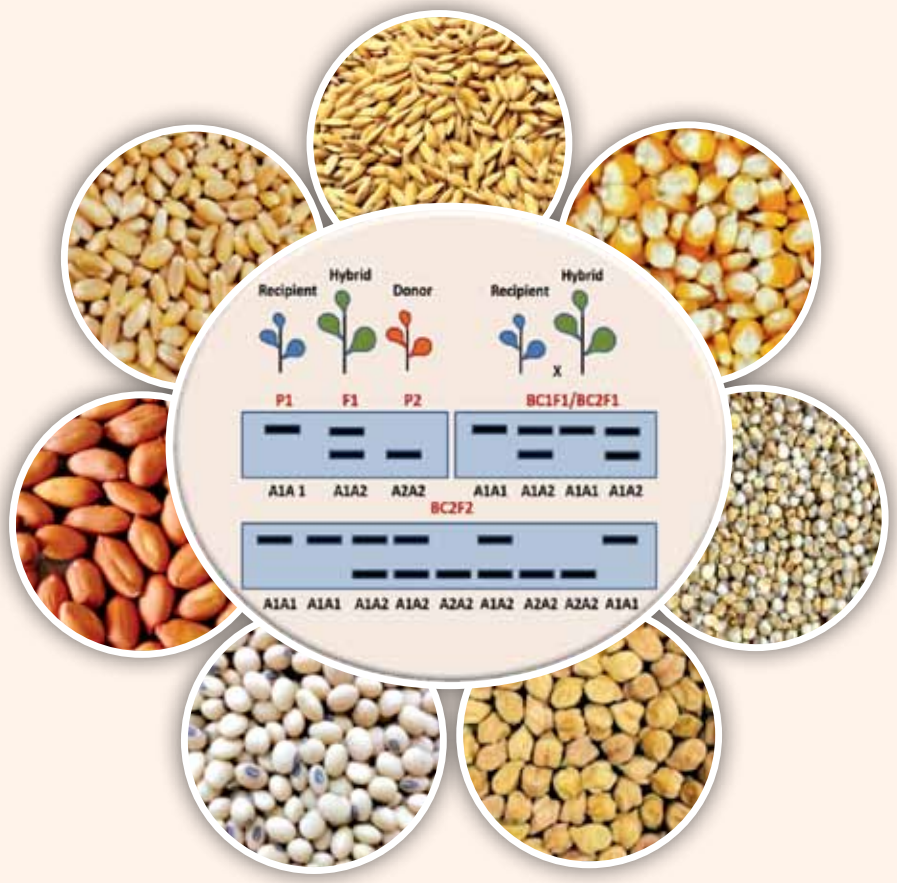
Azadi Ka Amrit Mahotsav

Second Edition

Crop Cultivars Developed Through Molecular Breeding



सत्यमेव जयते

Indian Council of Agricultural Research
New Delhi 110 001

भाकृअनुप
ICAR

Second Edition

Crop Cultivars Developed Through Molecular Breeding

Devendra Kumar Yadava
Firoz Hossain
Partha Ray Choudhury
Dinesh Kumar
Ashok Kumar Singh
Tilak Raj Sharma
Trilochan Mohapatra

Indian Council of Agricultural Research
New Delhi 110 001

Citation:

Devendra Kumar Yadava, Firoz Hossain, Partha Ray Choudhury, Dinesh Kumar, Ashok Kumar Singh, Tilak Raj Sharma and Trilochan Mohapatra (2022). Crop cultivars developed through molecular breeding (Second Edition). Indian Council of Agricultural Research, New Delhi.

Year of Publication: 2022, 80 p.

Conceived by:

Dr. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education; and Director General, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi - 110001

Designed by:

Dr. Firoz Hossain and Dr. Devendra Kumar Yadava,
ICAR-Indian Agricultural Research Institute, New Delhi -110012

Contributed by:

All the developers of the varieties and hybrids

Published by:

Dr. S.K. Malhotra, Project Director,
Directorate of Knowledge Management in Agriculture
Indian Council of Agricultural Research
KAB-I, Pusa Campus, New Delhi - 110012

Production:

Punit Bhasin, DKMA

ISBN No.: 978-81-7164-247-2

Printed by: M/s Royal Offset Printers,
A-89/1, Naraina Industrial Area, Phase-I, New Delhi 110028

नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR

सत्यमेव जयते

कृषि एवं किसान कल्याण मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF AGRICULTURE & FARMERS WELFARE
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

D.O. NO. 119 /AM

MESSAGE

India has achieved a phenomenal growth in food grain production (308.65 million tonnes) during 2020-21 despite the COVID-19 pandemic. This is a testimony to country's preparedness even during the odd times. It has been possible due to favourable government policies, untiring efforts of the farmers and use of technologies specifically large-scale cultivation of the improved varieties and hybrids. Despite the desired level of crop production over the years, our country faces numerous challenges. 'Climate change' has been the most worrying factor as occurrence of frequent drought and flooding, and appearance of new races of disease causing pathogens are resulting in significant crop losses. Further, 'malnutrition' caused by consumption of food inadequate in essential nutrients has emerged as a major health concern, which needs urgent attention.

Indian Council of Agricultural Research (ICAR) has recognized the pressing need to develop crop cultivars with better resilience to various biotic and abiotic stresses and high nutritional quality. It gives me immense pleasure to mention that National Agricultural Research System (NARS) led by ICAR has made significant progress in marker-assisted breeding for development of crop cultivars having climate resilience and high nutritional value in less than half of the time required through traditional methods. This method popularly known as 'Molecular Breeding' has resulted in commercial release of 74 cultivars in crops like rice, wheat, maize, pearl millet, chickpea, soybean and groundnut.

The information on cultivars developed through molecular breeding is being published in the form of second edition of the booklet entitled, '***Crop Cultivars Developed Through Molecular Breeding***'. I congratulate the developers of these varieties and appreciate ICAR for this initiative.

(Narendra Singh Tomar)

Office : Room No. 120, Krishi Bhawan, New Delhi-110 001, Tel.: 011-23383370, 23782691 Fax: 011-23384129
Resi.: 3 Krishna Menon Marg, New Delhi-110 001, Ph.: 011-23794697 / 98, Fax: 011-23794696

कैलाश चौधरी
KAILASH CHOUDHARY

सत्यमेव जयते

कृषि एवं किसान कल्याण
राज्य मंत्री
भारत सरकार
MINISTER OF STATE FOR AGRICULTURE
& FARMERS WELFARE
GOVERNMENT OF INDIA

MESSAGE

With immense happiness, I am happy to share that National Agricultural Research System (NARS) comprising mainly of Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs), has introduced 74 crop cultivars that have been developed through '*Molecular Breeding*'. These cultivars, now available for commercial cultivation, have been developed through accelerated breeding approach. While, rice and wheat are the main staple food, maize and pearl millet serve as the coarse cereals. Chickpea is an important crop as a source of plant protein. Soybean and groundnut serve as a source for cooking oil. These seven crops have been aptly given priority to come up with newer cultivars with resistance to diseases (bacterial blight, blast, leaf rust, stripe rust, wilt, downy mildew and yellow mosaic virus), tolerance to abiotic stresses (drought, water-submergence, salinity and low phosphorus), tolerance to herbicide application, better nutritional quality (high lysine, tryptophan, provitamin-A, oleic acid, free from trypsin inhibitor and less beany flavour) and early maturity. These 62 improved varieties (rice, wheat, chickpea, soybean and groundnut) and 12 hybrids (maize and pearl millet) developed through molecular breeding also provide high grain yield and are adapted to different agro-ecological conditions of India, thereby providing greater impetus to '*food and nutrition*' secure India.

The bulletin on '***Crop Cultivars Developed Through Molecular Breeding (second edition)***' provides necessary details of rice (43), wheat (5), maize (10), pearl millet (2), chickpea (6), soybean (6) and groundnut (2) cultivars, and would be of immense help for their popularization. My complements to the developers of these cultivars and authors for bringing out this very useful publication.

(Kailash Choudhary)

Office : 199Q, Krishi Bhawan, New Delhi-110 001. Tel. : +91-11-23782343, 23388165 Fax : 23074190

शोभा करांदलाजे
SHOBHA KARANDLAJE

राज्य मंत्री
कृषि एवं किसान कल्याण
भारत सरकार
Minister of State For
Agriculture & Farmers Welfare
Government of India
D.O. No.....MOS (A&FW)/VIP/2021-22/

MESSAGE

It's a matter of great pride that National Agricultural Research System (NARS) led by Indian Council of Agricultural Research (ICAR) the premier agricultural research and development organization in India has made significant contributions in accelerating the process of cultivar development through '*Molecular Breeding*'. Using this new technology, a set of 62 varieties and 12 hybrids have been developed across rice, wheat, maize, pearl millet, chickpea, soybean and groundnut. The traits that have been improved include resistance to bacterial blight and blast in rice, leaf and stripe rust in wheat, downy mildew in pearl millet, wilt in chickpea and yellow mosaic virus in soybean. Among abiotic stresses, drought, submergence, low phosphorus and salinity tolerance in rice and drought tolerance in chickpea have been improved. Herbicide tolerance is a novel trait incorporated in rice. Maize has been enriched with lysine, tryptophan and pro-vitamin-A, which are essential for growth and development of humans. Further, trypsin inhibitor and beany flavour have been reduced for wider acceptability of soybean varieties. Oil quality has been improved with enhanced level of oleic acid in groundnut. Besides, earliness has been induced in soybean. These improved cultivars provide better yield under stress conditions, and also possess higher nutritional value. I congratulate the developers of these cultivars. My appreciation is also due to ICAR for bringing the newer technologies through research in frontier areas of agriculture.

I am sure that the bulletin entitled '***Crop Cultivars Developed Through Molecular Breeding (second edition)***' would help in the dissemination of these new cultivars, and raise awareness among the stakeholders. Such massive efforts would help in achieving country's 'food and nutrition security'.

(Shobha Karandlaje)

सत्यमेव जयते

त्रिलोचन महापात्र, पीएच.डी.
सचिव एवं महानिदेशक
TRILOCHAN MOHAPATRA, Ph.D.
SECRETARY & DIRECTOR GENERAL

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद
कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली 110 001

GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION
AND
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
KRISHI BHAVAN, NEW DELHI 110 001
Tel.: 23382629; 23386711 Fax: 91-11-23384773
E-mail: dg.icar@nic.in

FOREWORD

Indian Council of Agricultural Research (ICAR) from its inception has spearheaded country's preparedness towards feeding the ever-increasing population. The development of improved high yielding varieties during 1960s made significant increase on food production through '*Green Revolution*'. So far, 5800 cultivars of different field crops have been released for cultivation in various agro-ecosystems of the country. However, development of cultivars takes quite long time, which generally takes 10-12 years. Taking the help of modern tools, scientists have been able to curtail the breeding cycle to develop cultivars much faster. '*Molecular Breeding*' technology provides significant advantage over 'traditional breeding' methods, where (i) the target gene is selected with more precision, (ii) desirable plants are selected at the seedling stage much before expression of the trait(s), (iii) costly and cumbersome phenotyping during the breeding programme is bypassed, and (iv) breeding cycle is significantly shortened to 5-6 years.

