogen control.

At TNAU, Coimbatore, among the fungicides tested, T3-Trifloxystrobin 25% + Tebuconazole 50% WG (Nativo) @ 0.5g/kg of seeds was found most effective in reducing the seedling mortality (1.75%) and disease incidence (0.25 and 0.00% at 30 and 45 DAS) and also improving seed germination (90%), vigour index I (1866) and vigour index II (4) followed by T2-Azoxystrobin 18.2% + Difenconazole 11.4% SC (Amistar Top) @ 1 ml/kg seeds. These treatments were on par with each other. Pathogen inoculated control recorded highest seedling mortality of 38.7%, disease incidence of 20.22 and 17.60% at 30 and 45 DAS, respectively and the lowest field emergence of 74%, vigour index I (1060) and II (1).



Field emergence studies of paddy crop

At AAU, Anand, the seed treatment with Trifloxystrobin 25% + Tebuconazole 50% WG at a rate of 0.5 ml/kg of seeds has been identified as a significantly effective seed treatment method for enhancing the health and quality of paddy seeds. This treatment has shown efficacy in managing *Pyricularia oryzae*, the fungus responsible for causing blast disease in paddy plants. At OUAT, Bhubaneshwar, seed treatment with pathogen + Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 1ml/kg seed recorded highest per cent emergence of 81.75, 81.75, 87% at 15, 30, 45DAS, lowest seedling mortality (2.75%) and lowest disease incidence (1.25%) at 45DAS and shoot length (23.81cm), root length (10.47cm), dry weight (23.13g/plant) followed by seed treatment with pathogen + Carbendazim 50% WP @ 2 gm/kg seed. Pathogen treated seeds showed lowest per cent emergence of 47.25, 47.25, 48.25 at 15, 30 and 45DAS, highest seedling mortality (20.25%) at 45DAS and highest disease incidence (11.25%, 17%) at 30 and 45DAS, respectively and shoot length (15.60cm), root length (3.54cm), dry weight (2.42g/plant).

At PAU, Ludhiana, seed treatment with Trifloxystrobin 25% + Tebuconazole 50% resulted in maximum seed germination and least seedling mortality in seeds infested with *Fusarium* spp. and *Sarocladium oryzae* in variety PUSA 1509 and PR 114, respectively. Trifloxystrobin 25% + Tebuconazole 50% WG @ 0.5 g/kg seed was found to be the best new seed treatment fungicide followed by Picoxystrobin 6.78% +Tricylcazole 20.33% SC @ 1ml/kg seed. At AAU, Jorhat, among the fungicides tested, Trifloxystrobin @25% + Tebuconazole 50% WG @ 0.5ml/kg seed was found most effective in reducing the per cent disease incidence (3.33 at both 30 and 45 DAS) against brown spot disease where field emergence (89.00 %) was observed followed by Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 1ml/kg seed with 6.67 per cent disease incidence at 30 and 45 DAS and field emergence of 87.67%. Further, shoot length (cm), root length (cm) and dry weight (g/plant) was also improved in treatment with Trifloxystrobin 25% + Tebuconazole 50% WG followed by Azoxystrobin 18.2% + Difenconazole 11.4% SC at 45 DAS. At PAJANCOA & RI, Karaikal, the seeds treated with Azoxystrobin 18.2%+ Difenoconazole 11.4% SC demonstrated maximum seed germination (96.7%; 80.0%), minimum seedling mortality (20.0%; 3.3%), minimum disease incidence (10.0 %; 0.0 %), maximum shoot length (17.97, 21.47cm), root length (6.01 cm; 7.81 cm) and dry matter production (4.25g; 4.10g) than all other fungicides and control in pot culture and field emergence studies, respectively. Pathogens treated seeds recorded minimum germination (83.3%; 63.3%), maximum seedling mortality (36.7; 16.7%) and disease incidence (26.7; 13.3 %), minimum shoot length (12.15 cm; 14.65 cm), root length (3.66 cm; 5.46 cm) and dry matter production (2.06 g; 2.01 g) in pot culture and field emergence studies, respectively.

At MPKV, Rahuri, for the management of seed borne pathogen *Helminthosporium oryzae* in paddy, seed treatment with Trifloxystrobin @25% + Tebuconazole 50% WG @ 0.5gm/ kg seed found the effective for decreasing seed mycoflora by 72.34%, increasing field emergence, seedling vigour and dry weight by 28.57, 107.41 and 60.94%, respectively. At GBPUA&T, Pantnagar, the field emergence was maximum in seeds treated with Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 1ml/ kg of seeds followed by Trifloxystrobin

@25% + Tebuconazole 50% WG and Picoxystrobin 6.78% +Tricylcazole 20.33% SC. Seedling mortality was not observed in Azoxystrobin 18.2% + Difenconazole 11.4% SC treated seeds. However, significant difference was not found within the treatments. Minimum disease incidence was observed in Trifloxystrobin @25% + Tebuconazole 50% WG followed by Azoxystrobin 18.2% + Difenconazole 11.4% SC and Picoxystrobin 6.78% +Tricylcazole 20.33% SC. At IARI, New Delhi, for the management of seed borne pathogen *Sarocladium oryzae* in paddy, seed treatment with Trifloxystrobin @25% + Tebuconazole 50% WG @ 0.5gm/ kg seed found the effective for decreasing seed mycoflora by 52.64%, increasing field emergence, seedling vigour and dry weight by 18.57,104.11 and 55.24%, respectively. At DRPCAU, Pusa, seed dressing fungicides T_4 - Trifloxystrobin 25% + Tebuconazole 50% WG @ 0.5g/kg seeds recorded highest germination percentage (96%), seedling vigour (1590) and lowest seed infection (7%) followed by T_2 - Azoxystrobin 18.2% + Difenconazole 11.4% SC (Amistar Top) @ 1ml/kg where germination percentage was 95%, seedling vigour, 1540 and seed infection was 7% in comparison with control where germination percentage 74, seedling vigour 925 and seed infection 17%.

II. Project title: Effect of seed dressing fungicides on seed and seedling associated pathogens of pigeon pea (Wilt: *Fusarium udum*)

At TNAU, Coimbatore, among the treatments, T3- seed treatment with pathogen+ Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1ml/kg seeds recorded lesser incidence of seedling mortality (1.65%) and nil incidence of wilt at 30 and 45 DAS compared to other treatments. The treatment also recorded higher field emergence (92%) and vigour index I (3860) and II (19) and was followed by T2- Seed treatment with pathogen+ Thiophanate methyl 45% + Pyraclostrobin 5% FS @ 1ml/kg seeds. Whereas, standard check carbendazim 50WP (Bavistin) treated seeds recorded 5.0% seedling mortality and 5.0% and 2.0% wilt incidence at 30 and 45 DAS, respectively with the filed emergence of 87% and vigour index I and II of 3437 and 18.

At PJTSAU, Hyderabad, the pretreated seeds with test pathogen *Fusarium udum* inferred that among the fungicides, Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (96.67; 1.00) followed by Thiophanate methyl 45% + Pyraclostrobin 5% FS @1 ml/kg (92.00;1.66) recorded highest germination and lowest seedling mortality at 15 DAS. Field emergence showed that among the evaluated fungicides, Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1ml/kg has recorded highest germination of 98.00 per cent followed by Thiophanate methyl 45% + Pyraclostrobin 5% FS with 96.25 per cent. At MPKV, Rahuri, for the management of seed borne pathogen *Fusarium udum* and *Macrophomina phasiolina* in pigeon ea, seed treatment with Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1ml/kg seed found effective for decreasing seed mycoflora by 92.35% and 88.54%, increasing field emergence by 93.0 and 71.15%, seedling vigour by 221.86 and 100.0%, dry weight by 79.44 and 53.36%, respectively.

***Fusarium udum* culture**

Pathogen and fungicide treated seeds

Penflufen 13.28% +Trifloxystrobin 13.2% FS

Pathogen alone inoculated

III. Project title: Effect of seed dressing fungicides on seed and seedling associated pathogens of green gram and black gram (Root rot: *Macrophomina phaseolina*)

At PJTSAU, Hyderabad, the pretreated seeds with test pathogen *Macrophomina phaseolina* revealed that, among the fungicides, Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (96.33; 2.00) followed by Pyraclostrobin5% +Metiram55% WG @ 1g/kg (94.33; 2.66) has recorded highest germination and lowest seedling mortality at 15 DAS. Further, the same fungicide has recorded 64.70 per cent reduction over standard check fungicide (4.25%) and 73.91 per cent pathogen control (5.75%) at 15 DAS. However, the seed treatment effect was more pronounced in terms of minimum disease incidence and maximum seedling vigour index-I and II. Similarly, in black gram, the pretreated seeds with test pathogen *Macrophomina phaseolina* showed that among the fungicides, Penflufen13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (93.67; 2.67) followed by Pyraclostrobin5% +Metiram55% WG @ 2g/kg (91.67; 4.00) has recorded highest germination and lowest seedling mortality at 15 DAS. Field Emergence studies sated that among the fungicides, the fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (92.50; 2.75) followed by Pyraclostrobin5% +Metiram55% WG @ 2g/kg (91.75; 4.25) has recorded highest germination and lowest seedling mortality at 15 DAS. Further, the same fungicide has recorded 52.17 per cent reduction over standard check fungicide (5.75%) and 64.51 per cent pathogen control (7.75%) at 15 DAS.

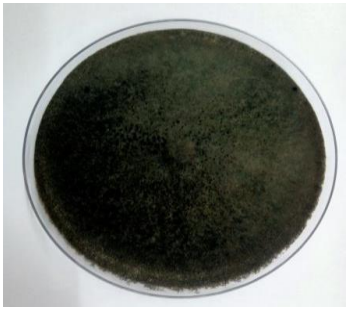
At TNAU, Coimbatore, results revealed that all the seed dressing fungicides significantly reduced the seedling mortality and root rot infection both in green gram and black gram and also improved the field emergence and vigour index I and II. Among the treatments, T1- Seed treatment with pathogen+ Penflufen 13.28% + Trifloxystrobin 13.2% FS (Ever Golxtend) @ 1 ml/kg seeds was found most effective in reducing the seedling mortality (2.0 and 1.80%) and root rot incidence (0.0% at 30 and 45 DAS) both in green gram and black gram, respectively. The pathogen alone treated green gram and black gram seeds recorded higher seedling mortality of 42.26 and 45.67% and the root rot incidence of 12.70 and 11.50% and 14.25 and 13.55% at 30 and 45 DAS, respectively. The treatment also recorded lower field emergence (82 and 85%) and vigour index I (2507 and 2471) and II (10 and 12) both in black gram and green gram. At AAU, Anand, the seed treatment with penflufen 13.28% + trifloxystrobin 13.2% FS at a rate of 1 ml/kg of seeds has been identified as a significantly effective seed treatment method for enhancing the health and quality of green gram seeds. This treatment has shown efficacy in managing *Macrophomina phaseolina*, the fungus responsible for causing dry root rot disease.

At OUAT, Bhubneshwar, seed treatment with pathogen+ Pyraclostrobin 5% + Metiram 55% WG (Cabriotop) @ 2g/kg seed recorded highest per cent emergence of 88.25, 90.25, 93.5% at 15, 30, 45 DAS, respectively, lowest seedling mortality (1.75) at 45 DAS, lowest disease incidence (2%) at 45DAS and shoot length (31.78cm), root length (7.99cm), dry weight (13.80 g/plant) followed by seed treatment with pathogen+ Penflufen 13.28% + Trifloxystrobin 13.2% FS @ 1ml/kg seed, per cent emergence of 88, 84.5, 87% at 15, 30 and 45DAS, seedling mortality (8%) at 45DAS, disease incidence (5.5%) at 45DAS and shoot length (33.52cm), root length (8.19cm), dry weight (15.09 g/plant) and seed treatment with pathogen + Carbendazim 50% WP @ 2 gm/kg seed per cent emergence of 91.25, 91.75, 85% at 15, 30, 45DAS, seedling mortality (2.5%) at 45DAS, disease incidence (2.25%, 3%) at 30 and 45DAS and shoot length (34.71cm), root length (6.70cm), dry weight (14.91g/plant). Pathogen treated seeds showed lowest per cent emergence of 66, 68.25, 69.75% at 15, 30, 45DAS, highest seedling mortality (27.25%) at 45DAS, highest disease incidence (17.75%, 24.75%) at 30 and 45DAS and shoot length (20.54cm), root length (5.79 cm), dry weight (5.36g/plant).

At PAU, Ludhiana, Penflufen 13.28%+ Trifloxystrobin 13.2% FS @1ml/kg treated seeds exhibited maximum seedling emergence and minimum seedling mortality in green gram and black gram. At AAU, Jorhat, among the fungicides tested, Penflufen 13.28% + Trifloxystrobin 13.2% FS @ 1ml/kg seed was found most effective in reducing per cent disease incidence (3.33 %) at 45 DAS and improve field emergence (95%) followed by Pyraclostrobin 5% + Metiram 55% WG @ 1g/kg seed with 6.67 % per cent disease incidence at 45 DAS and field emergence of 94%. Further, shoot length (cm), root length (cm) and dry weight (g/plant) were also improved in treatment with Penflufen 13.28% + Trifloxystrobin 13.2% FS at 45 DAS.