Using '*Molecular Breeding*', 74 varieties in seven crops namely, rice, wheat, maize, pearl millet, chickpea, soybean and groundnut have been released for commercial cultivation in India. It includes, 43 in rice, five in wheat, six in chickpea, six in soybean, two in groundnut, 10 in maize and two in pearl millet with improved biotic stress resistance, abiotic stress tolerance and nutritional quality.

This bulletin entitled, '***Crop Cultivars Developed Through Molecular Breeding (second edition)***' highlights the salient features of the varieties and hybrids developed through accelerated breeding. I dedicate this information bulletin to all our farmers with a hope that these varieties will reduce the risk due to climate change and enhance their income.

(Trilochan Mohapatra)

Dated: 18th February, 2022
New Delhi

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Introduction

The food grain production of 50.8 million tonnes in 1950-51 has now touched 308.65 million tonnes during 2020-21. This bumper food grain production is primarily attributed to cultivation of high yielding crop varieties developed by the National Agricultural Research System (NARS) led by Indian Council of Agricultural Research (ICAR).

Varieties are developed through crossing of suitable genotypes that possess desirable traits, followed by intensive selection for the target characters. 'Phenotypic selection' has been the mainstay of 'traditional breeding', which takes quite long time (10-12 years) to develop a suitable cultivar. However, the breeding cycle can be drastically shortened and selection can be made more directed and precise using '*Molecular Breeding*'. Here, selection of target gene(s) or quantitative trait locus/loci (QTL – genomic region harbouring the target gene or genes) also known as 'foreground selection' is achieved through tightly linked or gene-based 'DNA/molecular marker'. Thus, the process is also known as marker-assisted selection (MAS). It allows the selection of desirable plants at early seedling stage, and takes only 5-6 years to develop a cultivar. It helps avoiding selection of undesirable gene(s) linked to target desirable gene(s). Combining multiple genes into a single genotype is more straight forward. Existing elite cultivars can be easily converted to an improved version using MAS.

'*Molecular Breeding*' has now become an integral part of the cultivar development programmes at ICAR institutes and State Agricultural Universities (SAUs). Using this modern technique, NARS has developed 74 crop cultivars in seven different crops. Sixty six of these cultivars were developed during 2015-22, as against eight varieties before 2014. These non-GMO (genetically modified organism) crop varieties are easily acceptable by the consumers, and are expected to play vital role in achieving country's 'food and nutrition security'.

Rice

Improved Pusa Basmati 1

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa13* and *Xa21*
2.	Molecular markers used	:	CAPS and STS
3.	Recurrent parent	:	Pusa Basmati 1
4.	Donor parent	:	IRBB 55
5.	Salient features	:	

- Country's first MAS derived variety of rice resistant to bacterial blight
- Similar grain quality to Pusa Basmati 1 with less than 5% chalky grains
- Strong aroma with excellent cooking and eating quality
- Average grain yield: 55.0 q/ha
- Maturity: 135 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Punjab, Haryana, Delhi, Jammu, Uttarakhand and Uttar Pradesh
8.	Release & notification	:	CVRC, S.O. No. 1178(E), 20.07.2007
9.	Developed by	:	ICAR-Indian Agricultural Research Institute and ICAR-National Institute for Plant Biotechnology, New Delhi

Rice

Improved Samba Mahsuri

(Variety)

Trait improved: Bacterial blight resistance

1. Genes introgressed : *xa5, xa13* and *Xa21*
2. Molecular markers used : SSR
3. Recurrent parent : Samba Mahsuri
4. Donor parent : SS1113 (a near-isogenic line of the variety PR106)
5. Salient features :
   - Resistant to bacterial blight
   - High yield with excellent grain quality traits similar to Samba Mahsuri
   - Low glycemic index (50.9) makes it suitable for consumption by Type II diabetic patients
   - Average grain yield: 55.0 q/ha
   - Maturity: 130 days (~10 days earlier than Samba Mahsuri)
6. Suitability : Irrigated conditions (*Kharif*)
7. Recommended area : Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Maharashtra, Odisha and Chhattisgarh
8. Release & notification : CVRC, S.O. No. 627(E), 08.05.2008
9. Developed by : ICAR-Indian Institute of Rice Research, Hyderabad (Telangana) and CSIR-Centre for Cellular and Molecular Biology, Hyderabad (Telangana)

Rice
Improved Lalat
(Variety)

Trait improved: Bacterial blight resistance

1. Genes introgressed : *Xa4, xa5, xa13* and *Xa21*
2. Molecular markers used : STS
3. Recurrent parent : Lalat
4. Donor parent : IRBB 60
5. Salient features :
   - Four bacterial blight resistance genes pyramided leading to high degree of resistance to bacterial blight
   - Resistant to major pest like gall midge and moderately resistant to stem borer
   - Long slender grain type
   - Average grain yield: 47.5 q/ha
   - Maturity: 130 days
6. Suitability : Irrigated conditions (*Kharif*)
7. Recommended area : Irrigated areas of Odisha
8. Release & notification : SVRC, S.O. No. 312(E), 01.02.2013
9. Developed by : ICAR-National Rice Research Institute, Cuttack (Odisha)

Rice

Improved Tapaswini

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*Xa4, xa5, xa13* and *Xa21*
2.	Molecular markers used	:	STS
3.	Recurrent parent	:	Tapaswani
4.	Donor parent	:	IRBB 60
5.	Salient features	:	

- Bacterial blight resistant variety
- Resistant to major pests like yellow stem borer and white backed plant hopper and moderately resistant to stem borer
- Short bold grain type
- Average grain yield: 45.0 q/ha
- Maturity: 130 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Bacterial leaf blight prone areas of Odisha
8.	Release & notification	:	SVRC, S.O. No. 312(E), 01.02.2013
9.	Developed by	:	ICAR-National Rice Research Institute, Cuttack (Odisha)

Rice
PR 124
(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*Xa4* and *xa13*
2.	Molecular markers used	:	SSR
3.	Pedigree	:	PAU 3832-79-4-3-1 (PR 116//PAU 3075-3-38)/ PR106-P3
4.	Donor parent	:	PR 106-P3
5.	Salient features	:	

- Possesses two bacterial blight resistance genes including a novel bacterial blight resistance gene derived from *O. glaberrima*
- Resistant to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) presently prevalent in the Punjab
- Average grain yield: 76.0 q/ha
- Maturity: 135 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Punjab and Haryana
8.	Release & notification	:	CVRC, S.O. No. 1228(E), 07.05.2015
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Rice

Rice

Pusa 1592

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa13* and *Xa21*
2.	Molecular markers used	:	SSR and STS
3.	Recurrent parent	:	Pusa Sugandh 5
4.	Donor parent	:	Improved PB 1 (Pusa 1460)
5.	Salient features	:	

- Bacterial blight resistant variety of rice
- Extra-long slender translucent grain with 58.2% head rice recovery
- Strongly aromatic grain with high kernel length after cooking (14 mm)
- Alkali spreading score is 7, gel consistency (48.4 mm), water uptake (320.5 ml) and amylose content intermediate (24.4 %)
- Average grain yield: 47.3 q/ha
- Maturity: 120 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Punjab, Haryana, Delhi and Jammu & Kashmir
8.	Release & notification	:	CVRC, S. O. No. 1556(E), 11.06.2015
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice
PR 123
(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*Xa4, xa13* and *Xa21*
2.	Molecular markers used	:	SSR
3.	Pedigree	:	PR 116///PR 108/IRRI 76//PR 106-P2
4.	Donor parent	:	IET 17948 (PR106-P2)
5.	Salient features	:	

- Carries three bacterial blight resistance genes
- Resistant to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) presently prevalent in Punjab
- Average grain yield: 73.0 q/ha
- Maturity: 143 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Punjab
8.	Release & notification	:	SVRC, S.O. No. 2680(E), 01.10.2015
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Rice

Rice
PR 122
(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*Xa4, xa13* and *Xa21*
2.	Molecular markers used	:	SSR
3.	Pedigree	:	PR 108/IRRI 76//PR 106-P1
4.	Donor parent	:	PR 106-P1
5.	Salient features	:	

- Carries three bacterial blight resistance genes
- Resistant to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) presently prevalent in Punjab
- Average grain yield: 79.0 q/ha
- Maturity: 147 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Punjab
8.	Release & notification	:	SVRC, S.O. No. 2680(E), 01.10.2015
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Rice

Rice
PR 121
(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*Xa4, xa13* and *Xa21*
2.	Molecular markers used	:	SSR
3.	Pedigree	:	PR 116///PR 108/IRRI 76//PR 106-P2
4.	Donor parent	:	IET 17948 (PR106-P2)
5.	Salient features	:	

- Carries three bacterial blight resistance genes
- Resistant to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) presently prevalent in Punjab
- Average grain yield: 76.0 q/ha
- Maturity: 140 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Punjab
8.	Release & notification	:	SVRC, S.O. No. 2680(E), 01.10.2015
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Rice

Rice

Pusa Basmati 1728

(Variety)

Trait improved: Bacterial blight resistance

1. Genes introgressed : *xa13* and *Xa21*
2. Molecular markers used : SSR and STS
3. Recurrent parent : Pusa Basmati 6
4. Donor parent : Improved Pusa Basmati 1
5. Salient features :
   - Highly resistant reaction [SI of 2.8] to bacterial blight compared to the severe susceptibility in Pusa Basmati 6 [SI of 7.0]
   - Extra long slender grains (7.46 mm), very good kernel length after cooking (14.62 mm), intermediate alkali spreading value (7.0), intermediate amylose content (22.84 %) and very strong aroma
   - Average grain yield: 41.8 q/ha
   - Maturity: 145 days
6. Suitability : Irrigated conditions (*Kharif*)
7. Recommended area : Basmati growing areas of Punjab, Haryana, Delhi, Jammu & Kashmir, Uttarakhand and Western Uttar Pradesh
8. Release & notification : CVRC, S.O. No. 3540(E), 22.11.2016
9. Developed by : ICAR-Indian Agricultural Research Institute, New Delhi

Rice

Punjab Basmati 3

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa13* and *Xa21*
2.	Molecular markers used	:	SSR and STS
3.	Recurrent parent	:	Basmati 386
4.	Donor parent	:	IET 17948 (PR106-P2)
5.	Salient features	:	

- Resistance to all the 10 pathotypes of *Xanthomonas oryza*e pv. *oryzae* prevalent in Punjab
- Photoperiod sensitive Basmati rice variety
- Extra-long slender and translucent grains
- Strong aroma with good cooking and eating quality
- Average grain yield: 40.8 q/ha
- Maturity: 139 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Punjab
8.	Release & notification	:	SVRC, S.O. No. 3540(E), 22.11.2016
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All India Coordinated Research Project on Rice

Rice

Pusa Basmati 1718

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa13* and *Xa21*
2.	Molecular markers used	:	SSR and STS
3.	Recurrent parent	:	Pusa Basmati 1121
4.	Donor parent	:	SPS 97 derived from the cross PB1121/IRBB60
5.	Salient features	:	

- Highly resistant to bacterial blight disease [SI of 2.2] as compared to the recurrent parent, Pusa Basmati 1121 [SI of 7.4]
- Extra-long slender grains (8.10 mm) with very occasional grain chalkiness, very good kernel length after cooking (17.00 mm), intermediate amylose (22.2%) and strong aroma
- Average grain yield: 46.4 q/ha
- Maturity: 135 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Punjab, Haryana, Delhi, Jammu & Kashmir, Uttarakhand and Western Uttar Pradesh
8.	Release & notification	:	CVRC, S.O. No. 2805(E), 25.08.2017
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

CR Dhan 800

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa5, xa13* and *Xa21*
2.	Molecular markers used	:	STS
3.	Recurrent parent	:	Swarna
4.	Donor parent	:	IRBB 60
5.	Salient features	:	

- Resistant to bacterial blight
- Medium slender grain type, intermediate alkali spreading value, and amylose content ideal to Swarna
- Flowers in 115 days and plant height (85-90 cm)
- Average grain yield: 48.6 q/ha
- Maturity: 145 days

6.	Suitability	:	Rainfed shallow lowland ecology *(Kharif)*
7.	Recommended area	:	Odisha
8.	Release & notification	:	SVRC, S.O. No. 399(E), 24.01.2018
9.	Developed by	:	ICAR-National Rice Research Institute, Cuttack (Odisha)

Rice

Punjab Basmati 4

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa13* and *Xa21*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Basmati 370
4.	Donor parent	:	IET 17948 (PR106-P2)
5.	Salient features	:	

- Resistance to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) prevalent in Punjab
- Photoperiod sensitive Basmati rice variety
- Extra-long slender and translucent grains
- Strong aroma with good cooking and eating quality
- Average grain yield: 43.3 q/ha
- Maturity: 146 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Punjab
8.	Release & notification	:	SVRC, S.O. No. 1379(E), 27.03.2018
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All India Coordinated Research Project on Rice

Rice

Punjab Basmati 5

(Variety)

Trait improved: Bacterial blight resistance

1.	Genes introgressed	:	*xa13* and *Xa21*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Basmati 386
4.	Donor parent	:	IET 17948 (PR106-P2)
5.	Salient features	:	

- Resistant to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) prevalent in Punjab
- Photoperiod sensitive Basmati rice variety
- Extra-long slender and translucent grains
- Strong aroma with good cooking and eating quality
- Average grain yield: 37.1 q/ha
- Maturity: 137 days

6.	Suitability	:	Lowland irrigated rice ecosystem (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Punjab
8.	Release & notification	:	SVRC, S.O. No. 1379(E), 27.03.2018
9.	Developed by	:	Punjab Agricultural University, Ludhiana, (Punjab) under ICAR-All India Coordinated Research Project on Rice

Rice
PR 127
(Variety)

Trait improved: Bacterial blight resistance

1. Gene introgressed : *Xa45(t)*
2. Molecular markers used : STS
3. Recurrent parent : Pusa 44
4. Donor parent : *Oryza glaberrima* (Accession no. 102600b)
5. Salient features :
   - Resistant to all the 10 pathotypes of *Xanthomonas oryzae* pv. *oryzae* (causal organism of bacterial blight) presently prevalent in Punjab
   - Long slender grains and length/breadth ratio of 3.23 with 60.1% head rice recovery
   - Average grain yield: 75.0 q/ha
   - Maturity: 137 days
6. Suitability : Low land irrigated rice ecosystem (*Kharif*)
7. Recommended area : Punjab
8. Release & notification : SVRC, S.O. No. 99(E), 06.01.2020
9. Developed by : Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Rice

Rice

DRR Dhan 59

(Variety)

Trait improved: Bacterial blight resistance

1.	Gene introgressed	:	*Xa33*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Akshyadhan
4.	Donor parent	:	FBR1-13
5.	Salient features	:	

- Resistant to bacterial blight
- Average grain yield: 55.0 q/ha
- Plant height: 114 cm
- Maturity: 129 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Andhra Pradesh, Telangana, Tamil Nadu, Karnataka and Jharkhand
8.	Release & notification	:	CVRC, S.O. No. 8 (E), 24.12.2021
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana)

Rice

Pusa 6 (Pusa 1612)

(Variety)

Trait improved: Blast resistance

1.	Genes introgressed	:	*Pi2* and *Pi54*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Sugandh 5
4.	Donor parent	:	C101A51 (*Pi2*) and Tetep (*Pi54*) (near isogenic line in genetic background of cultivar CO39)
5.	Salient features	:	

- Blast resistant variety of rice
- Extra-long slender translucent grain with 53% mean head rice recovery and strongly aromatic with high kernel length of 15mm after cooking
- Alkali spreading score is 6.0 and amylose content is intermediate (24.53 %)
- Average grain yield: 50.7 q/ha
- Maturity: 120 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Punjab, Haryana, Delhi and Jammu & Kashmir
8.	Release & notification	:	CVRC, S. O. No. 2817(E), 19.09.2013
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

Pusa Basmati 1609

(Variety)

Trait improved: Blast resistance

1.	Genes introgressed	:	*Pi2* and *Pi54*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	PRR 78
4.	Donor parent	:	Pusa 1603 (Pi2) and Pusa 1602 (*Pi54*)
5.	Salient features	:	

- First Basmati rice variety developed by pyramiding blast resistance genes, *Pi2* and *Pi54*
- Resistant to neck blast and moderately resistant to leaf blast
- Extra-long slender grains (7.87 mm) with very occasional grain chalkiness, very good kernel length after cooking (13.9 mm), intermediate alkali spreading value (4.0), intermediate amylose content (24.60 %) and strong aroma
- Average grain yield: 46.0 q/ha
- Maturity: 120 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Uttar Pradesh, National Capital Region (NCR) of Delhi, Uttarakhand and Punjab
8.	Release & notification	:	CVRC, S.O. No. 2680(E), 01.10.2015
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

Pusa Basmati 1637

(Variety)

Trait improved: Blast resistance

1.	Gene introgressed	:	*Pi9*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Basmati 1
4.	Donor parent	:	IRBL-9W
5.	Salient features	:	

- Blast resistant variety of rice
- Long slender grains (7.3 mm) with very occasional grain chalkiness, very good kernel length after cooking (13.8 mm) and strong aroma
- Exhibits flaky appearance, tenderness on touching and chewing, desirable taste and optimum aroma with good elongation
- Average grain yield: 42.0 q/ha
- Maturity: 130 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Basmati growing areas of Western Uttar Pradesh, National Capital Region (NCR) of Delhi, Uttarakhand, Haryana and Punjab
8.	Release & notification	:	CVRC, S.O. No. 3540(E), 22.11.2016
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

DRR Dhan 51

(Variety)

Trait improved: Blast resistance

1.	Gene introgressed	:	*Pi2*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Swarna
4.	Donor parent	:	C101A51 (Pi2) –a near isogenic line in genetic background of cultivar CO39
5.	Salient features	:	

- Resistant to blast disease
- Short bold, head rice recovery (60.1%), amylose content (26.7%), alkali spreading value (4.0) and occasionally chalky grains
- Average grain yield: 60.3 q/ha
- Maturity : 135 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Swarna growing areas of Telangana, Uttar Pradesh, Chhattisgarh and Gujarat
8.	Release & notification	:	CVRC, S.O. 1379(E), 27.04.2018
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana)

Rice

Pusa Samba 1850

(Variety)

Trait improved: Blast resistance

1.	Genes introgressed	:	*Pi1*, *Pi54* and *Pita*
2.	Molecular markers used	:	SSR and STS
3.	Recurrent parent	:	Samba Mahsuri
4.	Donor parent	:	DHMASQ164-2b (A doubled haploid line)
5.	Salient features	:	

- Highly resistant to blast disease with an SI of 4.3 as compared to Samba Mahsuri with SI of 6.7
- Medium slender grains (5.6 mm) with non-chalky grains chalkiness, intermediate amylose content (21.5 %) and very high head rice recovery (68.8%)
- Average grain yield: 47.7 q/ha
- Maturity: 140 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Odisha and Chhattisgarh
8.	Release & notification	:	CVRC, S.O. No. 6318(E), 26.12.2018
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

DRR Dhan 62

(Variety)

Trait improved: Bacterial blight & blast resistance

1.	Genes introgressed	:	*Xa21, xa13, xa5, Pi2* and *Pi-54*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Improved Samba Mahsuri
4.	Donor parent	:	C101A51 and Tetep
5.	Salient features	:	

- Resistant to bacterial blight and blast
- Semi-dwarf stature and non-lodging habit, with long deflexed panicles which are completely exerted
- Resistant to neck blast, brown spot and sheath rot
- Average grain yield: 42 q/ha
- Maturity: 132 days
- Plant height: 89 cm

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Odisha, Jharkhand, Bihar, Chhattisgarh, Maharashtra, Gujarat, Andhra Pradesh, Telangana, Tamil Nadu and Karnataka
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana)

Rice

Pusa Basmati 1847

(Variety)

Traits improved: Bacterial blight & blast resistance

1.	Genes introgressed	:	*Xa21, xa13, Pi2* and *Pi-54*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Basmati 1509
4.	Donor parent	:	Pusa 1790
5.	Salient features	:	

- Bacterial blight resistant
- Average grain yield: 57.0 q/ha
- Maturity: 120 days
- Plant height: 110 cm

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Delhi, Punjab and Western Uttar Pradesh
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

Pusa Basmati 1885

(Variety)

Traits improved: Bacterial blight & blast resistance

1.	Genes introgressed	:	*Xa21, xa13, Pi2* and *Pi54*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Basmati 1121
4.	Donor parent	:	Pusa 1883/Pusa Basmati 1718
5.	Salient features	:	

- Bacterial blight and blast resistant
- Average grain yield: 47.0 q/ha
- Maturity: 145 days
- Plant height: 135 cm

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Delhi, Haryana and Punjab
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

Pusa Basmati 1886

(Variety)