At PAJANCOA & RI, Karaikal, green gram seeds treated with Pyraclostrobin 5% + Metiram 55% WG @ 2g/kg of seed on par with other fungicidal treatments except Carbendazim 50% WP demonstrated maximum seed germination. However, seedling mortality (43.3%; 10%) and disease incidence (10.0%; 3.3%) were significantly lesser in the

seeds treated with Pyraclostrobin 5% + Metiram 55% WG @ 2g/kg of seed as compared to other fungicidal seed treatments, untreated control and pathogen treated seeds.



***Macrophomina* culture**

Pathogen and fungicide treated seeds

Greengram **Blackgram**

Penflufen 13.28% +Trifloxystrobin 13.2% FS

Pathogen alone inoculated

At VNMKV, Parbhani, in green gram, treatment T_{1}- seed treatment with Penflufen + Trifloxystrobin @ 1ml/kg seed was found effective which shows 90.33% field emergence,

13.66, 15.66 and 18.66% at 15, 30 and seedling mortality 45DAS and 25.33 cm, 33.66cm and 8.0 gm/plant shoot length, root length and dry matter, respectively at 45 DAS in green gram followed by treatment T_3 Seed treatment with Propiconazole 13.9% + Difenconazole 13.9% EC @ 1ml/kg seed. Where 89.00% field emergence, 13.66, 17.00, 15.66, and 18.66% seedling mortality at 15, 30 and 45 DAS and 22.00, 30.33, and 6.33gm /plant shoot length, root length and dry matter, respectively at 45 DAS. At MPKV, Rahuri, for the management of seed borne pathogen *Macrophomina phaseolina* in green gram, seed treatment with Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1ml/ kg seed found effective for decreasing seed mycoflora by 49.13%, increasing field emergence, seedling vigour and dry weight by 102.38, 223.82 and 87.5%, respectively.

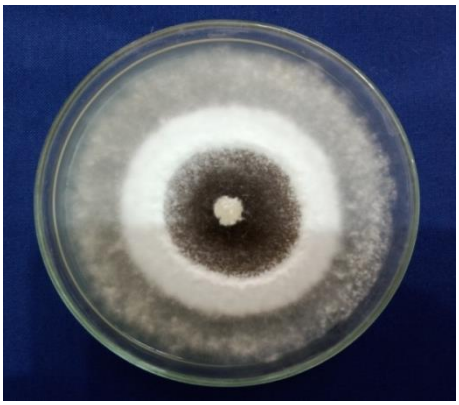
IV. Project title: Effect of seed dressing fungicides on seed and seedling associated pathogens of groundnut (Seed & collar rot and stem rot)

At PJTSAU, Hyderabad**,** the highest per cent germination was recorded by the fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (91.67%) followed by Thiophanate methyl 45% + Pyraclostrobin5% FS @ 1 ml/kg (91.00) and similar per cent seedling mortality (0.67%) at 15 DAS. Whereas, field emergence results stated that among the test fungicides, Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (91.75; 0.25%) has recorded highest germination and lowest seedling mortality at 15 DAS. The test fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS which recorded highest germination showed 11.44 per cent improvement over the pathogen control (81.25%). Further, the same fungicide has recorded 92.30 per cent reduction over pathogen control (3.25%) at 15 DAS. Similarly, the pre-treated seeds with test pathogen *A. niger,* the highest per cent germination was recorded by the fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (93.67%) followed by Carboxin 37.5% WS + Thiram 37.5% WS @ 3g/kg (91.67%) at 15 DAS. While the field emergence results indicated that among the test fungicides, the fungicides Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1 ml/kg (90.00%) and Thiophanate methyl 45% + Pyraclostrobin5% FS @ 1ml/kg (89.25%) has recorded highest germination, respectively, at 15 DAS. The test fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS which recorded highest germination showed 14.72 per cent improvement over the pathogen control (76.75%).

At TNAU, Coimbatore, for controlling seedling mortality and collar rot, among the fungicides tested, T1- Seed treatment with pathogen+ Penflufen 13.28% + Trifloxystrobin13.2% FS @ 1 ml/kg seeds recorded lesser seedling mortality of 2.80% and the collar rot incidence of 0.75 and 1.00% at 30 and 45 DAS, respectively followed by T3- Seed treatment with pathogen+ Thiophanate methyl 45% + Pyraclostrobin5% FS @ 1ml/kg seeds and T4- Seed treatment with pathogen+ Carboxin 37.5% WS + Thiram 37.5% WS (Vitavax power) @ 3g/kg seeds. At AAU, Anand, the seed treatment with penflufen 13.28% + trifloxystrobin 13.2% FS at a rate of 1 ml/kg of seeds has been identified as a significantly effective seed treatment method for enhancing the health and quality of groundnut seeds. This treatment has shown efficacy in managing *A. niger* (seed and collar rot) and *S. rolfsii* (stem rot) diseases in groundnut.

At OUAT, Bhubneshwar, the efficacy of seed treatments against seed borne pathogens *Aspergillus niger* infecting groundnut were evaluated in pot culture method. Seed treatment with pathogen+ Thiophanate methyl 45% + Pyraclostrobin 5% FS @ 1ml/kg seed recorded highest per cent emergence of 86, 86.6, 93.6 at 15, 30 and 45DAS, lowest seedling mortality (1.4%) at 45DAS, lowest disease incidence (1.6%) at 45DAS and shoot length(20.70 cm), root length (8.61cm), dry weight (18.27 g/plant) followed by seed treatment with pathogen+ Penflufen 13.28% + Trifloxystrobin 13.2% FS @ 1ml/kg seed and seed treatment with pathogen+ Carboxin 37.5% WS + Thiram 37.5% WS (Vitavax power) @ 3gm/kg of seed. Pathogen treated seeds showed lowest per cent emergence of 51.25, 53, 59.4% at 15, 30 and 45DAS, highest seedling mortality (27.2%) at 45DAS, highest disease incidence (10%, 27.2%) at 30 and 45DAS and shoot length (12.82cm), root length (4.11cm), dry weight (10.69 g/plant).

At PAU, Ludhiana, Thiophenate methyl 45%+ Pyraclostrobin 5% FS @ 1ml/kg followed by Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1ml/kg treated seeds exhibited maximum seedling emergence and minimum seedling mortality in groundnut. At PAJANCOA & RI, Karaikal, among the four fungicides evaluated along with untreated seed (check) and pathogens treated seed, the seeds treated with Pyraclostrobin 13.3% + Epoxyconazole 5% SE @ 0.75 ml/kg of seed demonstrated maximum seed germination (86.0% ; 83.0%), minimum seedling mortality (26.7% ; 6.7%), minimum disease incidence (13.9 % ; 5.8 %), maximum shoot length (19.03 , 32.40 cm), root length (13.92cm ; 11.61 cm) and dry matter production (5.30g ; 7.35g) than all other fungicides and control in pot culture and field emergence studies, respectively. At MPKV, Rahuri, for the management of seed borne pathogen *Aspergilus niger* in groundnut, seed treatment with Penflufen 13.28% +Trifloxystrobin 13.2% FS @ 1ml/ kg seed found effective for decreasing seed mycoflora by 97.73%, increasing field emergence, seedling vigour and dry weight by 93.33, 205.14 and 17.35%, respectively.



Aspergillus niger culture

Pathogen and fungicide treated seeds

Penflufen 13.28% +Trifloxystrobin 13.2% FS

***Aspergillus niger* alone inoculated**

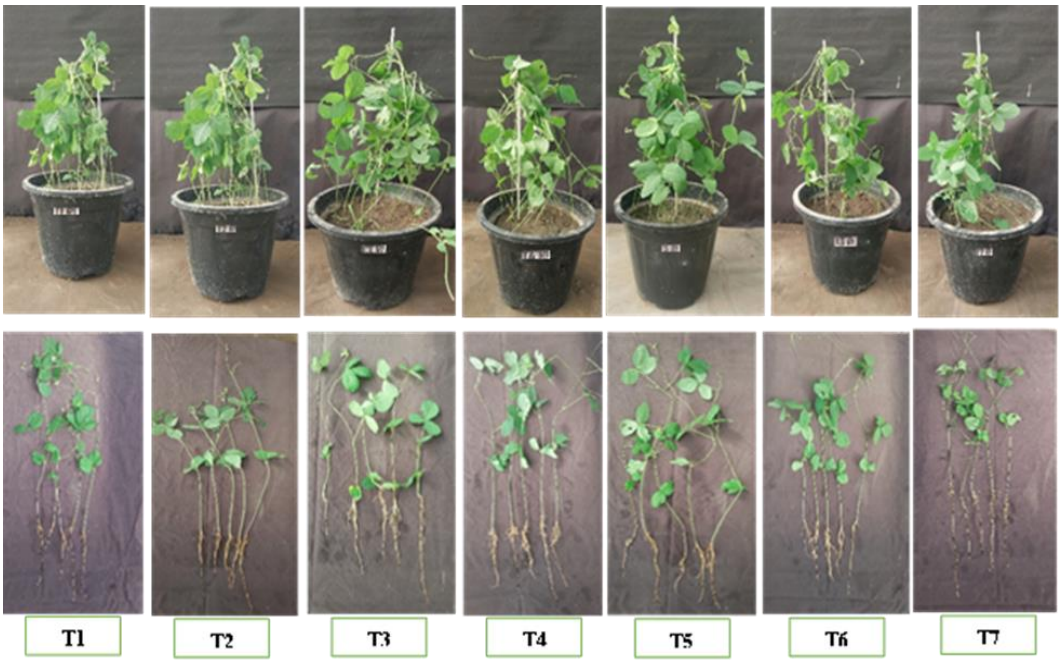
V. Project title: Effect of seed dressing fungicides on seed and seedling associated pathogens of Soybean (Charcoal rot and anthracnose)

At PJTSAU, Hyderabad, pretreated seeds with test pathogen *C. truncatum*, the highest per cent germination and lowest seedling mortality was recorded by the fungicides Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (96.17%; 2.33%) followed by Thiophanate methyl 45% + Pyraclostrobin5% FS @ 1 ml/kg (94.67%; 2.66%) at 15 DAS. In case of field emergence studies, among the test fungicides, the fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (96.25%; 3.75%) has recorded highest germination and lowest seedling mortality at 15 DAS. The test fungicide Penflufen 13.28% +Trifloxystrobin 13.2% FS which recorded highest germination showed 20.00 per cent improvement on pathogen control (77.00%). Similarly, the pretreated seeds with test pathogen *M. phaseolina* revealed that among the test fungicides evaluated the highest per cent germination and lowest seedling mortality was recorded by the fungicides Penflufen 13.28% +Trifloxystrobin 13.2% FS @1 ml/kg (98.00%; 2.00%) followed by Thiophanate methyl 45% + Pyraclostrobin5% FS @ 1 ml/kg (97.66%; 2.33%) at 15 DAS.

At PAU, Ludhiana, Thiophenate methyl 45%+ Pyraclostrobin 5% FS @ 1ml/kg treated seeds exhibited maximum seedling emergence and minimum seedling mortality in soybean against both pathogens. At MPKV, Rahuri, for the management of seed-borne pathogen *Colletotrichum dematium* and *Macrophomina phasiolina*, seed treatment with Carboxin 37.5%WS + Thiram 37.5% WS @ 3 g/kg seed found effective for decreasing seed mycoflora by 92.59% and 89.39%, increasing field emergence by 64.29 and 104.34%, seedling vigour by 164.14 and 102.64%, dry weight by 73.73 and 102.64%, respectively.

At VNMKV, Parbhani, seed treatment (T_2) with Pyraclostrobin 13.3% + Epoxyconazole 5% SE @ 1.5 ml/kg seed was found effective which shows 85.00% field emergence, 15.00, 17.33 and 21.00% seedling mortality at 15, 30 and 45 DAS and 25.33cm, 40.66cm and 7.00

gm/plant of shoot length, root length and dry matter at 45 DAS, respectively. At JNKVV, Jabalpur, the study evaluated the effectiveness of various fungicides on the health and quality of soybean seeds infected with *C. dematium*, a fungus causing anthracnose. Among the fungicides, besides standard check Carboxin 37.5% WS + Thiram 37.5% WS, Penflufen + Trifloxystrobin and Fluxapyraxod 33.3% FS demonstrated superior performance in promoting seedling growth, vitality and reducing anthracnose in soybean. These findings suggest the potential of these fungicides in managing anthracnose in soybean and improving seed health and quality. At GBPUA&T, Pantnagar, field emergence was maximum in seeds treated with Penflufen + Trifloxystrobin @ 1ml/ kg of seeds followed by Carboxin 37.5% WS + Thiram 37.5% WS and Fluxapyraxod 33.3% FS. Minimum seedling mortality was observed in Carboxin 37.5% WS + Thiram 37.5% WS (Standard check) treated seeds followed by Penflufen + Trifloxystrobin and Fluxapyraxod 33.3% FS after 45 days of sowing. Minimum disease incidence was observed in Carboxin 37.5% WS + Thiram 37.5% WS followed by Penflufen + Trifloxystrobin and Fluxapyraxod 33.3% FS at 45 days of sowing. Seedling length maximum being in Carboxin 37.5% WS + Thiram 37.5% WS.