Traits improved: Bacterial blight & blast resistance

1.	Genes introgressed	:	*Xa21, xa13, Pi2* and *Pi54*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Basmati 6
4.	Donor parent	:	Pusa 1602 (*Pi2* and *Pi54*)/ Pusa 1603 (*xa13* and *Xa21*)
5.	Salient features	:	

- Bacterial blight and blast resistant
- Average grain yield: 45 q/ha
- Maturity: 145 days
- Plant height: 95 cm

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Haryana and Uttarakhand
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

DRR Dhan 58

(Variety)

Traits improved: Bacterial blight resistance & seedling stage salinity tolerance

1.	Genes and QTL introgressed	:	*Xa21, xa13, xa5* and *qSaltol*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Improved Samba Mahsuri
4.	Donor parent	:	FL478
5.	Salient features	:	

- Resistant to bacterial blight
- Tolerant to salinity stress at seedling stage
- Average grain yield: 28 q/ha (salinity) compared to 45 q/ha under normal conditions
- Plant height: 95 cm
- Days to maturity: 129 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Telangana, Andhra Pradesh, Tamil Nadu, Karnataka, Chhattisgarh, Odisha, Jharkhand, Bihar, Gujarat and Maharashtra
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana)

Rice

DRR Dhan 60

(Variety)

Traits improved: Bacterial blight resistance & low soil phosphorous tolerance

1.	Genes and QTL introgressed	:	*Xa21, xa13, xa5* and *qPup1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Improved Samba Mahsuri
4.	Donor parent	:	Swarna
5.	Salient features	:	

- Resistant to bacterial blight
- Tolerant to low phosphorus condition
- Average grain yield: 38 q/ha (under low phosphorus condition) compared to 39 q/ha under normal condition
- Plant height: 82 cm
- Maturity: 127 days

6.	Suitability	:	Irrigated and rainfed shallow lowland (RSL) areas with low soil phosphorus (*Rabi* & *Kharif*)
7.	Recommended area	:	Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Odisha, Chhattisgarh, Jharkhand, Bihar, Gujarat and Maharashtra
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana)

Rice

Swarna Sub 1

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*qSub1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Swarna
4.	Donor parent	:	IR 49830-7-1-2-3 (FR13A)
5.	Salient features	:	

- Suitable for late planting with aged seedlings
- Tolerant to complete submergence up to 15-17 days
- Suitable for shallow low lands and flood prone areas
- Average grain yield: 52.5 q/ha
- Maturity: 140 days

6.	Suitability	:	Shallow lowland (*Kharif*)
7.	Recommended area	:	Shallow lowland areas of coastal Odisha, Bihar and West Bengal
8.	Release & notification	:	CVRC, S.O. No. 2187(E), 27.08.2009
9.	Developed by	:	ICAR-National Rice Research Institute, Cuttack (Odisha) and International Rice Research Institute, Philippines

Rice

Samba Sub 1

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*qSub1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Samba Mahsuri
4.	Donor parent	:	IR 49830-7-1-2-3 (FR13A)
5.	Salient features	:	

- Tolerant to submergence
- Resistant to leaf folder, blue beetles, plant hoppers, gall midge and moderately resistant to bacterial leaf blight and sheath rot
- Resistant to brown spot, neck blast and moderately resistant to stem borer and case worm
- High head rice recovery (78%) and intermediate amylose (24.75%)
- Average grain yield: 25.0 q/ha (under submergence) and 55.0 q/ha (under normal condition)
- Maturity: 140 days

6.	Suitability	:	Rainfed lowland (flash flood prone area in *Kharif*)
7.	Recommended area	:	Uttar Pradesh
8.	Release & notification	:	SVRC, S.O. No. 268(E), 28.01.2015
9.	Developed by	:	Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (Uttar Pradesh) under ICAR-All Indian Coordinated Research Project on Rice in collaboration with International Rice Research Institute, Philippines

Rice

CR 1009 Sub 1

(Variety)

Trait improved: Submergence tolerance

1. QTL introgressed : *qSub1*
2. Molecular markers used : InDel
3. Recurrent parent : CR 1009
4. Donor parent : IR 49830-7-1-2-3 (FR13A)
5. Salient features :
   - Tolerant to submergence
   - Moderately resistant to brown spot and blast diseases
   - Moderately resistant to brown plant hopper and white backed plant hopper
   - Short bold grain type, good milling (69.8%) and head rice recovery (62.5%), intermediate amylose (25%), intermediate gelatinization temperature and soft gel consistency, suitable for idli making
   - Average grain yield: 57.6 q/ha
   - Maturity: 150 days
6. Suitability : Irrigated transplanted (*Samba*), suitable for flood prone shallow lowland areas (*Kharif*)
7. Recommended area : Tamil Nadu
8. Release & notification : SVRC, S. O. No. 2805(E), 25.08.2017
9. Developed by : Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) under ICAR-All Indian Coordinated Research Project on Rice in collaboration with International Rice Research Institute, Philippines

Rice

Ranjit Sub 1

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*qSub1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Ranjit
4.	Donor parent	:	Swarna Sub1
5.	Salient features	:	

- Tolerant to submergence, can tolerate 12 days complete submergence
- Medium slender grains
- Average grain yield: 57.0 q/ha
- Maturity: 145 days , compared to 150-155 days in Ranjit, having the advantage of about a week

6.	Suitability	:	Sali (*Kharif*)
7.	Recommended area	:	Assam
8.	Release & notification	:	SVRC, S.O. No. 1379(E), 27.03.2018
9.	Developed by	:	Assam Agricultural University, Jorhat (Assam) under ICAR-All Indian Coordinated Research Project on Rice in collaboration with International Rice Research Institute, Philippines

Rice

Bahadur Sub 1

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*qSub1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Bahadur
4.	Donor parent	:	Swarna Sub1
5.	Salient features	:	

- Tolerant to submergence, can tolerate 12 days complete submergence
- Medium bold grain type
- Average grain yield: 55.0 q/ha
- Maturity: 140 days

6.	Suitability	:	Sali (*Kharif*)
7.	Recommended area	:	Assam
8.	Release & notification	:	SVRC, S.O. No. 1379(E), 27.03.2018
9.	Developed by	:	Assam Agricultural University, Jorhat (Assam) under ICAR-All Indian Coordinated Research Project on Rice in collaboration with International Rice Research Institute, Philippines

Rice

CO 43 Sub 1

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*qSub1*
2.	Molecular markers used	:	InDel
3.	Recurrent parent	:	CO 43
4.	Donor parent	:	IR 49830-7-1-2-3 (FR13A)
5.	Salient features	:	

- Tolerant to submergence
- Short bold, intermediate alkali spreading value and amylose content and high head rice recovery
- It is a semi dwarf (95-100 cm) variety
- Average grain yield: 50.0 q/ha (normal) and 32.5 q/ha (submergence)
- Maturity: 135 days

6.	Suitability	:	Irrigated lowland ecosystem (*Rabi*)
7.	Recommended area	:	Tamil Nadu, Andhra Pradesh, Odisha and Karnataka
8.	Release & notification	:	CVRC, SO No. 1379(E), 27.03.2018
9.	Developed by	:	Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) under ICAR-All Indian Coordinated Research Project on Rice in collaboration with International Rice Research Institute, Philippines

Rice

IR 64 Sub1

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*qSub1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	IR 64
4.	Donor parent	:	IR 49830-7-1-2-3 (FR13A)
5.	Salient features	:	

- Tolerant to submergence
- Moderately tolerant to blast, rice tungro virus, stem borer and leaf folder
- Average grain yield: 32.5 q/ha (submergence)
- Maturity: 123 days

6.	Suitability	:	Irrigated shallow lowland ecology (*Kharif*)
7.	Recommended area	:	Uttar Pradesh
8.	Release & notification	:	SVRC, S.O. No. 3482(E), 07.10.2020
9.	Developed by	:	Crop Research Station, Masodha; Narendra Deva University of Agriculture & Technology, Kumareani, Faizabad (Uttar Pradesh) under ICAR-All Indian Coordinated Research Project on Rice

Rice

DRR Dhan 53

(Variety)

Trait improved: Submergence tolerance

1.	QTL introgressed	:	*Xa21, xa13, xa5* and *Xa38*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Improved Samba Mahsuri
4.	Donor parent	:	PAU3554
5.	Salient features	:	

- Resistant to bacterial blight
- Average grain yield: 55 q/ha (submergence)
- Plant height: 85 cm
- Maturity: 132 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Andhra Pradesh, Bihar, Telangana, Gujarat, Chhattisgarh, Odisha, Maharashtra, Jharkhand, Maharashtra
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana)

Rice

CR Dhan 803 (Trilochan)

(Variety)

Trait improved: Submergence tolerance

1. QTL introgressed : *qSub1*
2. Molecular markers used : SSR
3. Recurrent parent : Pooja
4. Donor parent : Swarna Sub1
5. Salient features :
   - Resistant to stem borer and BPH
   - Moderately resistant to white ear head attack, WBPH, leaf folder, plant hopper, case worm and case worm
   - It is moderately resistant to neck blast and rice tungro virus
   - Average grain yield: 35 q/ha (under submergence) compared to 50 q/ha under normal condition
   - Maturity: 150 days
   - Plant height: 100 cm
6. Suitability : Rainfed shallow lowland ecology (*Kharif*)
7. Recommended area : Odisha
8. Release & notification : SVRC, S.O. No. 8(E), 24.12.2021
9. Developed by : ICAR-National Rice Research Institute, Cuttack (Odisha)

Rice

IR 64 Drt1 (DRR Dhan 42)

(Variety)

Trait improved: Drought tolerance

1.	QTL introgressed	:	*qDTY2.2* and *qDTY4.1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	IR 64
4.	Donor parent	:	Aday Selection, a traditional drought tolerant variety
5.	Salient features	:	

- Country's first MAS product for drought tolerance in rice
- Long slender grains with head rice recovery (52.9%), intermediate amylose content (22.96%) and alkali spreading value (4.0)
- Average grain yield: 23.2 q/ha (under severe drought stress), 40.9 q/ha (under moderate drought stress) and 53.5 q/ha (under irrigated condition)
- Maturity: 125 days

6.	Suitability	:	Rainfed, drought prone ecology, irrigated ecology (*Kharif*) for Andhra Pradesh and Tamil Nadu (*Rabi*)
7.	Recommended area	:	Tamil Nadu, Andhra Pradesh, Telangana, Madhya Pradesh, Chhattisgarh and Jharkhand
8.	Release & notification	:	CVRC, S.O. No. 268(E), 28.01.2015
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana) in collaboration with International Rice Research Institute, Philippines

Rice

DRR Dhan 50

(Variety)

Traits improved: Submergence & drought tolerance

1.	QTL introgressed	:	*qSub1, qDTY2.1* and *qDTY3.1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Samba Mahsuri
4.	Donor parent	:	IR 81896-B-B-195 (near isogenic line in genetic background of Swarna)
5.	Salient features	:	