D. Seed Entomology

Under seed entomology, six experiments *viz.* (1) Survey and evaluation of seed health status of farmers' saved seed with respect to insect infestation; (2) Demonstration of efficacy of commercially available neem products on storage pest management during storage under ambient condition; (3) Demonstration of efficacy of new insecticide molecule (spinetoram @3ppp) for management of storage insects of seed; (4) Evaluation of commercial formulation of entomopathogens; (5) Evaluation of plant based neutral silica on storage insects and seed quality during storage under ambient condition and (6) Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition were taken up during 2023-24. The details and research findings are given below:

❖ **Experiment on survey and evaluation of seed health status of farmers' saved seed**

The survey was conducted in nine states and one union territory across the country and about 2236 farmers' saved seed samples have been collected and analysed for seed quality. The survey revealed that about 32.7% seed samples had germination bellow IMSCS and about 44.5% seed samples were infested with various storage pests. About 37.1% samples had insect damage beyond permissible limit. The intensity of damaged seeds varied from 0.25-6.5%. Out of 850 samples collected from Ahmednagar, Dhule, Jalgaon, Nandurbar, Sangli, Solapur and Akola district of Maharashtra, Mau district of UP, Gir Somnath, Rajkot and Junagadh districts of Gujrat (38% of total samples collected), only 12.8% samples were infested and 6.6% samples had insect damage above IMSCS whereas 88.6% samples had seed germination as per IMSCS.

About 92.6% samples collected (total 527 samples) from Chikkballapur, Bangalore Rural, Dharwad, Belgavi, Haveri, Bagalkot Vijayapura and Gadag district of Karnataka, Coimbatore, Erode, Krishnagiri, Nagapattinam, Thanjavur, Tiruppur, Tirunelveli and Cuddalore districts in Tamilnadu, Puducherry, Karaikal and Mahe district of Puducherry were infested with storage insects. Out of this, 89.2% samples collected from these areas failed to meet the standards w.r.t insect damage and only 34.9% of these samples maintained the standard of seed germination as per IMSCS. Therefore, state specific advisories to respective State Dept. of Agriculture is the need of the hour for improvement of seed health status of farmers' saved seed.

Table 4.1: Seed health status of farmer's saved seed with respect to storage insects

Name of centre	No. of sample	Crops	Storage period (months)	Per cent infested sample	Insect recorded	Intensity of insect damage (%)	Samples with insect damage beyond permissible limit (%)	Seed germination (%) range	Samples having Germination above IMSCS (%)
UAS, Bangalore	200	Cowpea, Field bean, Chickpea, Horse gram	2-12	100	So, Rd, Tc, Cc, Os	0.50-15.0	97.5	30-85	9.5
PAJANCOA, Karaikal	102	Paddy	1-10	99	Rd, Sc, So	0.33-40.3	90.2	0.0-99	40.2
UAS, Dharwad	125	Chickpea, Sorghum, Wheat	1-8	76.8	Cc, So	0.20-13.04	76	55-87	27.2
TNAU, Coimbatore	100	Paddy, Groundnut, Ragi	2-6	91.0	So, Cs, Rd, Sc,	0.00-6.50	88.0	68-96	90.0
OUAT, Bhubaneswar	181	Paddy, Green gram	4-6	70.2	Rd, Sc, Cc	0.0-15.0	66.9	0.0-98	54.1
AAU, Jorhat	102	Paddy	8-10	90.2	Rd, Sc, So	0.10-4.0	7.8	69-86	70.6
PJTSAU, Hyderabad	151	Paddy, Chickpea	6-8	36.4	Rd, Sc, Cc	0.36-11.07	33.8	94-100	100.0
SKNAU, Jobner	325	Wheat, Pearl millet	2-7	31.4	Rd, So, Tc	0.0-22.0	31.4	62-89	59.7
CSUAT, Kanpur	100	Wheat	7-15	21.0	Rd, Tc, Sc	0.0-86	21.0	5-91	52.0
PDKV, Akola	159	Chickpea, pigeon pea, Soybean	3-8	23.3	Cc, Rd, Os	0.20-2.50	3.1	74-89	95.0
MPKV, Rahuri	299	Pigeon pea, Chickpea, Soybean	6-8	12.7	Cc	0.0-11.0	8.0	50-98	91.0
IISS, Mau	284	Wheat	6	10.6	Rd, So	0.25-13.25	8.1	0.0-99	78.2
JAU, Junagadh	108	Groundnut	7-9	3.7	*Cs, Tc*	0.0-3.5	3.7	73-98	100
Total	2236			44.5			37.1		67.3

Rd – *Rhyzopertha dominica* (Lesser grain borer); So – *Sitophilus oryzae* (Rice weevil); Cc – *C. chinensis* (Pulse beetle); Sc – *Sitotroga cerealella* (Angoumois grain moth); Tc - *Tribolium castaneum* (Red flour beetle); *Cs-Corcyra cephalonica* (Rice moth); *Os-Oryzaephilus surinamensis*

❖ **Demonstration on 'Efficacy of commercially available Neem products against storage insect-pests during storage under ambient condition'**

Two neem formulations (neemazal T/S and neemoz-gold @7.5ml) with azadirachtin 10000ppm as the major insecticidal compound were demonstrated along with deltamethrin at various centres based on the cumulative results of the experiment 'efficacy of commercially available neem products on storage pest management during storage under ambient condition' conducted during 2020-2023. Packaging material and packaging size recommended for seed certification of respective crops were used for the demonstration. Based on Six months' storage results, it was found that both the formulations @7.5ml/kg seed were significantly at par with respect to insect damage in most of the crops. Insect damage remained within permissible limit (0.50% in cereals and 1.00% in maize and pulses) and seed germination was maintained above IMSCS up to six months of storage in most of the centres. Thus, it can be concluded that neem formulations containing 10000ppm azadirachtin @7.5ml//kg seed can be used for management of storage insects up to 6 months in paddy, wheat, sorghum, green gram, black gram, pigeon pea, cowpea and field pea seeds without reduction in seed germination. In view of requirements of organic farming these neem formulations can be recommended for safe storage of seeds at least up to six months.

Table 4.2: Effective seed treatment botanicals and storage periods for different crops at various centres

Crop	Centre	Safe period of storage (months)	#Effective botanicals/insecticide
Wheat	MPKV, Rahuri	6	Neemazal T/S @ 7.5ml/kg seed (ID-nil), Deltamethrin @ 1ppm
Paddy	AAU, Jorhat	6	Neemoz-Gold @ 7.5ml/kg, Deltamethrin @ 1ppm
Sorghum	PDKV, Akola	6	Neemazal T/S & neemoz-Gold @ 7.5ml/kg Deltamethrin @ 1ppm
Green gram	OUAT, Bhubaneswar	6	Neemazal T/S @ 7.5ml/kg seed (ID-nil), neemoz-Gold @ 7.5ml/kg (ID-nil) Deltamethrin @ 1ppm (ID-nil)
	UAS, Dharwad	6	Neemazal T/S @ 7.5ml/kg seed (ID-nil), neemoz-Gold @ 7.5ml/kg (ID-nil) Deltamethrin @ 1ppm (ID-nil)
Pigeon pea	PJTSAU, Telangana	6	Neemazal T/S @7.5ml/kg, Deltamethrin @ 1ppm
Black gram	PAJANCOA, Karaikal	6	Neemazal T/S @ 7.5ml/kg seed and Neemoz-gold @7.5ml//kg seed, Deltamethrin @ 1ppm
Chickpea	IISS, Mau	*6	Neemazal T/S @7.5ml/kg and Neemoz-gold @7.5ml//kg seed, Deltamethrin @ 1ppm.

Field pea	CSAUT, Kanpur	6	Neemazal T/S @ 7.5ml/kg seed (ID-nil), neemoz-Gold @ 7.5ml/kg (ID-nil) Deltamethrin @ 1ppm (ID-nil)
Cowpea	TNAU, Coimbatore	3	Neemazal T/S @ 7.5ml/kg seed (ID-nil), neemoz-Gold @ 7.5ml/kg (ID-nil), Deltamethrin @ 1ppm (ID-nil)

restricted insect damage (ID) below the prescribed limits and maintained seed germination above IMSCS

*ID standard maintained up to six months but seed germination fell below standard after three months due poor initial seed quality.

❖ **Demonstration on 'Studies on the effect of insecticidal seed treatment on seed viability during storage under ambient condition'.**

Newer insecticide, spinetoram (derivative of natural fermentation product of actinomycete, *Saccharopolyspora spinosa*) which comes under category IV (very low toxicity) insecticides (EPA) having very low toxicity towards mammals and other non-target organisms was tested for its efficacy against storage insects during 2020-2023. Based on the results, efficacy of spinetoram@3ppm was demonstrated in large scale along with deltamethrin @1ppm (check) during 2023-24 following standard packaging size and packaging materials recommended for seed certification. Based on Six months' storage results, it was found that newer insecticide spinetoram@3ppm was significantly best in providing effective control (insect damage within permissible limit as per IMSCS i.e. 1% for maize and pulses and 0.5% for other crop seeds) of storage insects without affecting seed germination (maintained seed germination above IMSCS) of wheat, paddy, sorghum, pigeon pea, chickpea, cowpea, black gram and field pea across the centres under different agro-climatic conditions up to 6 months. Even though the cost of this chemical is slightly higher, in lieu of limited alternatives for seed treatment for the management of storage insect pests, this effective chemical will help farmers from storing the seeds for at least 6 months period.

Table 4.3: Effective seed treatment insecticides and storage periods for different crops and at various centres

Crop	Centre	Safe period of storage (months)	Effective treatments
Wheat	IISS, Mau	6	Spinetoram@3ppm (ID-nil), deltamethrin @1ppm
Paddy	PJTSAU, Telangana	6	Spinetoram@3ppm
Sorghum	SKNAU, Jobner	6	Spinetoram @3ppm
Pearl millet	JAU, Junagadh	*3	All seed treatments
Pigeon pea	PDKV, Akola	6	Spinetoram@3ppm, deltamethrin @1ppm
Cow pea	UAS, Bangalore	6	Spinetoram @3ppm

	UAS, Dharwad	6	Spinetoram 3ppm (ID-nil), deltamethrin@1ppm (ID-nil)
Green gram	TNAU, Coimbatore	*3	All seed treatments
Black gram	PAJANCOA & RI, Karaikal	6	Spinetoram @3ppm, deltamethrin @1ppm
Chick pea	MPKV, Rahuri	6	*Spinetoram 3ppm (ID-nil), deltamethrin@1ppm*
Field pea	CSAUAT, Kanpur	6	Spinetoram @3ppm

* Results up to 3 months storage received from the centre

❖ **Studies on the effect of Entomopathogens and inert dust on storage insect pests and seed viability during storage under ambient condition.**

Two commercial formulations (1.2X10^8 CFU) of *Beauveria bassiana* and *Metarhizium anisopliae* were tried for management of storage insects of cereals and pulses. Although there were some variations in storability of different crops primarily due to agro-climatic conditions, combinations of both the entomopathogens with diatomaceous earth (T5, T6, T7 & T8) restricted insect damage within permissible limit and maintained seed germination above IMSCS up to 6 months of storage in most of the crops except maize and wheat. However, T6 (*Beauveria bassiana (*CFU: 1.0 X10^8) @ 20g /kg seed +Diatomaceous earth @ 5g /kg seed) & T8 (*Metarhizium anisopliae* (CFU: 1.0 X10^8) @20g /kg seed+ Diatomaceous earth @ 5g /kg seed) excelled over other treatments in most the centres for longer duration of storage (>6months). Thus, it can be concluded that combinations of both the entomopathogens @ 20g /kg seed with diatomaceous earth@ 5g /kg seed can provide effective management of storage insects in paddy, sorghum, pearl millet, green gram, black gram, cowpea, pigeon pea and chickpea without affecting seed germination up to 6-9 months.

Table 4.4: Effective seed treatments and storage periods for different crops and at various centres

Crop	Centre	Safe period of storage (months)	Effective treatments
Maize	TNAU, Coimbatore	3	T5 (*B. bassiana* @ 10g /kg seed +DE @ 5g /kg seed), (ID-1.00%), T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil), T7 (*M. anisopliae* @ 10g /kg seed +DE @ 5g /kg seed) (ID-nil), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil) up to 9 months of storage but failed to meet the standard of seed germination after six months of storage.

	RPCAU, Dholi	-	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil) (up to 9 months but failed to meet the standard of seed germination due to poor initial germination)
Wheat	RPCAU, Dholi	-	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil) (up to 6 months but failed to meet the standard of seed germination due to poor initial germination)
	CSAUAT, Kanpur	3	All seed treatments (ID-nil)
	IISS, Mau	3	T5 (*B. bassiana* @ 10g /kg seed +DE @ 5g /kg seed), (ID-0.40%), T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.04%), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.03%) T9- Deltamethrin@1ppm (ID-0.02%)
Paddy	PJTSAU, Telangana	9	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.23%), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.33%) T9- Deltamethrin@1ppm (ID-0.33%)
	RPCAU, Dholi	9	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil), T8(*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil)
	AAU, Jorhat	6	All seed treatments
Sorghum	MPKV, Rahuri	9	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.33%), T9- Deltamethrin@1ppm (ID-nil)
Pearl millet	JAU, Jamnagar	9	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.33%), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.33%) T9- Deltamethrin@1ppm (ID-nil)
	SKNAU, Jobner	3	All seed treatments
Green gram	TNAU, Coimbatore	12	T5 (*B. bassiana* @ 10g /kg seed +DE @ 5g /kg seed), (ID-nil), T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil),

			T7(*M. anisopliae* @ 10g /kg seed +DE @ 5g /kg seed) (ID-nil), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil) T9- Deltamethrin@1ppm (ID-0.02%) (ID-nil)
	OUAT, Bhubaneswar	6	T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil) T9- Deltamethrin@1ppm (ID-nil)
	SKNAU, Jobner	6	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.67%, T7 (*M. anisopliae* @ 10g /kg seed +DE @ 5g /kg seed) (ID-1.00%), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.33%) T9- Deltamethrin@1ppm (ID-0.02%) (ID-0.33%)
Cowpea	UAS, Bangalore	6	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.75%),
	UAS, Dharwad	6	All seed treatments
Pigeon pea	PDKV, Akola	12	All seed treatments except T1 and T3
	UAS, Dharwad	3	All seed treatments
Black gram	PAJANCOA, Karaikal	6	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil), T7 (*M. anisopliae* @ 10g /kg seed +DE @ 5g /kg seed) (ID-nil) T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-nil)
	AAU, Jorhat	6	All treatments (ID-0.0-0.17%)
	UAS, Bangalore	6	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-1.00%),
Chickpea	PDKV, Akola	12	All treatments (ID-0.19-0.72%)
	MPKV, Rahuri	9	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.33%), T9- Deltamethrin@1ppm (ID-nil)
	JAU, Jamnagar	9	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-0.67%), T8 (*M. anisopliae* @ 20g /kg seed +DE @ 5g /kg seed) (ID-1.00%)
Field pea	CSUAT, Kanpur	3	T6 (*B. bassiana* @ 20g /kg seed +DE @ 5g /kg seed) (ID-1.00%),

❖ **Studies on efficacy of plant based neutral silica on storage insects and seed quality during storage under ambient condition**

Three different doses of neutral silica (2500ppm, 3000ppm and 3500ppm) were evaluated against storage pests of cereals and pulses. The study was initiated during 2022 and

subsequently doses of neutral silica were modified during 2023. Results up to six months of storage only available from the centres. Preliminary results suggest that all the treatments involving neutral silica were significantly better than control with respect to insect damage. It has also been observed that neutral silica @ 3500 ppm was significantly better than diatomaceous earth @ 5g /kg seed with respect to insect damage and provided safe storage (restricted insect damage within permissible limit and maintained seed germination above IMSCS) of wheat, paddy, pearl millet, green gram, black gram, cowpea, pigeon pea, chickpea and field pea up to six months at most of the centres.

Table 4.5: Effective seed treatments and storage periods for different crops and at various centres

Crop	Centre	Safe period of storage (months)	Effective treatments
Wheat	IISS, Mau	6	Neutral silica @ 3000 ppm (ID-0.34%), Neutral silica @ 3500 ppm (ID-nil) DE@5g/kg seed (ID-nil)
	RPCAU, Dholi	*6	Neutral silica @ 3000 ppm (ID-0.34%), Neutral silica @ 3500 ppm (ID-nil)
Paddy	OUA&T, Bhubaneswar	6	Neutral silica @ 2500 ppm (ID-nil) Neutral silica @ 3000 ppm (ID-nil) Neutral silica @ 3500 ppm (ID-nil)
	AAU, Jorhat	6	All seed treatments (ID<0.50%)
	PJTSAU, Hyderabad;	3	All seed treatments (ID-Nil)
	TNAU, Coimbatore	3	All seed treatments (ID-Nil)
Pearl millet	SKNAU, Jobner	6	Neutral silica @ 3500 ppm (ID0.33%)
	JAU, Junagadh	3	Deltamethrin @ 1 ppm
Black gram	UAS, Dharwad	6	All seed treatments (ID-Nil)
	PAJANCOA, Karaikal	6	Neutral silica @ 3500 ppm (ID-0.89%)
	UAS, Bangalore	3	Neutral silica @ 3500 ppm (ID-0.58%)
Cowpea	PDKV, Akola;	6	All seed treatments (ID<0.50%)
	UAS, Dharwad	6	All seed treatments (ID-Nil)
Chickpea	MPKV, Rahuri	6	All seed treatments (ID-0.0-0.25%)
Green gram	UAS, Bangalore	6	Neutral silica @3500ppm (ID-1.00%)
	AAU, Jorhat	6	All seed treatments (ID-0.0-0.25%)
	CSAUAT, Kanpur	6	Neutral silica @ 3000 ppm (ID-0.33%) Neutral silica @ 3500 ppm (ID-Nil)
Pigeon pea	PJTSAU, Telangana	6	All seed treatments (ID-Nil)
	PDKV, Akola;	6	All seed treatments (ID<0.50%)

Field pea	RPCAU, Dholi	6	Neutral silica @3500ppm (ID-nil)
	CSAUAT, Kanpur	6	All seed treatments (ID-0.0-0.33%)

* Germination fell below IMSCS after three months of storage due to poor initial seed quality

❖ **Studies on the effect of insecticidal seed treatment on seed quality during storage under ambient condition.**

Two newer insecticides i.e. broflanilide (first compound under the new IRAC group 30 which comes under Category-IV (very low toxicity) of EPA toxicity category of insecticides) and dinotefuran (Neonicotinoid, IRAC group 4A, Category-III) having low toxicity towards mammals and other non-target organisms were tested for their efficacy against storage insects. Different concentrations of these insecticides (broflanilide @ 1ppm, 2ppm & 3ppm; dinotefuran@1ppm, 2ppm & 3ppm) were tested along with emamectin benzoate @2ppm and deltamethrin@1ppm. All those treatment(s) where seed germination was maintained above IMSCS as well as insect damage was within permissible limit under IMSCS i.e. 1% for maize and pulses and 0.5% for other crop seeds, were considered as safe and effective for seed.

Only six months' storage studies have been completed in most of the centres. The results revealed that among various concentrations of newer insecticides, broflanilide @3ppm and dinotefuran @3ppm provided control of storage insects infesting wheat, paddy, pearl millet, sorghum, green gram, pigeonpea, chickpea, cowpea, black gram, horse gram and field pea across the centres under different agro-climatic conditions up to 6 months without impairing the seed viability. However, lower concentrations of both the insecticides had also shown promising results in some of the centres which might be ascertained after one season of storage. Newer insecticides were found at par with deltamethrin @1.0ppm and emamectin benzoate @2ppm or even better in some of the centres.

Table 4.6: Effective seed treatment insecticide molecules and storage periods for different crops and at various centres

Crop	Centre	Safe period of storage (months)	Effective treatments
Wheat	CSAUA&T, Kanpur	6	Broflanilide @3ppm, dinotefuran @3ppm, deltamethrin @1ppm
	IISS, Mau	3	All concentrations of Broflanilide
	CCSHAU, Hisar	-	None of the treatments
Paddy	AAU, Jorhat	6	All seed treatments
	PJTSAU, Telangana	3	All seed treatments
	OUAT, Bhubaneswar	3	All seed treatments

Pearl millet	JAU, Junagadh	6	Broflanilide @1,2&3ppm, Emamectin benzoat@2ppm, deltamethrin @1ppm
	SKNAU, Jobner	6	Broflanilide @ 3 ppm
Sorghum	MPKV, Rahuri	9	All seed treatments
	PDKV, Akola	6	All seed treatments
Pigeon pea	PJTSAU, Telangana	6	Broflanilide @2ppm &3ppm, dinotefuran @2ppm&3ppm, Emamectin benzoate@2ppm, deltamethrin @1ppm
	PDKV, Akola	6	All seed treatments
Cow pea	UAS, Dharwad	6	All seed treatments
	UAS, Bangalore	3	All seed treatments
Green gram	CSUAT, Kanpur	6	All seed treatments
	OUAT, Bhubaneswar	6	Broflanilide @1,2&3ppm, dinotefuran @3ppm, Emamectin benzoate@2ppm
	TNAU, Coimbatore	3	All seed treatments
Black gram	PAJANCOA & RI, Karaikal	6	dinotefuran @3ppm, Emamectin benzoate@2ppm, deltamethrin @1ppm
	TNAU, Coimbatore	3	All seed treatments
	UAS, Bangalore	3	Broflanilide @3ppm, dinotefuran @3ppm, Emamectin benzoate@2ppm, deltamethrin @1ppm
Chick pea	MPKV, Rahuri	9	Broflanilide @2ppm &3ppm, dinotefuran @2ppm&3ppm, Emamectin benzoate@2ppm, deltamethrin @1ppm
	UAS, Dharwad	6	All seed treatments
Field pea	CSAUAT, Kanpur	6	Broflanilide @1ppm, 2ppm &3ppm, dinotefuran @2ppm&3ppm, deltamethrin @1ppm
Horse gram	IISS-RS, Bangalore	6	All treatments
Groundnut	JAU, Junagadh	3	Broflanilide @1ppm, 2ppm & 3ppm, emamectin benzoate@2ppm, deltamethrin @1ppm

E. Seed Processing

❖ **Experiment on optimum sieve size and type of screen for grading seeds of different crop varieties and hybrids including their parents**

- Optimum sieve size for thickness grading in paddy variety ASD 21 (Coarse/ bold) was found to be 2.00mm (s) as against recommended sieve size of 1.85mm (s); and for Pusa Basmati 1847 (Medium slender) was found to be 1.9mm (s) and 1.80mm (s) for Pusa Basmati 1885, Pusa Basmati 1886 (Medium slender), PDKV Sadhana, Sakoli 8 and SYE 2001 (long slender) and GNV 1109 (small seeded) as against recommended sieve sizes of 1.85mm (s) for long slender, 1.80mm (s) for medium slender and 1.7mm (s) for fine/ superfine varieties. 1.70mm may be recommended as grading screen for medium slender KKL (R) 2; 1.60mm for medium slender cultivar PR 130 and small seeded variety PDKV Ganesh; and 1.55mm for small seeded variety DRR Dhan 58; and 1.50mm (s) for ADT54 (medium slender) and 1.40mm for small variety PDKV Sakoli (Red Rice 1).
- Optimum sieve size for thickness grading in four wheat, *Triticum aestivum* varieties *viz.*, HI 1654 HI 1620, HD 3410 and HD 3390 was found to be 2.40mm (s) against recommended sieve size of 2.30mm (s) as per IMSCS but for two PAU varieties *viz.*, PBW 824 and PBW 826 recommended sieve size of 2.30mm holds good.
- For medium seeded *desi* chickpea varieties *viz.*, BGD 111-1, PDKV Harita and PDKV Kanak optimum grading sieve size was found to be 6.00mm (r) and 5.50mm (r) for variety PDKV Gulak against recommended size of 5.5mm (r). Grading sieve size of 7.00mm (r) for bold seeded *desi* varieties *viz.*, Vishal, Digvijay, Phule Vishwaraj and bold seeded *kabuli* variety PKV Kabuli-2 and 8.00mm (r) for PDKV Kabuli 4 were found most suitable.
- Optimum grading sieve size was found to be 3.75mm (s) against recommended size of 4.0mm (s) for small seeded soybean variety DSb-34; and the sieve size of 4.75mm (s) for the medium seeded varieties Phule Kimaya (KDS 753), Phule Sangam (KDS 726) and Phule Durva (KDS 992); and 5.00mm (s) for bold seeded varieties *viz.*, PDKV Amba, Suvarna Soya.
- Optimum grading sieve size was found to be 6.50mm (r) for maize hybrid MAH 14-138; against recommended size of 6.40/ 7.00mm (r).
- Optimum sieve size for grading of bold seeded pigeon pea cultivar BRG 5 was found to be 5.00 mm (r) against recommended size of 4.75mm (r); sieve size of 4.75mm were recommended for PDKV Ashlesha, Maruti, AKT 8811, Phule Trupti; but for small seeded cultivar BSMR 853 sieve size of 4.00mm (r) and variety KRG 33 sieve size of 3.75mm (r) against recommended size of 4.00mm (r) was recommended for the best size for grading.
- Optimum grading sieve size was found to be 3.20mm (s) against recommended size of 2.80mm (s) for bold seeded black gram varieties *viz.*, CO 7, BDU 12 and 3.00mm (s) for TRCRU 22.

- Optimum grading sieve size was found to be 2.60mm (s) against recommended size of 2.80mm (s) for bold seeded green gram variety TRCRM 147 and 2.70mm (s) for VBN 4.
- Sieve aperture sizes of 1.80mm and 1.60mm (Slotted) were found to be ideal grading screens for size grading of *daincha cv.* CSD 137 seeds for which no IMSCS recommendation is given.
- Recommended sieve size of 6.00mm (r) hold good for the new cultivar HA 5 of field bean.
- Optimum grading sieve size was found to be 1.20mm (r) against recommended size of 1.40mm (s) for finger millet variety KMR 340.
- Optimum grading sieve size was found to be 2.80mm (s) against recommended size of 2.40mm (s) for male parental line RHA 92 of sunflower hybrid KBSH-78 and hybrids *viz.*, RSFH 700, RSFH 1887; and 2.40mm (s) sieve size hold good for the female parental line CMS 1103A of sunflower hybrid KBSH-78; and 2.00mm (s) for CMS 38A; and 1.80mm (s) for sunflower inbred lines R 127-1, RGM 49.