- Tolerant to drought and submergence
- Distinguishable by strong culm and lodging resistance
- Average grain yield: 25.0 q/ha (under submergence stress), 28.0 q/ha (under severe drought stress), and 38.0 q/ha (under drought stress)
- Maturity: 145 days

6.	Suitability	:	Transplanted (irrigated)/ rainfed drought and submergence prone areas (*Kharif*)
7.	Recommended area	:	Rainfed and irrigated areas of Tamil Nadu, Andhra Pradesh, Telangana, Madhya Pradesh, Chhattisgarh and Jharkhand, and Samba Mahsuri growing regions of the country: Andhra Pradesh, Telangana, Karnataka, Bihar, Odisha, West Bengal, Uttar Pradesh and Madhya Pradesh
8.	Release & notification	:	CVRC, S.O. No. 1379(E), 27.03.2018
9.	Developed by	:	ICAR-Indian Institute of Rice Research, Hyderabad (Telangana) in collaboration with ICAR-National Institute of Plant Biotechnology, New Delhi and IRRI, Philippines

Rice

CR Dhan 801

(Variety)

Traits improved: Submergence & drought tolerance

1.	QTL introgressed	:	*qSub1, qDTY1.1, qDTY2.1* and *qDTY3.1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Swarna Sub1
4.	Donor parent	:	IR 81896-B-B-195 and IR 91659-54-35
5.	Salient features	:	

- Tolerant to drought and submergence
- Medium slender grain type, intermediate alkali spreading value, and amylose content ideal to Swarna
- Plant height: 85-90 cm
- Average grain yield: 40.8 q/ha (submergence), 29.3 q/ha (drought) and 63.5 q/ha (normal)
- Maturity: 140 days

6.	Suitability	:	Rainfed shallow lowland ecology (*Kharif*)
7.	Recommended area	:	Odisha, West Bengal, Uttar Pradesh, Andhra Pradesh and Telangana
8.	Release & notification	:	CVRC, S.O.1498(E), 01.04.2019
9.	Developed by	:	ICAR-National Rice Research Institute, Cuttack (Odisha) in collaboration with International Rice Research Institute, Philippines

Rice

CR Dhan 802 (Subhash)

(Variety)

Traits improved: Submergence & drought tolerance

1.	QTL introgressed	:	*qSub1, qDTY1.1* and *qDTY2.1*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Swarna Sub1
4.	Donor parent	:	IR 81896-B-B-195
5.	Salient features	:	

- Tolerant to drought and submergence
- Short bold grain type, intermediate alkali spreading value, and amylose content similar to Swarna
- Plant height: 90-100 cm
- Average grain yield: 41.4 q/ha (submergence), 23.4 q/ha (drought) and 65.1 q/ha (normal)
- Maturity: 145 days

6.	Suitability	:	Rainfed shallow lowland ecology (*Kharif*)
7.	Recommended area	:	Bihar and Madhya Pradesh
8.	Release & notification	:	CVRC, S.O.1498(E), 01.04.2019
9.	Developed by	:	ICAR-National Rice Research Institute, Cuttack (Odisha) in collaboration with International Rice Research Institute, Philippines

Rice

Pusa Basmati 1979

(Variety)

Trait improved: Herbicide (Imazethapyr) tolerance

1.	Gene introgressed	:	*AHAS*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Basmati 1121
4.	Donor parent	:	Robin
5.	Salient features	:	

- Imazethapyr herbicide tolerant
- Average grain yield: 46 q/ha
- Maturity: 133 days
- Plant height: 125 cm

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Delhi, Punjab and Haryana
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Rice

Pusa Basmati 1985

(Variety)

Trait improved: Herbicide (Imazethapyr) tolerance

1.	Gene introgressed	:	*AHAS*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa Basmati 1509
4.	Donor parent	:	Robin
5.	Salient features	:	

- Imazethapyr herbicide tolerant
- Average grain yield: 52 q/ha
- Maturity: 115 days
- Plant height: 110 cm

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Delhi, Punjab and Western Uttar Pradesh
8.	Release & notification	:	CVRC, S.O. No. 8 (E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Wheat

PBW 761 (*Unnat* PBW 550)

(Variety)

Trait improved: Stripe rust resistance

1. Gene introgressed : *Yr15*
2. Molecular markers used : SSR
3. Recurrent parent : PBW 550
4. Donor parent : Avocet + *Yr15*
5. Salient features :
   - Very high level of resistance to stripe rust
   - Bold and hard grain, suitable for processing at commercial level
   - Suitable for medium late planting and provides better opportunity for rice residue management as well as timely sowing of summer mung bean owing to its early maturity
   - Average grain yield: 57.5 q/ha
   - Maturity: 145 days
6. Suitability : Timely sown irrigated conditions (*Rabi*)
7. Recommended area : Punjab
8. Release & notification : SVRC, S.O.1498(E), 01.04.2019
9. Developed by : Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Wheat and Barley

Wheat
PBW 752
(Variety)

Trait improved: Stripe rust resistance

1.	Gene introgressed	:	*Yr10*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	PBW 621
4.	Donor parent	:	Avocet + *Yr10*
5.	Salient features	:	

- Very high level of resistance to stripe rust
- Exhibited better adaptability to changes in agronomic variables when sown early and late
- Average grain yield: 48.0 q/ha
- Maturity: 130 days

6.	Suitability	:	Late sown irrigated conditions (*Rabi*)
7.	Recommended area	:	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur divisions), Western Uttar Pradesh (except Jhansi division), Jammu and Kathua districts of Jammu & Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand
8.	Release & notification	:	CVRC, S.O. No.1498(E), 01.04.2019
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Wheat and Barley

Wheat
PBW 757
(Variety)

Trait improved: Stripe rust resistance

1.	Genes introgressed	:	*Yr15*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	PBW 550
4.	Donor parent	:	Avocet + *Yr15*
5.	Salient features	:	

- Very high level of resistance to stripe rust
- Exhibited better adaptability to changes in agronomic variables as indicated by higher yield gain when sown early and very late
- Average grain yield: 39.5 q/ha
- Maturity: 104 days

6.	Suitability	:	Very late sown irrigated conditions (*Rabi*)
7.	Recommended area	:	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur divisions), Western Uttar Pradesh (except Jhansi division), Jammu and Kathua districts of Jammu & Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand
8.	Release & notification	:	CVRC, S.O.1498(E), 01.04.2019
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Wheat and Barley

Wheat

PBW 723 (*Unnat* PBW 343)

(Variety)

Traits improved: Stripe & leaf rust resistance

1.	Genes introgressed	:	*Yr17, Yr40, Lr37* and *Lr57*
2.	Molecular markers used	:	SSR and CAPS
3.	Recurrent parent	:	PBW 343
4.	Donor parent	:	*Aegilops umbellulata* and *Aegilops ventricosa*
5.	Salient features	:	

- Country's first wheat variety developed through MAS
- Carries five rust resistance genes at two loci- Yr17/Lr37/Sr38 from *Triticum ventricosum* (syn. *Aegilops ventricosa*) on chromosome 2AL and *Yr40/Lr57* (or its allelic variants *Yr70/Lr76*) from *Aegilops umbellulata* on chromosome 5DS
- Average grain yield: 58.0 q/ha
- Maturity: 155 days

6.	Suitability	:	Timely sown irrigated conditions (*Rabi*)
7.	Recommended area	:	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur divisions), Western Uttar Pradesh (except Jhansi division), Jammu and Kathua districts of Jammu & Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand
8.	Release & notification	:	CVRC, S.O. 1007 (E), 31.03.2017
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Wheat and Barley

Wheat

PBW 771

(Variety)

Traits improved: Stripe & leaf rust resistance

1.	Genes introgressed	:	*Yr40 and Lr57*
2.	Molecular markers used	:	CAPS and SSR
3.	Recurrent parent	:	DBW 17
4.	Donor parent	:	*Ae. umbellulata* (Accession no. 3732)
5.	Salient features	:	

- Very high level of resistance to leaf and stripe rust
- High grain zinc content (>40 ppm)
- Average grain yield: 54.0 q/ha
- Maturity: 120 days

6.	Suitability	:	Late sown irrigated conditions (*Rabi*)
7.	Recommended area	:	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur division), Western Uttar Pradesh (except Jhansi divisions), Jammu and Kathua districts of Jammu & Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand
8.	Release & notification	:	CVRC, S.O. No. 99(E), 06.01.2020
9.	Developed by	:	Punjab Agricultural University, Ludhiana (Punjab) under ICAR-All Indian Coordinated Research Project on Wheat and Barley

Maize

Vivek QPM9

(Hybrid)

Traits improved: Lysine & tryptophan

1.	Gene introgressed	:	*opaque2*
2.	Molecular markers used	:	SSR
3.	Recurrent parents	:	CM212 and CM145 (parents of maize hybrid, Vivek Maize Hybrid 9)
4.	Donor parents	:	CML180 and CML 170
5.	Salient features	:	

- Country's first MAS-derived maize hybrid
- Quality protein maize (QPM) hybrid
- High lysine (4.19%) and tryptophan (0.83%) as compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 52.0 q/ha
- Maturity: 88 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hill region), North Eastern states, Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu
8.	Release & notification	:	CVRC, S.O. No. 2458(E), 16.10.2008
9.	Developed by	:	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttarakhand)

Maize

Pusa HM4 Improved

(Hybrid)

Traits improved: Lysine & tryptophan

1.	Gene introgressed	:	*opaque2*
2.	Molecular markers used	:	SSR
3.	Recurrent parents	:	HKI1105 and HKI323 (parents of maize hybrid, HM4)
4.	Donor parents	:	CML161 and HKI161
5.	Salient features	:	

- Quality protein maize (QPM) hybrid
- High lysine (3.62%) and tryptophan (0.91%) as compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 64.2 q/ha
- Maturity: 87 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Punjab, Haryana, Delhi, Western Uttar Pradesh and Plains of Uttarakhand
8.	Release & notification	:	CVRC, S.O. No. 2805(E), 25.08.2017
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving HM4 developed by CCS-Haryana Agricultural University, Hisar (Haryana)

Maize

Pusa HM8 Improved

(Hybrid)

Traits improved: Lysine & tryptophan

1.	Gene introgressed	:	*opaque2*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	HKI1105 (parent of maize hybrid, HM8)
4.	Donor parent	:	CML161
5.	Salient features	:	

- Quality protein maize (QPM) hybrid
- High lysine (4.18%) and tryptophan (1.06%) as compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 62.6 q/ha
- Maturity: 95 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Andhra Pradesh, Tamil Nadu, Karnataka, Telangana and Maharashtra
8.	Release & notification	:	CVRC, S.O. No. 2805(E), 25.08.2017
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving HM8 developed by CCS-Haryana Agricultural University, Hisar (Haryana)