Table 5.1: Crop & variety wise screen size optimized for grading of seeds

Centre	Crop / Seed Size (categories)	Variety	Sieves used (mm)	IMSC Recommended Sieve Size (mm)	Standardized Sieve Size (mm)	Seed Recovery (%)
	Paddy					
ICAR-IARI RS, Karnal	Medium slender	PB 1847	2.2, 2.1, 1.9, 1.8, 1.6s	1.80 s	1.90 s	95.0
	Medium slender	PB 1885		1.80 s	1.80 s	93.1
	Medium slender	PB 1886		1.80 s	1.80 s	89.3
TNAU, Coimbatore	Coarse/ Bold	ASD 21	2.5, 2.2, 2.0, 1.9, 1.8s	1.85 s	2.00s	91.2
	Medium slender	ADT 54	2.0, 1.8, 1.7, 1.6, 1.5s	1.80 s	1.50 s	95.3
PAJANCOA & RI, Karaikal	Medium slender	KKL (R) 2	2.2, 2.0, 1.8, 1.7, 1.6, 1.5s	1.70 s	1.70 s	97.6
	Medium slender	PR 130	2.0, 1.8, 1.7, 1.6, 1.5s	1.70 s	1.60 s	99.3
	Small seeded	DRR Dhan 58	1.8, 1.7, 1.6, 1.55, 1.5s	1.70 s	1.55 s	99.4
PDKV, Akola	Small seeded	PDKV Ganesh	1.8, 1.6, 1.4s	1.70 s	1.60 s	96.6
	Medium seeded	PDKV Sakoli Red Rice 1	1.8, 1.6, 1.4, 1.2s	1.80 s	1.40 s	98.1
	Bold seeded	PDKV Sadhana	2.2, 2.0, 1.8, 1.6s	1.85 s	1.80 s	97.9
	Bold seeded	Sakoli 8	2.0, 1.8, 1.6s	1.85 s	1.80 s	91.2
	Bold seeded	SYE 2001	2.2, 2.0, 1.8, 1.6s	1.85 s	1.80 s	96.6

UAS, Raichur	Small seeded	GNV 1109	2.2, 2.0, 1.8, 1.6, 1.4s	1.70 s	1.80 s	94.9
	Wheat					
ICAR-IARI RS, Karnal	Bold seeded	HI 1654	3.2, 2.8, 2.4, 2.2, 2.1s	2.30 s	2.40 s	91.9
	Bold seeded	HI 1620		2.30 s	2.40 s	94.5
	Bold seeded	HD 3410		2.30 s	2.40 s	86.0
	Bold seeded	HD 3390		2.30 s	2.40 s	90.1
PAU Ludhiana	Bold seeded	PBW 824	2.5, 2.4, 2.3, 2.1, 1.9s	2.30 s	2.30 s	91.1
	Bold seeded	PBW 826		2.30 s	2.30 s	86.3
	Chickpea					
UAS, Dharwad	Medium seeded	BGD 111-1	7.25, 6.5, 6.0, 5.25, 5.0r	5.50 r	6.00 r	86.2
PDKV, Akola	Medium seeded	PDKV Gulak	6.5, 6.0, 5.5, 5.0, 4.5r	5.50 r	5.50 r	82.5
	Medium seeded	PDKV Harita	7.0, 6.5, 6.0, 5.5, 5.0r	5.50r	6.00 r	90.5
	Medium seeded	PDKV Kanak		5.50 r	6.00 r	96.6
	Bold seeded	PKV Kabuli-2	8.5, 8.0, 7.5, 7.0, 6.5r	6.00 r	7.00 r	93.9
	Bold seeded	PKV Kabuli-4	10.0, 9.5, 9.0, 8.5, 8.0, 7.5r	6.00 r	8.00 r	89.9
MPKV, Rahuri	Bold seeded	Vishal	7.0, 6.5, 6.0, 5.5, 5.0r	6.00 r	7.00 r	86.6
	Bold seeded	Digvijay		6.00 r	7.00 r	87.4
	Bold seeded	Phule Vishwaraj		6.00 r	7.00 r	87.4
	Soybean					
UAS, Dharwad	Small seeded	DSb 34	4.4, 4.3, 4.0, 3.75, 3.5s	4.00 s	3.75 s	83.5
MPKV, Rahuri	Medium seeded	KDS 753	4.75, 4.5, 4.0, 3.75, 3.5s	4.00 s	4.75 s	86.9
	Medium seeded	KDS 726		4.00 s	4.75 s	87.1
	Medium seeded	KDS 992		4.00 s	4.75 s	85.7
PDKV, Akola		PDKV Amba	6.5, 6.0, 5.5, 5.0, 4.5s	4.00 s	5.00 s	97.8
		Suvarna Soya	6.0, 5.5, 5.0, 4.5s	4.00 s	5.00 s	90.3
	Maize					
UAS, Bengaluru	Medium seeded	MAH 14-138	7.0, 6.75, 6.5, 6.25, 6.0r	6.40/ 7.00 r	6.50 r	94.7
	Pigeon pea					
UAS, Bengaluru	Bold seeded	BRG 5	6.0, 5.5, 5.0, 4.75, 4.5r	4.75 r	5.00 r	92.6
UAS, Raichur	Medium seeded	KRG 33	4.5, 4.25, 4.0, 3.75, 3.5r	4.00 r	3.75 r	88.1
PDKV, Akola	Medium seeded	BSMR 853	5.0, 4.75, 4.5, 4.0r	4.00 r	4.00 r	95.7

	Medium seeded	PDKV Ashlesha	5.5, 5.0, 4.75, 4.5, 4.0r	4.00 r	4.75 r	87.3
	Bold seeded	Maruti	5.5, 5.0, 4.75, 4.5r	4.75 r	4.75 r	93.7
	Bold seeded	AKT 8811		4.75 r	4.75 r	88.6
	Bold seeded	Phule Trupti	5.5, 5.0, 4.75, 4.5, 4.0r	4.75 r	4.75 r	90.0
	Black gram					
TNAU, Coimbatore	Bold seeded	CO 7	3.6, 3.4 .3.2, 3.0s	2.80 s	3.20 s	96.0
UAS, Raichur	Bold seeded	BDU 12	3.6, 3.4, 3.2, 3.0, 2.8s	2.80 s	3.20 s	91.2
	Bold seeded	TRCRU 22		2.80 s	3.00 s	92.8
	Green gram					
UAS, Raichur	Medium seeded	TRCRM147	3.2, 3.0, 2.8, 2.6, 2.4s	2.80 s	2.60 s	89.9
PAJANCOA & RI, Karaikal	Medium seeded	VBN 4	3.4, 3.2, 3.0, 2.8, 2.7, 2.5s	2.80 s	2.70 s	94.5
	Daincha					
ICAR-IARI RS, Karnal	Medium seeded	CSD 137	2.4, 2.2, 2.1, 2.0, 1.9, 1.8, 1.6s	---	1.8 s	95.4
PAJANCOA & RI, Karaikal	Medium seeded	CSD 137	2.2,2.0, 1.8, 1.7, 1.6, 1.5s	---	1.60 s	72.3
	Field bean					
UAS, Bengaluru	Medium seeded	HA 5	7.0, 6.5, 6.0, 5.5, 5.0r	6.50 r	6.00 r	93.7
	Finger millet					
UAS, Bengaluru	Medium seeded	KMR 340	1.4, 1.3, 1.2, 1.1, 1.0r	1.40 s	1.20 r	91.7
	Sunflower					
UAS, Bengaluru	Medium seeded	CMS 1103 A	3.0, 2.8, 2.4, 1.85, 1.8s	2.40 s	2.40 s	93.1
	Medium seeded	RHA 92	3.25, 3.0, 2.8, 2.4, 1.85s	2.80 s	2.80 s	91.7
UAS, Raichur	Small Seeded	CMS-38 A	2.2, 2.0, 1.8, 1.6, 1.4s	2.40 s	2.00 s	90.8
	Small Seeded	R-127-1		2.40 s	1.80 s	91.6
	Small Seeded	RGM-49		2.40 s	1.80 s	89.1
	Bold Seeded	RSFH-700	3.2, 3.0, 2.8, 2.6, 2.4s	2.80 s	2.80 s	92.3
	Bold Seeded	RSFH-1887		2.80 s	2.80 s	92.7

❖ **Experiment on assessment of post-harvest deterioration of soybean seed quality**

- Manually harvested and threshed seeds of soybean had significantly lesser damaged seeds and lower electrical conductivity.
- The seed threshed with stick beating at physiological maturity (MC≥15%) recorded better seed quality followed by seeds threshed by multicrop thresher.

- Threshing at higher rpm of 500-800 (farmers practice) resulted in 8% - 12% losses in seed germination whereas the threshing at rpm 350 to 450 minimizes the losses up to 3% to 7%. Similarly, 3.5% higher losses in germination were recorded in seed lot having higher moisture content (15% to 17%) as compared to seed lot of lower moisture content (12% to 15%) with both threshing drum speeds.
- The highest seed damage, electrical conductivity, seed mycoflora and lower values of germination (%), physical purity (%) was recorded by the seeds threshed with combine harvester at harvest maturity (MC<15%).

❖ **Experiment on performance evaluation of solar tunnel dryer for drying of soybean seed**

- The drying time in solar tunnel was shorter as compared to that of the natural sun drying. Soybean seed dried in the solar tunnel dryer have recorded significantly higher germination (90.3%) with optimum moisture content (10-12%) and thus, it can be used for early drying of seeds.

Recommendations of Seed Technology Research 2022-23

The discipline-wise recommendations made under seed technology research component of AICRP on Seed (Crops) during 2022-23 are compiled and presented below.

A. Seed Physiology, Storage and Testing

1. Reaffirming the validity periods of seed certification in field crops

Introduction: Regarding the General Seed Certification Standards of IMSCS, the validity period shall be nine months from the test date at the time of initial certification, which can be extended to six months until the seed lot conforms to prescribed standards. However, based on prevailing ambient storage conditions and the inherent storage potential of crop species, it is known that seed longevity during storage is varied. The inception of the current study was done to know about crop species-wise seed storage potential and validity periods.

Technique: The validity period of 9 months from the testing date was verified for crops viz. barley, Kabuli chickpea, lentil, mustard, oats, onion, pigeon pea and sunflower. The cooperating centres aptly worked out the validity periods for different crops as detailed below.

Crops	Recommendations on maximum period maintaining germination percent above IMSCS based on findings by participating centers
Barley	17 months of Germination >85%
Kabuli Chickpea	14 months of Germination >85%
Lentil	10 months of Germination >75%
Mustard	12 months of Germination >85%
Oat	11 months of Germination >85%
Onion	05 months of Germination >70%
Pigeon pea	13 months of Germination >75%
Sunflower	09 months of Germination >70%

The initial validity period of barley, Kabuli chickpea, lentil, mustard, oats, pigeon pea and sunflower, should be 09 months as in vogue. Whereas, first and further revalidation period should be restricted to the period of 06 months only. While in case of onion, it was recommended that the initial validity period should be six months from the date of test at the time of initial certification. After sample analysis, if seed is found to conform to the prescribed standards, the certification agency shall extend the validity of the seed for a further period of three months from the expiry of the previous validity period or date of the test, whichever is earlier and second revalidation may be discouraged in onion.

Conclusion: Inference based on storability studies conducted under ambient conditions at diverse locations reaffirmed the validity period of 9 months for initial certification in barley,

Kabuli chickpea, lentil, mustard, oats, pigeon pea and sunflower, however, it reiterated the storability issues associated with onion and suggested a validity period of 6 months in this regard to safeguard against any crop failures due to unwarranted seed deterioration in seed lots stored in agro-climatic conditions of high humidity and temperature.

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2. Rapid assessment of genetic purity in paddy hybrid cv. JRH 8 through molecular marker

Introduction: Among various seeds quality attributes, genetic purity is of top priority in order to have the fullest potential yield. Maintenance of high level of genetic purity in hybrid seed lot is a major challenge to exploit heterosis. For instance, it is estimated that for every one per cent impurity in paddy hybrid seed lot, the yield reduction is 100 kg per hectare. As per the Indian Minimum Seed Certification (IMSCS), 2013, minimum level of acceptable genetic purity for hybrid paddy seed lot is 95 per cent. Moreover, with ever increasing number of varieties in seed chain, the chances of admixture of seeds are high due to post harvest mishandling. Grow-out-test (GOT) is the approved practice for ascertaining genetic purity of seed lots. However, it takes much time (entire growing season), land resource, labour, thus escalating the cost of process and plant phenotype also gets influenced by the environment. Use of molecular markers as an alternative to GOT could be the viable option as the results are independent of environmental interference and provides reproducible results.

Technique: The Simple Sequence Repeat (SSR) marker RM 510 was identified as unique molecular marker that differentiate hybrid paddy JRH-8 from rest of paddy hybrids/ varieties

in seed chain at JNKVV, Jabalpur and results were validated across the four centres for reproducibility. The RM 510 produced specific allele size of 110 bp in CMS-97A (A-line) and 130 bp in NPT 29 (R-line) when resolved in 3.5 % agarose gel. Based on the validation studies (Fig.1), RM 510 is recommended for ascertaining the genetic purity of seed lots of paddy hybrid cv. JRH-8.

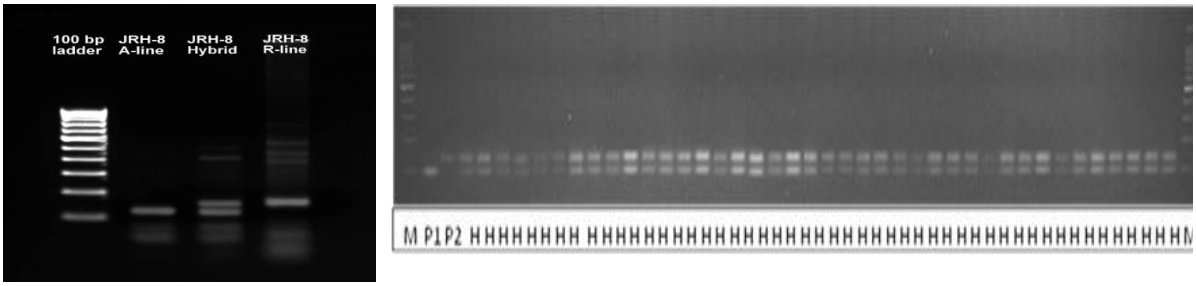

Fig.1: Amplification among parental lines and genetic purity assessment of JRH 8 seed lot using RM 510

Conclusion: The use of seeds with low genetic purity results in segregation of the traits, lower yields and genetic deterioration of varieties. The technique developed will enable rapid and faster determination of genetic purity, reduce time, energy and high manual input and also provide reproducible results for genetic purity assessment. The identified molecular i.e. RM 510 can be used solely or can supplement the GOT in ascertaining genetic purity of seed lots of paddy hybrid cv. JRH 8.

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3. Seed bio-priming for enhancing the planting value of the seed in field crops under sub-optimal conditions

Introduction: Seed biopriming is an eco-friendly and economical approach to delivering beneficial microorganisms through seed to soil. They can multiply with plant roots and elicit enhancement effects for an improved plant stand and consequential yield advantages. Regarding delineated benefits, microbes protect crops by increasing tolerance to various biotic and abiotic stresses. Microbial seed priming is used as an effective alternative to chemicals and is in tune with the goals of sustainable agriculture. Plant growth-promoting

microorganisms exert beneficial effects on plants either through direct or indirect mechanisms. The direct mechanism of plant growth promotion is through facilitating resource acquisitions (nitrogen, phosphorus, and other essential nutrients) or by means of modulating plant hormone levels. Whereas, w.r.t indirect mechanism, i.e., as biocontrol agents, induction of systemic resistance, and production of antifungal metabolites.

Technique: Several bio priming agents viz. BioNPK, Drought Alleviating Bacteria (DAB), Trichoderma harzianum, Biogrow, and Biophos were experimented with under a three-tier approach with standardization, validation, and demonstration aspects as the crux of the methodology. Coating of hydro-primed seeds with delineated bio-formulations at specified concentrations facilitated in augmentation under delineated stress conditions viz. mean temperatures @ ≤ 16 °C for cold stress and ≥ 37 °C for heat stress; moisture content maintenance @ ≥ 20 °C to ≤ 40 °C for moisture stress and > 2 to < 6 dSm^{-1} for salinity stress conditions. Amidst referred stress conditions below, referred treatment combinations fared better across multi-locations.

Crop	Priming technology standardized	Remarks
Kabuli Chickpea	Seed coating on hydro primed (4h @ 20°C) seed with Drought Alleviating Bacteria + Biogrow	Seed yield enhanced up to 19.8% in treatment as compared to control. The maximum B:C ratio of 1.78 was observed in treatment in comparison to 1.18 in control.
Paddy	Seed coating on hydroprimed (30h @ 25°C) seeds with *Trichoderma harzianum* @ 15g/kg seed.	Seed coating increased seed yield up to 12.4% over control.
Lentil	Seed coating on hydroprimed (8h @ 25°C) seeds with Drought Alleviating Bacteria + Biogrow.	Enhancement in seed yield up to 22.69% over control. The B:C ratios of control and validated treatments are 1.43 and 1.75, respectively.
Mustard	Seed coating with Biophos on hydro primed (16h @ 20°C) seeds	Seed treatment resulted up to 16.8 % increment in seed yield as compared to control.
Cotton	Seed coating with Drought Alleviating Bacteria on hydro primed (12h @ 25°C) seeds.	Significantly higher seed yield was observed in the treatment.

Note: All the microbial consortia (containing 1 x 10^9 cfu/g) are recommended to be used with 10 % sugar @ 250 ml for seed of one hectare area.

Conclusion: Seed biopriming is widely used by diverse stakeholders to enhance seed vigour regarding germination potential and increased stress tolerance. Enhanced early seedling vigour coupled with optimum plant stand establishment and seed yield was noticed. The bioformulations deployed, viz. BioNPK, Drought Alleviating Bacteria, BioGrow, and *Trichoderma harzianum,* were sourced from ICAR-NBAIM, and their dosage standardization and multilocation experimentation for assessing the effectiveness was carried out.

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4. Mitigation of terminal heat stress for better seed yield and quality in field crops

Introduction: Climate is rapidly changing and can disrupt food availability, reduce access to food, and affect food quality. Heat (high temperatures) stress will be the prime abiotic constraint, under the current and climate change scenario in future. Although, heat obstruct productivity at all crop growth stages, the extent of damage at reproductive phase of crop growth, mainly the seed filling phase, is critical and causes considerable yield losses as well as the quality of seed produced. It could substantially affect the seed yields by reducing seed size and number, eventually affecting the commercial trait '1000 seed weight' and seed quality. There are various strategies for improvement of seed yield and quality under high temperature stress. A well-integrated genetic and agronomic management option may be good option to enhance tolerance to heat. One of the programmatic approaches could be the exogenous use/spray of heat stress alleviating compounds, inorganic salts, natural and synthetic plant growth regulators and stress signaling molecules having specific properties and roles to improve yields and germination in a number of agri-horticultural crops.

Technique: The spraying of salicylic acid (400 to 800 ppm) two times i.e. first at vegetative stage and second at anthesis stage overcome the adverse effects of heat stress on seed yield and quality in paddy, sorghum and wheat. Augmentation in seed yield was noticed up to 23.9% by spraying of 400 ppm of salicylic acid in case of paddy under elevated temperature conditions. Influence of terminal heat stress on seed set, seed yield, and quality in field crops,

with successful demonstrations of the below-referred technologies in mentioned crops were conducted.

Crops	Recommended Technology	Remarks
Paddy	Foliar spray with Salicylic acid @ 400 ppm at vegetative and anthesis stage	Seed yield augmentation up to 23.9 % was reported in comparison to control. B:C ratios of 1.22 and 1.46 were recorded for control and validated treatments, respectively.
Sorghum	Foliar spray with Salicylic acid @ 400ppm at vegetative and anthesis stage	Foliar spray increased the seed yield up to 15.2 % over control.
Wheat	Foliar spray with Salicylic acid @ 800 ppm at vegetative and anthesis stage	Foliar spray produced a per cent increase in seed yield up to 9.7% over control.

Demonstration of spray of 400 ppm salicylic acid for mitigating heat stress in Paddy cv. ADT (R) 45

Conclusion: Simple spraying of salicylic acid led to a physiological state that enabled the plant to reverse the deleterious effect of heat stress coinciding the flowering, seed set and filling stage. The usefulness of spraying of salicylic acid @ 800ppm and 400ppm as foliar sprays were found to mitigate the influence of terminal heat stress on seed set, yield, and quality in various field crops and same was validated and demonstrated on large scale. The technology would benefit seed production agencies at large.

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B. Seed Processing

1. Optimization of aperture size of bottom/ grading sieves for processing of new crop varieties

Introduction: The Varietal Replacement Rate (VRR) in field crops is steadily increasing through induction of new crop varieties into seed chain. Share of new varieties (< 5 years old) in total breeder seed indents in recent years are in increasing trend in crops viz. wheat, paddy, chickpea, pigeon pea, mung bean, soybean and groundnut. Mostly, new crop varieties are bred for enhanced crop productivity that means bolder seed size or higher no. of seeds/plant. So, in order to achieve better seed recovery (in terms of pure seed) and quality of seed (as set under IMSCS, 2013), during processing operations, aperture size of bottom/ grading sieves need to be realigned time and again. Use of optimized sieve sizes shall enhance the seed processing efficiency and cost economics of seed production programme per se.

Optimized grading sieve size: In order to optimize the bottom/ grading sieve size, several aperture sizes were tested for new varieties in crops viz. paddy, wheat, maize, chickpea, soybean, pigeon pea, black gram, dhaincha, field bean, sunflower sunnhemp and finger millet. Following modifications are derived from the data generated by different centers of AICRP on Seed (Crops) during 2021-23.

Proposed modifications for Bottom/ Grading Screen in Appendix VII (Screen Aperture Size for Seed Processing) of IMSCS, 2013

Crop / Seed Size (Categories)	IMSCS Recommended Sieve Size (mm)	Standardized Sieve Size (mm)	Modifications Proposed (mm)
Paddy			
Coarse grain/ Bold type	1.85s	1.85s, 2.00s, 2.20s	1.85s, **2.00s*, 2.20s***
Medium Slender	1.80s	1.80s, 1.85s, 1.90s	1.80s, **1.85s*, 1.90s***
Small seeded/ Fine/ Super fine	1.70s	1.60s, 1.40s, 1.50s, 1.55s	**1.40s*, 1.50s*, 1.55s*, 1.60s***, 1.70s
Wheat			

T. aestivum	**1.8s**,** 2.1s, 2.3s	2.1s, 2.2s, 2.3s, 2.4s	2.1s, **2.2s*,** 2.3s, **2.4s***
T. durum	2.1s, 2.3s	2.40s	2.1s, 2.3s, **2.40s***
Maize			
Except Popcorn	6.4r, 7.0r	6.4r, 6.5r, 7.0r, 8.0r	6.4r, **6.5r***, 7.0r, **8.0r***
Finger millet	1.4s	1.2r	**1.2r*, 1.4r***
Chickpea			
Small seeded	5.0r, 5.5r, 6.0r	4.75r	5.0r, 5.5r, 6.0r, **4.75r***
Medium/ bold seeded	5.0r, 5.5r, 6.0r	5.5r, 6.0r, 6.5r, 7.0r, 8.5r, 9.0r	5.0r, 5.5r, 6.0r, **6.5r*, 7.0r*, 8.5r*, 9.0r***
Kabuli/ Very bold	5.0r, 5.5r, 6.0r	6.5r	5.0r, 5.5r, 6.0r, **6.5r***
Soybean	4.00s	3.75s, 4.75s	4.00s, **3.75s*, 4.75s***
Sunflower	2.40s	1.8r, 2.0r, 2.80s	**1.8r*, 2.0r*,** 2.40s, **2.80s***
Pigeon pea	3.20s, 4.00r, 4.75r	3.75r, 4.5r, 5.00r	3.20s, **3.75r*,** 4.00r, **4.50r*,** 4.75r, **5.00r***
Green gram	2.80s, 3.20s	2.5s, 2.6s, 2.7s	**2.5s*, 2.6s*, 2.7s*,** 2.80s, 3.20s
Black gram	2.80s	2.7s, 3.0s, 3.2s	**2.7s*,** 2.8s **3.0s*, 3.2s***
Field bean	6.50r	6.0r	**6.0r*,** 6.50r
Dhaincha	-	1.60s, 2.0s	**1.60s*, 2.0s***
Sunnhemp	-	2.0s	**2.0s***

*Additions proposed under Appendix VII of IMSCS, 2013

**Deletions proposed under Appendix VII of IMSCS, 2013

Conclusion: The proposed modification shall result in efficient removal of impurities and enhanced recovery of pure seeds up to 15-20 % in finger millet and 4-6 % in rest of the crops. In case of fine/superfine paddy varieties the recommended sieve size of 1.70s resulted in loss of physically pure seed. Hence, sieve size of 1.60s is recommended to increase the pure seed recovery by 3-4 %. The recommended sieve sizes need to be notified by DA&FW, GoI and after inclusion in IMSCS would benefit the organizations involved in seed production and marketing.

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Human Resource Development, Publications and Awards

AICRP on Seed (Crops) with the mandate of human resource development in seed domain, various modules of trainings have been designed by varied cooperating centres to cater the need of seed producing personnel including farmers, trainers and employees (field staff) of State Seed Certification Agency/ State Seed Corporation/ Seed Producer Companies and NGOs. Trainings were mainly focused on seed production, processing, storage, packaging, quality enhancement, quality control and seed health management. According to crop season, need and type of beneficiary, trainings were imparted under AICRP on Seed (Crops) on regular basis under Human Resource Development (HRD) component. Scientific staff of AICRP on Seed (Crops) was also conferred with awards and other recognitions during 2023-24 in various international/ national seminars, conferences and workshops. The efforts made by cooperating centres in capacity building will certainly boost the quality and quantity of the seed and would help in amelioration of Seed Replacement Rate (SRR) in different crops.