Maize

Pusa HM9 Improved

(Hybrid)

Traits improved: Lysine & tryptophan

1.	Gene introgressed	:	*opaque2*
2.	Molecular markers used	:	SSR
3.	Recurrent parents	:	HKI1105 and HKI1128 (parents of maize hybrid, HM9)
4.	Donor parents	:	CML161 and HKI193-2
5.	Salient features	:	

- Quality protein maize (QPM) hybrid
- High lysine (2.97%) and tryptophan (0.68%) as compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 52.0 q/ha
- Maturity: 89 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Bihar, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh
8.	Release & notification	:	CVRC, S.O. No. 2805(E), 25.08.2017
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving HM9 developed by CCS-Haryana Agricultural University, Hisar (Haryana)

Maize

Pusa Vivek QPM9 Improved

(Hybrid)

Trait improved: Provitamin-A

1. Gene introgressed : *crtRB1*
2. Molecular markers used : InDel
3. Recurrent parents : VQL1 and VQL2 (parents of maize hybrid, Vivek QPM-9)
4. Donor parents : HP465-43 and HP465-41
5. Salient features :
   - Country's first provitamin-A rich multi-nutrient rich maize hybrid
   - High provitamin-A (8.15 ppm) compared to 1-2 ppm in popular hybrids
   - High lysine (2.67%) and tryptophan (0.74%) compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan content in popular hybrids
   - Average grain yield: 55.9 q/ha (Northern Hill Zone: NHZ) and 59.2 q/ha (Peninsular Zone: PZ)
   - Maturity: 93 days (NHZ) and 83 days (PZ)
6. Suitability : Irrigated conditions (*Kharif*)
7. Recommended area : Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Hill region), North Eastern states, Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu
8. Release & notification : CVRC, S.O. 2805(E), 25.08.2017
9. Developed by : ICAR-Indian Agricultural Research Institute, New Delhi by improving Vivek QPM9 developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttarakhand)

Maize

Pusa Vivek Hybrid-27 Improved

(Hybrid)

Trait improved: Provitamin-A

1.	Gene introgressed	:	*crtRB1*
2.	Molecular markers used	:	InDel
3.	Recurrent parents	:	V335 and V345 (parents of maize hybrid, Vivek Hybrid-27)
4.	Donor parents	:	HP465-30 and HP465-35
5.	Salient features	:	

- High provitamin-A (5.49 ppm) compared to 1-2 ppm in popular hybrids
- Average grain yield: 48.5 q/ha
- Maturity: 84 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Bihar, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh
8.	Release & notification	:	CVRC, S.O. No. 99(E), 06.01.2020
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving Vivek Hybrid-27 developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttarakhand)

Maize

Pusa HQPM-5 Improved

(Hybrid)

Trait improved: Provitamin-A

1.	Genes introgressed	:	*crtRB1* and *lcyE*
2.	Molecular markers used	:	InDel
3.	Recurrent parents	:	HKI163 and HKI161 (parents of maize hybrid, HQPM-5)
4.	Donor parents	:	HP704-22 and HP704-23
5.	Salient features	:	

- High provitamin-A (6.77 ppm) compared to 1-2 ppm in popular hybrids
- High lysine (4.25%) and tryptophan (0.94%) compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 72.6 q/ha (Northern Hill Zone: NHZ), 75.1 q/ha (North Western Plain Zone: NWPZ), 53.4 q/ha (North Eastern Plain Zone: NEPZ), 71.2 q/ha (Peninsular Zone: PZ) and 51.2 q/ha (Central West Zone: CWZ)
- Maturity: 111 days (NHZ), 92 days (NWPZ) 88 days (NEPZ), 98 days (PZ), 91 days (PZ)

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Across the country
8.	Release & notification	:	CVRC, S.O. No. 99(E), 06.01.2020
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving HQPM-5 developed by CCS-Haryana Agricultural University, Hisar (Haryana)

Maize

Pusa HQPM-7 Improved

(Hybrid)

Trait improved: Provitamin-A

1.	Genes introgressed	:	*crtRB1* and *lcyE*
2.	Molecular markers used	:	InDel
3.	Recurrent parents	:	HKI193-1 and HKI161 (parents of maize hybrid, HQPM-7)
4.	Donor parent	:	HP704-23
5.	Salient features	:	

- High provitamin-A (7.10 ppm) compared to 1-2 ppm in popular hybrids
- High lysine (4.19%) and tryptophan (0.93%) compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 74.5 q/ha
- Maturity: 97 days

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu
8.	Release & notification	:	CVRC, S.O. No. 99(E), 06.01.2020
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving HQPM-7 developed by CCS-Haryana Agricultural University, Hisar (Haryana)

Maize

Pusa HQPM-1 Improved

(Hybrid)

Trait improved: Provitamin-A

1.	Genes introgressed	:	*crtRB1* and *lcyE*
2.	Molecular markers used	:	InDel
3.	Recurrent parents	:	HKI193-1 and HKI163 (parents of maize hybrid, HQPM-1)
4.	Donor parent	:	HP704-23 and HP704-22
5.	Salient features	:	

- High provitamin-A (7.02 ppm) compared to 1-2 ppm in popular hybrids
- High lysine (4.59%) and tryptophan (0.85%) compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 81.9 q/ha (NHZ), 69.7 q/ha (NWPZ), 59.5 q/ha (NEPZ), 79.3 q/ha (PZ) and 50.9 q/ha (CWZ)
- Maturity: 111 days (NHZ), 94 days (NWPZ), 90 days (NEPZ), 96 days (PZ), 92 days (CWZ)

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Across the country
8.	Release & notification	:	CVRC, S.O. No. 8 (E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi by improving HQPM-1 developed by CCS-Haryana Agricultural University, Hisar (Haryana)

Maize

Pusa Biofortified Maize Hybrid-1

(Hybrid)

Trait improved: Provitamin-A

1.	Genes introgressed	:	*crtRB1* and *lcyE*
2.	Molecular markers used	:	InDel
3.	Pedigrel	:	PMI-PV5 and PMI-PV10
4.	Donor parents	:	HP704-23 and HP704-22
5.	Salient features	:	

- High provitamin-A (6.60 ppm) compared to 1-2 ppm in popular hybrids
- High lysine (3.37%) and tryptophan (0.72%) compared to 1.5-2.0% lysine and 0.3-0.4% tryptophan in popular hybrids
- Average grain yield: 76.2 q/ha (NHZ) & 54.4 q/ha (NEPZ)
- Maturity: 107 days (NHZ) and 86 days (NEPZ)

6.	Suitability	:	Irrigated conditions (*Kharif*)
7.	Recommended area	:	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, (Hill region) Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh, Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region) and West Bengal
8.	Release & notification	:	CVRC, S.O. No. 8 (E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Pearl Millet

HHB 67 Improved

(Hybrid)

Trait improved: Downy mildew resistance

1.	Genes introgressed	:	*qRSg1* and *qRSg4*
2.	Molecular markers used	:	RFLP
3.	Recurrent parent	:	H 77/833-2 (male parent of hybrid, HHB 67)
4.	Donor parent	:	ICMP 451
5.	Salient features	:	

- Country's first MAS-derived cultivar
- Highly resistant to moisture stress
- Small bristles and thin stem
- Suitable for early, medium and late sowing
- Average grain yield: 20.1 q/ha
- Maturity: 65 days

6.	Suitability	:	Rainfed conditions (*Kharif*)
7.	Recommended area	:	Drier areas of Rajasthan, Gujarat and Haryana
8.	Release & notification	:	CVRC, S.O. No. 1566(E), 05.11.2005
9.	Developed by	:	CCS-Haryana Agriculture University, Hisar (Haryana) under ICAR-All Indian Coordinated Research Project on Pearl millet in collaboration with International Crops Research Institute for the Semi-Arid Tropics, Patancheru (Telangana)

Pearl Millet

HHB 67 Improved 2

(Hybrid)

Trait improved: Downy mildew resistance

1. Genes introgressed : *qRSg3.1, qRSg4.2* and *qRSg6.1*
2. Molecular markers used : SSR
3. Recurrent parent : H 77/833-2-202 (male parent of hybrid, HHB 67)
4. Donor parent : P1449 and 863B
5. Salient features :
   - Highly resistant to downy mildew (58.6% less infestation over HHB-67 Improved)
   - Resistant to blast, smut, rust and ergot
   - Tolerant to drought condition
   - Average grain yield: 20.0 q/ha
   - Maturity: 76 days
6. Suitability : Rainfed conditions (*Kharif*)
7. Recommended area : Drier areas of Rajasthan, Gujarat and Haryana
8. Release & notification : CVRC, S.O. No. 8 (E), 24.12.2021
9. Developed by : CCS-Haryana Agriculture University, Hisar (Haryana) under ICAR-All Indian Coordinated Research Project on Pearl millet in collaboration with International Crops Research Institute for the Semi-Arid Tropics, Patancheru (Telangana)

Chickpea

Super Annigeri-1

(Variety)

Trait improved: Fusarium wilt resistance

1.	Gene introgressed	:	*foc4*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Annigeri-1
4.	Donor parent	:	WR-315 (ICC 8933)
5.	Salient features	:	

- Country's first wilt resistant MAS-derived chickpea variety
- Medium seed size (18-20 g/100 seeds), angular seed shape and rough testa with ribbing on seeds
- Average grain yield: 18.4 q/ha
- Maturity: 105 days

6.	Suitability	:	Irrigated and rainfed conditions (*Rabi*)
7.	Recommended area	:	Andhra Pradesh, Karnataka, Maharashtra and Gujarat
8.	Release & notification	:	CVRC, S.O. No. 99(E), 06.01.2020
9.	Developed by	:	University of Agricultural Sciences, Raichur (Karnataka) under ICAR-All Indian Coordinated Research Project on Chickpea in collaboration with International Crops Research Institute for the Semi-Arid Tropics, Pattencheru (Telangana)

Chickpea

Pusa Chickpea 20211

(Variety)

Trait improved: Fusarium wilt resistance

1.	Genes introgressed	:	*foc1*, *foc3*, *foc4* and *foc5*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa 391
4.	Donor parent	:	WR 315
5.	Salient features	:	

- Resistant to Fusarium wilt
- Medium seed size (19.5 g/100 seeds)
- Average grain yield: 22.9 q/ha (under drought stress condition)
- Maturity: 108 days

6.	Suitability	:	Irrigated and rainfed conditions (*Rabi*)
7.	Recommended area	:	Madhya Pradesh, Maharashtra and Gujarat
8.	Release & notification	:	CVRC, S.O. No. 500 (E), 29.01.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Chickpea