During 2023-24, in total 264 training programmes were organized for varied stakeholders of seed industry. Similarly, 77 exhibitions/ kisan melas, were organized on diverse themes related to seed by different cooperating centres. Scientific staffs of AICRP on Seed (Crops) published 299 research papers in the varied journals of national and international repute and also received 74 awards for contributions made in seed domain.

Table 7.1: Capacity building programmes, publications and awards under AICRP on Seed (Crops) 2023-24

Sl. No.	Centre	No. of Training/ Field Day/ Seed Day	No. of Beneficiaries	No. of Exhibition/ Kisan Mela /Kisan Goshti	No. of Beneficiaries	No. of Publication		No. of Award
						Research Paper	Other Publication	
1	AAU, Anand	17	891	1	500	14	20	6
2	AAU, Jorhat	13	449	-	-	8	16	1
3	ANGRAU, Guntur	17	1051	6	1139	27	19	4
4	AU, Kota	-	-	-	-	2	1	-
5	BAU, Ranchi	-	-	1	-	-	1	1
6	BAU, Sabour	-	-	3	10000	-	-	1
7	BCKV, Mohanpur	1	68	1	600	6	2	1
8	BHU, Varanasi	6	219	-	-	4	1	1
9	BSKKV, Dapoli	2	70	-	-	25	-	-
10	CAU, Imphal	2	120	-	-	-	-	1

Sl. No.	Centre	No. of Training/ Field Day/ Seed Day	No. of Beneficiaries	No. of Exhibition/ Kisan Mela /Kisan Goshti	No. of Beneficiaries	No. of Publication		No. of Award
						Research Paper	Other Publication	
11	CAZRI, Jodhpur	1	-	1	-	-	-	-
12	CCARI, Goa	2	161	-	-	-	2	-
13	CCS HAU, Hisar	4	200	3	45000	18	1	1
14	CIARI, Port Blair	21	337	-	-	-	-	1
15	CICR, Nagpur	3	165	1	85	7	3	1
16	CRIJAF, Barrackpore	1	58	2	350	1	1	1
17	CSAUAT, Kanpur	-	-	1	350	-	-	1
18	CSKHPKV, Palampur	-	-	-	-	7	-	1
19	DGR, Junagadh	3	240	-	-	-	3	1
20	DRMR, Bharatpur	1	1000	-	-	-	1000	1
21	GBPUAT, Pantnagar	-	-	2	4800	-	-	1
22	ICAR-IARI, New Delhi	-	-	-	-	-	-	-
23	ICAR-NEH, Manipur	17	659	1	200	-	-	-
24	IGFRI, Jhansi	1	60	-	-	-	-	1
25	IGKV, Raipur	-	-	-	-	4	-	1
26	IIMR, Hyderabad	-	-	1	250	-	-	1
27	IIMR, Ludhiana	5	426	3	100	-	-	1
28	IIOR, Hyderabad	3	258	-	-	-	-	1
29	IIPR, Kanpur	1	110	-	-	7	35	2
30	IIRR, Hyderabad	1	5	2	500	-	-	-
31	IISR, Indore	1	1200	-	-	-	-	1
32	IISR, Lucknow	-	-	-	-	-	1	-
33	IISS, Mau	-	-	-	-	-	-	-
34	IIWBR, Karnal	6	16395	-	-	1	3	1
35	JAU, Junagadh	1	540	1	2000	10	1	2
36	JNKVV, Jabalpur	2	350	1	65	12	1	-
37	KAU, Thrissur	4	169	1	2000	0	-	1
38	MPKV, Rahuri	-	-	-	-	13	-	1
39	MPUAT, Udaipur	-	-	-	-	5	-	1

Sl. No.	Centre	No. of Training/ Field Day/ Seed Day	No. of Beneficiaries	No. of Exhibition/ Kisan Mela /Kisan Goshti	No. of Beneficiaries	No. of Publication		No. of Award
						Research Paper	Other Publication	
40	NAU, Navsari	6	378	-	-	-	-	1
41	NDUAT, Ayodhya	-	-	1	6000	6	-	1
42	NRRI, Cuttack	-	-	-	-	-	-	1
43	OUAT, Bhubaneswar	5	500	-	-	5	4	1
44	PAJANCOA & RI, Karaikal	7	1466	-	-	4	1	1
45	PAU, Ludhiana	3	210	14	80000	6	8	-
46	PDKV, Akola	6	1200	-	-	1	2	2
47	PJTSAU, Hyderabad	3		1	1525	12	13	1
48	RPCAU, Pusa	6	185	1	-	5	3	-
49	RVSKVV, Gwalior	-	-	-	-	-	-	1
50	SBI, Coimbatore	4	325	-	-	-	-	-
51	SDAU, S. K. Nagar	4	280	-	-	6	5	1
52	SKNAU, Jobner	-	-	-	-	-	-	-
53	SKRAU, Bikaner	-	-	-	-	-	3	1
54	SKUAST K, Srinagar	16	814	3	6500	7	1	4
55	SKUAST, Jammu	3	72	1	504	7	-	1
56	SVPUAT, Meerut	5	175	1	14187	-	6	1
57	TNAU, Coimbatore	1	60	4	15025	16	10	3
58	UAHS, Shivamogga	6	955	-	-	-	5	1
59	UAS, Bangalore	6	2115	10	1505500	10	3	6
60	UAS, Dharwad	6	636	3	5740	9	20	3
61	UAS, Raichur	22	2494	3	5000	16	3	1
62	UBKV, Pundibari	13	583	-	-	-	-	1
63	VNMKVV, Parbhani	-	-	3	2500	17	-	2
64	VPKAS, Almora	1	30	-	-	1	-	1
65	VSI, Pune	5	1494	-	-	-	-	-
	Total	**264**	**39173**	**77**	**1710420**	**299**	**1198**	**74**

Training on Seed production at BSKKV, Dapoli

Seed Day at ICAR-CRIJAF, Barrackpore

Training on Seed production at PAJANCOA&RI, Karaikal

Training on Seed production at TNAU, Coimbatore

Tribal Sub Plan (TSP) Programme

Balanced growth and economic development are the ultimate aim of every country. In spite of significant strides made in agriculture, development is yet to take place in remote areas, which have not received any assistance for their upliftment and the farmers of these areas were still dependent upon the old varieties and landraces in different crops. Hence, Tribal Sub Plan (TSP) was initiated for socio-economic amelioration of the tribal communities with the objectives of organizing seed production in farmers' participatory mode to cater the local demand of quality seed, imparting training on quality seed production, enhancing quality of farm saved seeds, supply of quality seeds, storage structures and other farm inputs (physical assets).

During 2023-24, under AICRP on Seed (Crops), Rs. 187.00 lakhs were released to 21 cooperating centres across the country for organizing mandated activities in tribal areas for the benefit of farmers. Special training programmes on quality seed production in various crops; farmers' participatory seed production activities; distribution of quality seed and fertilizers, seed storage structures, crop protection and small farm equipments; FLDs, exhibitions and exposure visits were instituted by varied cooperating centres benefiting 10,115 tribal farmers. *In toto*, 73,382 kg of quality seed; 3,144 nos of seed storage structures, crop protection equipments and small farm equipments were distributed. Similarly, 85 training programmes on various aspects of seed production, storage and quality enhancement and 1,319 FLDs were also organized for the benefit of tribal farmers.

Summary of physical achievements under TSP of AICRP on Seed (Crops) during 2023-24

S. No.	Centres	Seed distributed (kg.)	Seed storage bins; sprayers, small farm implements (No's)	Training (No's)	FLDs (No's)	Exposure visit (No's)	Beneficiary (No's)
1	AAU, Anand	-	-	1	-	-	50
2	ANGRAU, Guntur	50	-	1	-	-	13
3	AU, Kota		28	1	-	-	28
4	BCKV, Nadia	-	-	3	-	-	177
5	BSKKV, Dapoli	1860	480	3	-	-	130
6	IGKV, Raipur	-	-	-	12	-	12
7	MPKV, Rahuri	14740	-	7		-	402
8	SDAU, S. K. Nagar	4000	-	3	100	-	400
9	SKRAU, Bikaner	-	-	1		-	20
10	SKUAST, Srinagar	7000	330	9	300	2	3726
11	CSKHPKV, Palampur	-	25	2	-	-	255
12	KAU, Pattambhi	-	20	2	-	-	119
13	NAU, Navsari	1520	-	12	176	2	1257
14	PAJANCOA&RI, Karaikal	-	140	1	-	-	100
15	PDKV, Akola	19280	-	8	473	-	697

S. No.	Centres	Seed distributed (kg.)	Seed storage bins; sprayers, small farm implements (No's)	Training (No's)	FLDs (No's)	Exposure visit (No's)	Beneficiary (No's)
16	RPCAU, Pusa	-	-	1	-	-	25
17	UAS, Bengaluru	2850	600	1	-	-	150
18	UAS, Dharwad	3500	600	2	-	-	304
19	UAS, Raichur	2420	-	4	-	1	124
20	UBKV, Pundibari	7050	-	10	250	1	563
21	TNAU, Coimbatore	1200	800	4	-	-	400
22	VPKAS, Almora	2340	-	4	1	1	166
23	ICAR-RC NEH, Manipur Centre	5372	21	3	7	3	456
24	ICAR-CICR, Nagpur	-	100	1	-	1	80
25	ICAR-CIARI, Port Blair	200	-	1	-	11	361
26	ICAR-SBI, Coimbatore	-	-	1	-	-	150
	Total	**73382**	**3144**	**85**	**1319**	**22**	**10115**

Nursery plant distributed (nos)- 46,650 / Bio-fertilizer distributed (Kg/ltrs)- 1,817.50 / Fertilizer distributed (kgs)- 10,055 / Pesticides distributed (ltrs)- 137.05

TSP activity at UAS, Bengaluru

TSP activity at VPKAS, Almora

TSP activity at RPCAU, Pusa

TSP activity at UAS, Raichur

TSP activity at AU, Kota

TSP activity at SDAU, SK Nagar

Scheduled Caste Sub Plan (SCSP) Programme

Scheduled Caste Sub Plan (SCSP) was for the first time brought under the ambit of AICRP on Seed (Crops) during 2021-22. The major aim of SCSP is socio-economic amelioration of scheduled caste farmers. During 2023-24, under AICRP on Seed (Crops), even though there was no demarcation of budget under SCSP programme, cooperating centres have organized activities viz. training programmes on quality seed production in various crops; distribution of quality seed and fertilizers, seed storage structures, crop protection and small farm equipments; FLDs, exhibitions and exposure visits utilizing the unspent balance of previous financial year. The programme benefited 150 scheduled caste farmers. *In toto*, 20 nos of seed storage structures, crop protection and small farm equipments were distributed. Similarly, 03 training programmes on various aspects of seed production, storage and quality enhancement were organized for the benefit of scheduled caste farmers.

Summary of physical achievements under SCSP of AICRP on Seed (Crops) during 2023-24

S. No.	Centres	Seed distributed (kg.)	Seed storage bins; sprayers, small farm implements (No's)	Fertilizer (kg.)	Training (No's)	FLDs (No's)	Exposure visit (No's)	Beneficiary (No's)
1	BCKV, Nadia	-	-	-	2	-	-	110
2	SKRAU, Bikaner		20		1			40
	Total	**-**	**20**	**-**	**3**	**-**	**-**	**150**

SCSP activity at BCKV, Nadia

Status of AICRP on Seed (Crops) - Revolving Fund during 2023-24

Indian Council of Agricultural Research (ICAR) took firm steps as early as 1979-80 by launching AICRP–National Seed Project (Crops) and created as many as 41 Breeder Seed Production (BSP) units in almost all State Agricultural Universities and crop based ICAR institutes to cater to the requirement of breeder seeds in different crops. To support and strengthen breeder seed production programme, ICAR during VIII Plan made the provision of revolving fund with a policy of single window system for stringent compliance to avoid operational problem of recurring fund in the BSP centres.

Further during 2005-06, ICAR launched ICAR Seed Project to augment the quality seed production and seed infrastructure in the country. During X plan period, provision of revolving fund was made to all existing centres. During 2021-22, both the i.e., AICRP on NSP Crops) and ICAR Seed Project were merged as single entity 'AICRP on Seed (Crops)'. In few centres, the two revolving funds were merged and in most of the centres, they are operating independently. To make the system more efficient, vibrant, accountable and sustainable, centres were instructed to operate single account of the fund and the Nodal Officers were entrusted with the responsibility of fund operation. It is mentionable that profits earned by the centres were ploughed back in the system for creation of infrastructure facilities to enhance the capability of QSP units.