IPCMB 19-3 (Samriddhi)

(Variety)

Trait improved: Fusarium wilt resistance

1.	Gene introgressed	:	*foc2*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa 256
4.	Donor parent	:	Vijay
5.	Salient features	:	

- Resistant to Fusarium wilt
- Large seed size (24.1 g/100 seeds)
- Protein content (22.9%)
- Average grain yield: 20.8 q/ha and (under drought stress condition)
- Maturity: 106 days

6.	Suitability	:	Irrigated and rainfed conditions (*Rabi*)
7.	Recommended area	:	Madhya Pradesh, Maharashtra and Gujarat
8.	Release & notification	:	CVRC, S.O. No. 8 (E), 24.12.2021
9.	Developed by	:	ICAR-Indian Institute of Pulse Research, Kanpur (Uttar Pradesh)

Chickpea

Pusa Chickpea 10216

(Variety)

Trait improved: Drought tolerance

1. Genes introgressed : *QTL* hotspot on LG4
2. Molecular markers used : SSR
3. Recurrent parent : Pusa 372
4. Donor parent : ICC 4958
5. Salient features :
   - Country's first drought tolerant MAS-derived chickpea variety
   - Average 100-seed weight is 22.2 g with 22.6% grain protein
   - Moderately resistant to *Fusarium* wilt , dry root rot and stunt
   - Moderately resistant to pod borer
   - Average grain yield: 14.8 q/ha (under drought stress condition)
   - Maturity: 106 days
6. Suitability : Irrigated and rainfed conditions (*Rabi*)
7. Recommended area : Madhya Pradesh, Chhattisgarh, Maharashtra, Gujarat and Bundelkhand region of Uttar Pradesh
8. Release & notification : CVRC, S.O. No. 99(E), 06.01.2020
9. Developed by : ICAR-Indian Agricultural Research Institute, New Delhi in collaboration with International Crops Research Institute for the Semi-Arid Tropics, Patancheru (Telangana)

Chickpea

Pusa Chickpea 4005

(Variety)

Trait improved: Drought tolerance

1.	Genes introgressed	:	*QTL* hotspot on LG4
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	Pusa 362
4.	Donor parent	:	ICC 4958
5.	Salient features	:	

- Tolerant to drought conditions
- Average 100-seed weight is 22.4 g with 17.2% grain protein
- Average grain yield: 16.2 q/ha (under drought stress condition)
- Maturity: 138 days

6.	Suitability	:	Timely sown rainfed conditions (*Rabi*)
7.	Recommended area	:	Punjab, Haryana, Western Uttar Pradesh and Rajasthan
8.	Release & notification	:	CVRC, S.O. No. 8(E), 24.12.2021
9.	Developed by	:	ICAR-Indian Agricultural Research Institute, New Delhi

Chickpea

IPCL4-14

(Variety)

Trait improved: Drought tolerance

1. Genes introgressed : *QTL* hotspot on LG4
2. Molecular markers used : SSR
3. Recurrent parent : DCP 92-3
4. Donor parent : ICC 4958
5. Salient features :
   - Tolerant to drought condition
   - Average 100-seed weight is 16.6 g with 18.1% grain protein
   - Average grain yield: 15.70 q/ha (under drought stress condition)
   - Maturity: 130 days
6. Suitability : Timely sown rainfed conditions (*Rabi*)
7. Recommended area : Punjab, Haryana, Western Uttar Pradesh and Rajasthan
8. Release & notification : CVRC, S.O. No. 8(E), 24.12.2021
9. Developed by : ICAR-Indian Institute of Pulse Research, Kanpur (Uttar Pradesh)

Soybean

NRC 127

(Variety)

Trait improved: Kunitz trypsin inhibitor free

1.	Genes introgressed	:	Null allele of *KTi3*
2.	Molecular markers used	:	STS & SSR
3.	Recurrent parent	:	JS 97-52
4.	Donor parent	:	EC 481207 (PI542044 - A USDA line derived from Williams/PI 157440)
5.	Salient features	:	

- Country's first Kunitz trypsin inhibitor (KTI) free variety in comparison to 30-45 mg/g of KTI in seed meal of popular varieties
- Oil content: 19.1 % and protein content: 39.0%
- Average grain yield: 18.0 q/ha
- Maturity: 104 days

6.	Suitability	:	Rainfed conditions (*Kharif*)
7.	Recommended area	:	Madhya Pradesh, Bundelkhand region of Uttar Pradesh, Rajasthan, Gujarat, and Marathwada and Vidarbha regions of Maharashtra
8.	Release & notification	:	CVRC, S.O. No. 1318(E), 26.12.2018
9.	Developed by	:	ICAR-Indian Institute of Soybean Research, Indore (Madhya Pradesh)

Soybean
MACSNRC 1667
(Variety)

Trait improved: Kunitz trypsin inhibitor free

1.	Genes introgressed	:	Null allele of *KTi3*
2.	Molecular markers used	:	STS & SSR
3.	Recurrent parent	:	MACS 450
4.	Donor parent	:	PI 542044
5.	Salient features	:	

- Kunitz trypsin inhibitor (KTI) free variety in comparison to 30-45 mg/g of KTI in seed meal of popular varieties
- Oil content: 19.0%
- Protein content: 40%
- Average grain yield: 20.5 q/ha
- Maturity: 96 days

6.	Suitability	:	Irrigated and rainfed conditions (*Kharif*)
7.	Recommended area	:	Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamil Nadu excluding rust prone areas on bank of river Krishna like Southern Maharashtra, entire area of Belagavi, Dharwad, Haveri Bidar & Bagalkot districts
8.	Release & notification	:	CVRC, S.O. No. 2986(E), 20.07.2021
9.	Developed by	:	ICAR-Indian Institute of Soybean Research, Indore (Madhya Pradesh)

Soybean

NRC 132

(Variety)

Trait improved: Less beany flavour

1.	Genes introgressed	:	Null allele of *lox2*
2.	Molecular markers used	:	STS & SSR
3.	Recurrent parent	:	JS 97-52// PI 596540
4.	Donor parent	:	PI 596540
5.	Salient features	:	

- Country's first less beany flavour variety
- Oil content: 18% (SZ) and 19.7% (EZ)
- Protein content: 39.0%
- Average grain yield: 22.9 q/ha (SZ) and16.5 q/ha (EZ)
- Maturity: 98 days (SZ) and 104 days (EZ)

6.	Suitability	:	Irrigated and rainfed conditions (*Kharif*)
7.	Recommended area	:	West Bengal, Bihar, Jharkhand, Chhattisgarh, Odisha, Southern Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamil Nadu
8.	Release & notification	:	CVRC, S.O. No. 500(E), 29.01.2021
9.	Developed by	:	ICAR-Indian Institute of Soybean Research, Indore (Madhya Pradesh)

Soybean

NRC 142

(Variety)

Traits improved: Kunitz trypsin inhibitor free & less beany flavour

1.	Genes introgressed	:	Null allele of *KTi3* and *lox2*
2.	Molecular markers used	:	STS & SSR
3.	Recurrent parent	:	JS 97-52
4.	Donor parent	:	PI 542044 and PI 596540
5.	Salient features	:	

- Kunitz trypsin inhibitor (KTI) free variety in comparison to 30-45 mg/g of KTI in seed meal of popular varieties
- Less beany flavour
- Oil content: 22.4% (CZ) and 21.7% (SZ)
- Average grain yield: 20.0 q/ha (CZ) and 22.4 (SZ)
- Maturity: 97 days (CZ) and 99 days (SZ)

6.	Suitability	:	Irrigated and Rainfed (*Kharif*)
7.	Recommended area	:	Madhya Pradesh, Bundelkhand region of UP, Rajasthan, Gujarat and Marathwada and Vidarbha region of Maharashtra in Central Zone and Southern Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamil Nadu in South Zone excluding rust prone areas on banks of river Krishna like Southern Maharashtra, entire area of Belagavi, Dharwad, Haveri Bidar & Bagalkot districts
8.	Release & notification	:	CVRC, S.O. No. 2986(E), 20.07.2021
9.	Developed by	:	ICAR-Indian Institute of Soybean Research, Indore (Madhya Pradesh)

Soybean

NRCSL 1

(Variety)

Trait improved: YMV resistance

1.	Genes introgressed	:	*Rymv*
2.	Molecular markers used	:	SSR
3.	Recurrent parent	:	JS 335
4.	Donor parent	:	SL525
5.	Salient features	:	

- Resistant to Yellow Mosaic Virus (YMV)
- Oil content: 19.5%
- Protein content: 38.5%
- Average grain yield: 17.1 q/ha
- Maturity: 107 days

6.	Suitability	:	Irrigated and rainfed conditions (*Kharif*)
7.	Recommended area	:	West Bengal, Bihar, Jharkhand, Chhattisgarh and Odisha
8.	Release & notification	:	CVRC, S.O. No. 500(E), 29.01.2021
9.	Developed by	:	ICAR-Indian Institute of Soybean Research, Indore (Madhya Pradesh)

Soybean
NRC 138
(Variety)

Trait improved: Early maturity

1.	Genes introgressed	:	Null allele of *E1*
2.	Molecular markers used	:	STS & SSR
3.	Recurrent parent	:	JS 97-52/ NRC 107
4.	Donor parent	:	NRC 107 (Early maturing mutant of NRC 37 variety developed through gamma ray irradiation)
5.	Salient features	:	

- Early maturity: 93 days
- Resistant to Yellow Mosaic virus (YMV)
- Oil content: 21.0%
- Protein content: 39.4 %
- Average grain yield: 17.9 q/ha

6.	Suitability	:	Irrigated and rainfed conditions (*Kharif*)
7.	Recommended area	:	Madhya Pradesh, Bundelkhand region of Uttar Pradesh, Rajasthan, Gujarat, Marathwada and Vidarbha region of Maharashtra
8.	Release & notification	:	CVRC, S.O. No. 2986(E), 20.07.2021
9.	Developed by	:	ICAR-Indian Institute of Soybean Research, Indore (Madhya Pradesh)

Groundnut

Girnar 4

(Variety)

Trait improved: Oleic acid

1. Genes introgressed : *ahFAD2a* and *ahFAD2b*
2. Molecular markers used : AS-PCR and CAPS
3. Pedigree : ICGV-06420//SunOleic 95R
4. Donor parent : SunOleic 95R
5. Salient features :
   - High oleic acid (78.5%)
   - Moderately tolerance to late leaf spot, rust, stem rot and peanut bud necrosis diseases
   - Moderately tolerant to leaf hopper, leaf miner, thrips and *Spodoptera*
   - Oil content: 53%
   - Protein content: 27%
   - Average grain yield: 32.2 q/ha (pod) and 21.3 q/ha (kernel)
   - Maturity: 112 days
6. Suitability : Irrigated and rainfed conditions (*Kharif*)
7. Recommended area : Rajasthan, Karnataka, Gujarat, Tamil Nadu and Andhra Pradesh
8. Release & notification : CVRC, S.O. No. 3099(E), 07.10.2020
9. Developed by : ICAR-Directorate of Groundnut Research, Junagadh (Gujarat)