Highlights

1. Revolving fund has made significant impact in enhancing breeder seed production and production of other classes of seed in the country as a whole and subsequently strengthened the infrastructure facilities at all cooperating centres of AICRP on Seed (Crops).
2. At the end of FY 2022-23, all the centres had positive balance (except BAU, Ranchi and UAS, Dharwad) in the revolving fund account and collective balance at the end of referred FY under revolving fund schemes viz. breeder seed production and quality seed production were Rs. 251.98 lakhs and Rs. 7614.18 lakhs, respectively.
3. PAU, Ludhiana; JAU, Junagadh; IGKV, Raipur; VNMKV, Parbhani; SKRAU, Bikaner; ICAR-IIWBR, Karnal; ICAR-IIOR, Hyderabad; ICAR-IIMR, Hyderabad; ICAR-IIPR, Kanpur; MPKV, Rahuri; UAS, Bengaluru; SKUAST, Jammu and SVPUAT, Meerut performed better in terms of generating the revenues under seed revolving fund.
4. All the centres have refunded the revolving fund amount under breeder seed production scheme. Centres have invested the profit obtained through the operation of revolving funds for infrastructure development in their respective centres.

Table 10.1: Utilization of revolving fund under AICRP on Seed (Crops) during 2023-24

(Rs. in lakhs)

Sl. No.	Name of centre	Initial seed money sanctioned	Seed money refunded to ICAR till date	Opening balance as on 1st April 2022	Revenue generated during 2022-23	Profits utilized during 2022-23	Balance on 31st March, 2023
1	**AAU, Anand**						
	ICAR Seed Project	41.50	41.50	76.62	93.36	16.74	82.82
2	**BAU, Ranchi**						
	Breeder seed production	9.00	9.00	-	-	-	-
	ICAR Seed Project	30.50	25.00	-4.15	11.50	7.35	-2.95
3	**BHU, Varanasi**						
	Breeder seed production	10.00	10.00	-	-	-	-
	ICAR Seed Project	20.50	15.00	24.36	28.13	21.06	31.43
4	**DBSKKV, Dapoli**						
	Breeder seed production	4.00	4.00	23.91	11.28	17.69	17.50
	ICAR Seed Project	55.90	55.90	-	-	-	-
5	**JAU, Junagadh**						
	Breeder seed production	2.70	2.70	-	-	-	-
	ICAR Seed Project	48.40	48.40	148.45		67.90	85.43
6	**MPKV, Rahuri**						
	Breeder seed production	14.00	14.00	-	-	-	-
	ICAR Seed Project	73.00	73.00	247.59	949.22	183.66	430.62
7	**PAU, Ludhiana**						
	Breeder seed production	15.00	15.00	-	-	-	-
	ICAR Seed Project	50.00	50.00	1696.72	227.15	70.00	1853.87
8	**SKRAU, Bikaner**						
	ICAR Seed Project	40.00	40.00	145.68	150.87	75.00	221.55
9	**SKUASTK, Srinagar**						
	Breeder seed production	4.00	4.00	-	-	-	-

Sl. No.	Name of centre	Initial seed money sanctioned	Seed money refunded to ICAR till date	Opening balance as on 1st April 2022	Revenue generated during 2022-23	Profits utilized during 2022-23	Balance on 31st March, 2023
	ICAR Seed Project	30.50	25.00	52.44	14.52	5.50	40.46
10	**TNAU, Coimbatore**						
	Breeder seed production	18.00	18.00	27.54	71.56	50.17	48.93
	ICAR Seed Project	55.00	55.00	-	-	-	-
11	**UAS, Bangalore**						
	Breeder seed production	13.00	13.00	41.53	127.26	106.92	61.87
	ICAR Seed Project	64.32	64.32	281.85	144.44	106.25	320.04
12	**VSI, Pune**						
	ICAR Seed Project	20.00	20.00	-	-	-	-
13	**AAU, Jorhat**						
	Breeder seed production	5.00	5.00	19.67	2.81	0.00	22.48
	ICAR Seed Project	36.82	36.82	-	-	-	-
14	**AU, Kota**						
	Breeder seed production	0.00	0.00	-	-	-	-
15	**BCKV, Nadia**						
	ICAR Seed Project	15.00	15.00	143.40	49.86	50.58	142.68
16	**CAU, Imphal**						
	ICAR Seed Project	28.00	28.00	51.14	1.76	0.00	71.92
17	**CSAUAT, Kanpur**						
	Breeder seed production	17.00	17.00	-	-	-	-
	ICAR Seed Project	55.50	20.50	-	-	-	-
18	**CSKHPKV, Palampur**						
	Breeder seed production	6.00	6.00	41.19	40.68	-	41.28
	ICAR Seed Project	20.00	20.00	35.31	23.58	2.69	32.61
19	**GBPUAT, Pantnagar**						
	Breeder seed production	18.00	18.00	0.00	410.82	36.74	36.74

Sl. No.	Name of centre	Initial seed money sanctioned	Seed money refunded to ICAR till date	Opening balance as on 1st April 2022	Revenue generated during 2022-23	Profits utilized during 2022-23	Balance on 31st March, 2023
	ICAR Seed Project	52.32	0.00	-	-	-	-
20	**CCSHAU, Hisar**						
	Breeder seed production	15.00	15.00	-	-	-	-
	ICAR Seed Project	61.82	35.00	33.17	45.09	22.41	36.68
21	**JNKVV, Jabalpur**						
	Breeder seed production	16.00	16.00	4.56	516.26	515.95	4.87
	ICAR Seed Project	70.50	65.00	-	-	-	-
22	**KAU, RARS, Pattambi**						
	Breeder seed production	4.00	4.00	18.95	21.55	17.93	18.31
	ICAR Seed Project	46.82	10.00	20.47	46.35	49.63	17.12
23	**MPUAT, Udaipur**						
	ICAR Seed Project	44.32	44.32	-	-	-	-
24	**NAU, Navsari**						
	ICAR Seed Project	30.00	30.00	189.11	42.30	49.72	181.69
25	**NDUAT, Ayodhya**						
	Breeder seed production	10.00	10.00	-	-	-	-
	ICAR Seed Project	50.50	0.00	-	-	-	-
26	**OUAT, Bhubnaswer**						
	Breeder seed production	13.00	13.00	-	-	-	-
	ICAR Seed Project	30.50	16.00	109.56	167.20	0.00	166.39
27	**PDKV, Akola**						
	Breeder seed production	13.75	13.75	-	-	-	-
	ICAR Seed Project	55.50	55.50	-	-	-	-
28	**PJTSAU, Hyderabad**						
	Breeder seed production	18.00	18.00	-	-	-	-
	ICAR Seed Project	55.00	40.00	138.63	90.83	0.00	177.55

Sl. No.	Name of centre	Initial seed money sanctioned	Seed money refunded to ICAR till date	Opening balance as on 1st April 2022	Revenue generated during 2022-23	Profits utilized during 2022-23	Balance on 31st March, 2023
29	**RPCAU, Pusa**						
	Breeder seed production	10.00	10.00	-	-	-	-
	ICAR Seed Project	30.50	0.00	18.50	56.74	66.27	8.95
30	**SDAU, S. K. Nagar**						
	Breeder seed production	20.00	20.00	-	-	-	-
	ICAR Seed Project	45.00	34.00	17.49	44.39	30.24	63.64
31	**SKUAST, Jammu**						
	ICAR Seed Project	25.00	25.00	265.24	97.72	0.00	343.11
32	**SVPUAT, Meerut**						
	ICAR Seed Project	20.00	20.00	247.36	84.98	80.86	251.48
33	**UAS, Dharwad**						
	Breeder seed production & ISP	63.00	63.00	50.00	434.41	2043.19	-201.73
34	**UBKV, Pundibari**						
	ICAR Seed Project	25.50	25.50	0.00	0.00	0.00	119.31
35	**VNMKVV, Parbhani**						
	ICAR Seed Project	55.00	55.00	1126.25	229.25	221.18	1134.32
36	**IGKV, Raipur**						
	Breeder seed production	8.50	8.50	-	-	-	-
	ICAR Seed Project	45.50	45.50	261.31	450.14	2.15	258.73
37	**CRIJAF, Barrackpore**						
	Breeder seed production	2.00	2.00	-	-	-	-
	ICAR Seed Project	10.00	10.00	5.19	18.18	23.23	0.14
38	**DRMR, Bharatpur**						
	ICAR Seed Project	5.00	5.00	33.16	123.90	137.24	19.85
39	**CAZRI, Jodhpur**						
	Breeder seed production	3.00	3.00	-	-	-	-

Sl. No.	Name of centre	Initial seed money sanctioned	Seed money refunded to ICAR till date	Opening balance as on 1st April 2022	Revenue generated during 2022-23	Profits utilized during 2022-23	Balance on 31st March, 2023
	ICAR Seed Project	10.00	10.00	84.21	50.00	0.00	63.05
40	**CIARI, Port Blair**						
	ICAR Seed Project	17.00	14.26	-	-	-	-
41	**CICR, Nagpur**						
	ICAR Seed Project	10.00	10.00	27.47	19.24	4.30	42.42
42	**DGR, Junagadh**						
	ICAR Seed Project	10.00	10.00	46.80	0.17	0.00	46.98
43	**IIMR, Hyderabad**						
	Breeder seed production	10.50	10.50	-	-	-	-
	ICAR Seed Project	5.00	5.00	137.46	79.29	60.12	156.64
44	**IIOR, Hyderabad**						
	ICAR Seed Project	5.00	5.00	121.29	33.14	20.17	141.46
45	**IIPR, Kanpur**						
	Breeder seed production	5.00	5.00	-	-	-	-
	ICAR Seed Project	10.00	10.00	89.71	189.66	113.10	166.28
46	**IIRR, Hyderabad**						
	Breeder seed production	4.82	4.82	-	-	-	-
	ICAR Seed Project	5.00	0.00	11.40	31.38	29.12	13.65
47	**IISR, Indore**						
	ICAR Seed Project	10.00	10.00	97.01	44.41	33.52	107.90
48	**IISS, Mau**						
	ICAR Seed Project	5.00	5.00	172.12	112.79	127.80	15.71
49	**IIWBR, Karnal**						
	ICAR Seed Project	5.00	5.00	621.86	740.86	266.56	888.77
50	**NRRI, Cuttack**						
	ICAR Seed Project	15.00	15.00	34.79	25.85	2.35	37.14

Sl. No.	Name of centre	Initial seed money sanctioned	Seed money refunded to ICAR till date	Opening balance as on 1st April 2022	Revenue generated during 2022-23	Profits utilized during 2022-23	Balance on 31st March, 2023
51	**SBI, Coimbatore**						
	ICAR Seed Project	10.00	10.00	-	-	-	-
52	**VPKAS, Almora**						
	Breeder seed production	4.50	4.50	-	-	-	-
	ICAR Seed Project	5.00	5.00	32.75	25.86	20.34	38.28
53	**CCARI, Goa**						
	ICAR Seed Project	18.82	16.29	-	-	-	-
54	**IARI, New Delhi**						
	ICAR Seed Project	45.00	45.00	-	-	-	-
55	**IISR, Lucknow**						
	ICAR Seed Project	10.00	10.00	-	-	-	-
56	**SBI, Coimbatore**						
	ICAR Seed Project	10.00	10.00	-	-	-	-
57	**IGFRI, Jhansi**						
	Breeder seed production	3.00	3.00	-	-	-	-
	ICAR Seed Project	10.00	10.00	8.15	0.00	1.96	8.19
Summary							
Sl. No.	**Name of centre**	**Initial seed money sanctioned**	**Seed money refunded to ICAR till date**	**Opening balance as on 1st April 2021**	**Revenue generated during 2021-22**	**Profits utilized during 2021-22**	**Balance on 31st March, 2022**
1	Breeder seed production	296.77	296.77	177.35	1202.22	745.40	251.98
2	ICAR Seed Project	1722.54	1417.81	6899.87	4978.52	4012.19	7614.18
	Total	**2019.31**	**1714.58**	**7077.22**	**6180.74**	**4757.59**	**7866.16**

Note:

1. All centres have returned the sanctioned amount to council under breeder seed production scheme
2. At few centres the revolving of BSP and ICAR Seed Project have been merged

At a Glance

Summary of quality seed production during 2023-24 under AICRP on Seed (Crops)

(in quintals)

S. No.	Particulars	In University/Institute		Participatory Seed Production		Total	
		Target	Production	Target	Production	Target	Production
1	Breeder seed	62104.66	106397.59	-	-	**62104.66**	**106397.59**
2	Foundation seed	67979.54	76833.87	31285.10	34776.21	**99264.64**	**111610.08**
3	Certified seed	60167.44	67675.92	65950.60	74009.55	**126118.04**	**141685.47**
4	TFL seed	44350.11	55320.40	47995.15	53640.28	**92345.26**	**108960.68**
5	Planting material	53660.00	65789.77	-	-	**53660.00**	**65789.77**
	Total	**288261.75**	**372017.55**	**145230.85**	**162426.04**	**433492.60**	**534443.59**

(in lakh)

S. No.	Particulars	Target	Production	Target	Production	Target	Production
1	Planting material	83.09	103.89	-	-	83.09	103.89
2	Tissue culture plants	9.73	10.38	-	-	9.73	10.38
	Total	**92.82**	**114.27**	**-**	**-**	**92.82**	**114.27**

All India Coordination Research Programme (AICRP)
on Seed (Crops)

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