Groundnut

Girnar 5

(Variety)

Trait improved: Oleic acid

1.	Genes introgressed	:	*ahFAD2a* and *ahFAD2b*
2.	Molecular markers used	:	AS-PCR and CAPS
3.	Pedigree	:	ICGV-06420//SunOleic 95R
4.	Donor parent	:	SunOleic 95R
5.	Salient features	:	

- High oleic acid (78.4%)
- Moderately tolerant to late leaf spot, rust, stem rot and collar rot; moderate tolerant to leaf hopper, leaf miner, thrips and *Spodoptera*
- Oil content: 53%
- Protein content: 26%
- Average yield: 31.2 q/ha (pod) and 21.3 q/ha (kernel)
- Maturity: 113 days

6.	Suitability	:	Irrigated and rainfed conditions (*Kharif*)
7.	Recommended area	:	Rajasthan, Karnataka, Gujarat, Tamil Nadu and Andhra Pradesh
8.	Release & notification	:	CVRC, S.O. No. 3099(E), 07.10.2020
9.	Developed by	:	ICAR-Directorate of Groundnut Research. Junagadh (Gujarat)

Traits improved

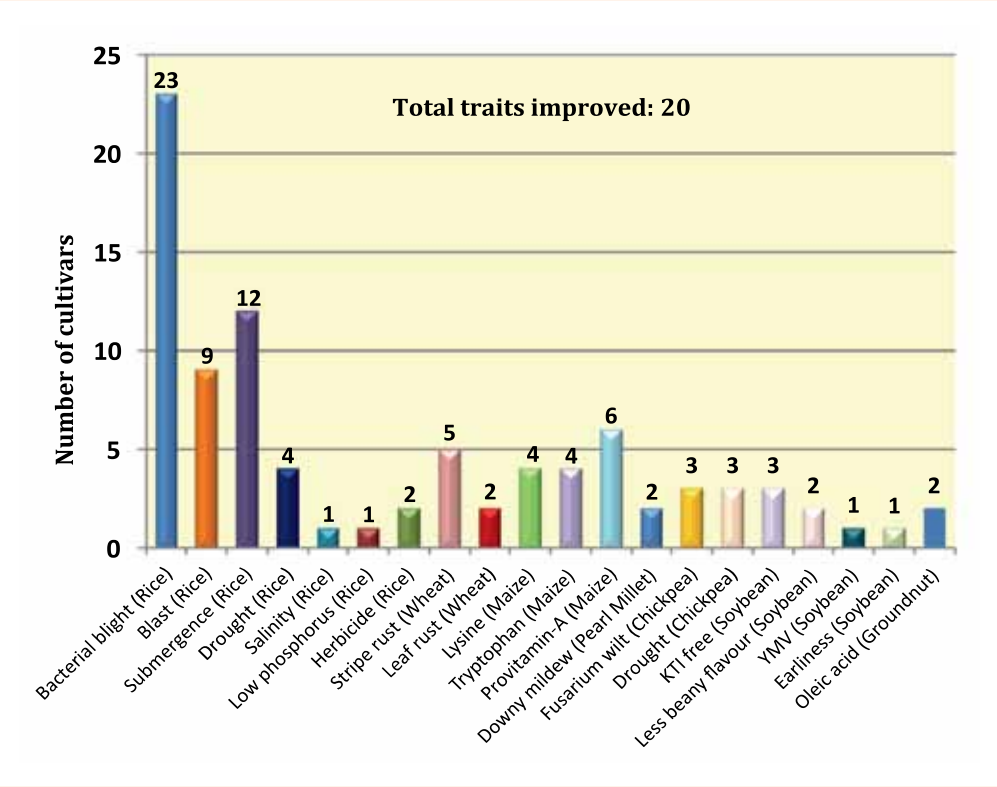

Figure 1: Number of cultivars improved for various traits using molecular breeding

Combinations of traits improved

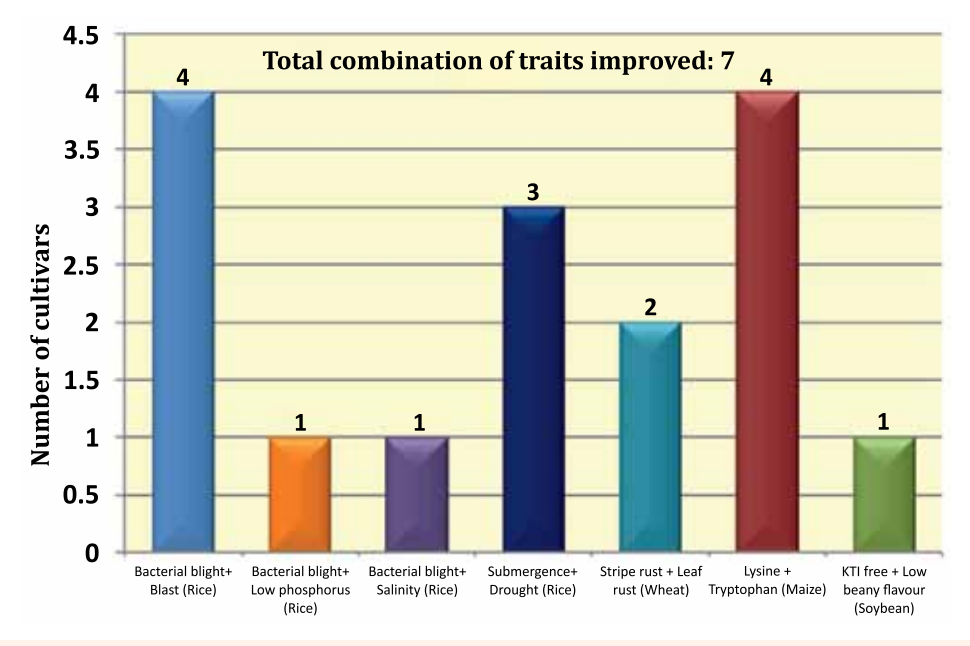

Figure 2: Number of cultivars improved for multiple traits using molecular breeding

Crops improved

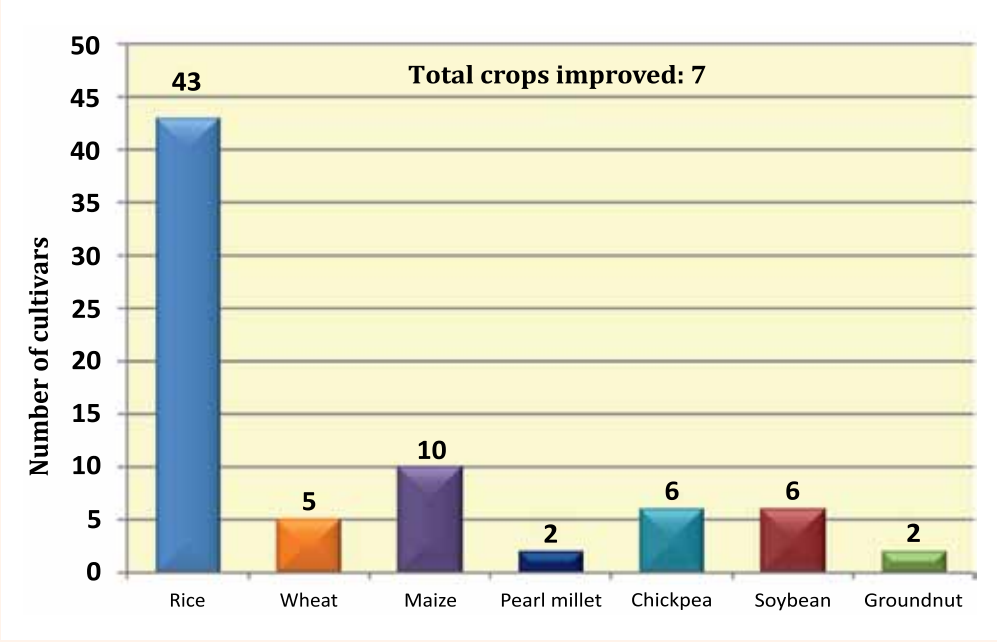

Figure 3: Number of crops improved for various traits using molecular breeding

Time line

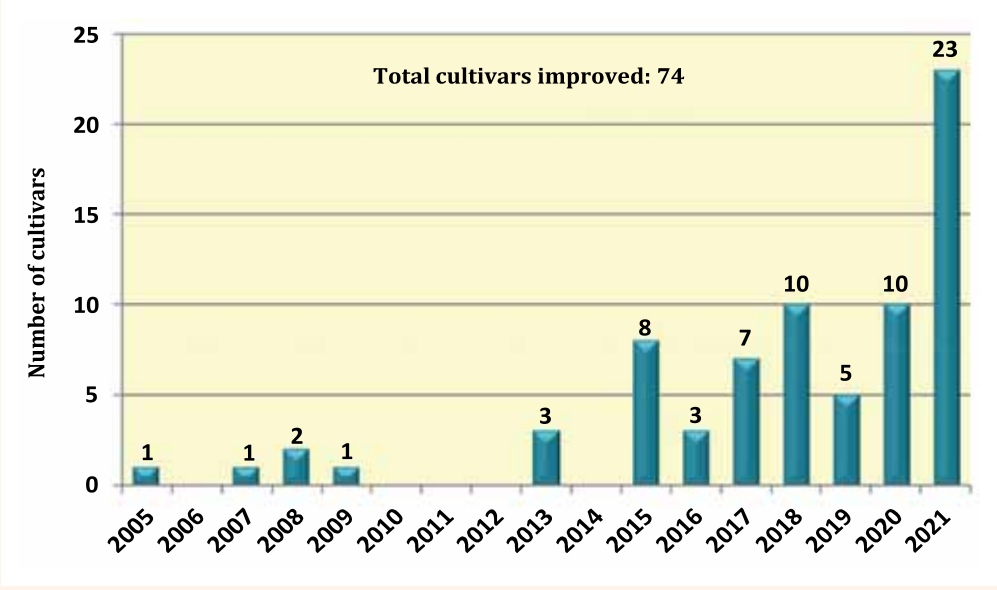

Figure 4: Number of MAS-derived varieties released in India year-wise

For details contact:

Assistant Director General (Seed)
Indian Council of Agricultural Research
Krishi Bhavan, Dr. Rajendra Prasad Road, New Delhi-110 001
Email: adgseed.icar@nic.in; Phone: 011-23382257, 23046457
www.icar.org.in

ISBN:978-81-7164-247-2