



Notification and germplasm registration

Rice

Variety: ADT58

ADT58, a high yielding mid early duration rice variety (125-130 days) was released for the cultivation in Cauvery Delta Zone of Tamil Nadu for the Thaladi season. Thaladi season (Oct-Nov) of Cauvery Delta Zone, Tamil Nadu is characterized by continuous water logging due to previous rice crop cultivation with typical features of nutrients imbalances in soil, fluffy soils, low temperature stresses resulting in poor establishment of second rice crop. It is mainly attributed to zinc deficiency, poor nutrients uptake, and spikelet sterility results in unstable performances of rice varieties with duration of 125 days. The variety with adaptive features of Thaladi season includes higher levels of seedling establishment, moderate zinc deficiency tolerance, increased spikelet fertility, non-shattering and non-lodging. During 1983, the mid early variety, ADT39 was released for the cultivation under Thaladi conditions. ADT 39 was a hybrid derivative of IR 8 X IR 20 and selected through pedigree method. It belonged to mid early group with duration of 120-125 days with average yield of 4500-5400 kg/ha. This variety was high yielding and having good grain and cooking quality and one of the contingent variety suited to direct seeded conditions for marginal soils. It has become very popular variety in many parts of rice growing regions of Tamil Nadu. The variety is consumed as rice and idly with dual purposes. The variety ADT39, though it became popular among farmers, it had inherent issues of grain shattering, higher proportion of chaffy grains and susceptibility to leaf folder.

To develop alternate variety to ADT39, In Tamil Nadu Rice Research Institute, Aduthurai, a breeding programme was initiated by crossing two popular varieties viz., ADT 39 with Konark during 2002. The segregating F₂ generation were screened under Thaladi conditions during 2004. Totally, 17 promising progenies were identified, forwarded to further generations with continuous selection. A homozygous progeny was fixed during F₆ and named as AD12132. Initial yield trial was conducted at TRRI, Aduthurai, the culture AD12132 recorded 7800 kg/ha, the check ADT39 with 6250 kg/ ha with 24.8% yield increase. Over all mean yield of station trials was 6770, 5592 kg/ha for the culture AD12132 and the check ADT39 respectively. In pooled MLT I and MLT II, the yield of 5606 and 4908 kg/ha for the culture and the check respectively with yield increase of 19.4%. In ART, the yields were 5843 and 5735 kg/ha respectively. Over all yield

mean with MLT, ART, OFTs and large scale demonstrations of the promising culture AD12132 was 6376 kg/ha and the check recorded 5354 kg /ha respectively with yield increase of 19.0%.

To popularize the culture for the adaptive features suitable under Thaladi conditions, field days were conducted and the yield increase, adaptability, grain cooking and taste quality were evaluated. Based on the SVRC recommendations 2023, it was released as ADT58, high yielding rice variety suited for the cultivation during Thaladi/late samba seasons of Cauvery Delta Zone and late conditions in other parts of the State. The variety ADT58 was registered in NBPGR as germplasm (IC647769) and notified for cultivation in Tamil Nadu with vide notification No. S.O. 4222(E), September 25, 2023 by the Central Sub Committee on Crop Standard Notification and Release of Varieties for Agricultural Crops, Govt of India.

Under low temperature conditions (16-18°C), the panicle exertion is normal with high levels of spikelet fertility % (95.0%). The variety does not have shattering grains and has higher levels of filled grains without chaffy which are inherent issues associated with parental check and popular variety, ADT39. The variety ADT58 is medium tall (120 cm) with erect basal stem with non-lodging tendencies suitable for Thaladi seasons. Pale green leaves, turgid and lignified leaves, erect boot leaf, profuse tillering and tolerant to leaf folder and BPH. Moderately tolerant to sheath rot, sheath blight and blast. The variety has 72.0 % milling and 65.0 % head rice recovery with 16.5 g of 1000 seed weight. Medium Slender grains with LB ratio of 2.91 and linear elongation after cooking, 9.2 mm and breadthwise elongation, 2.9mm. Cooking and taste qualities are highly preferable, non-sticky rice with moderate amylose content (23.5%). Taste quality is highly preferred with overall score of 8.5. The grains are highly suitable for both rice and idly making. The variety, ADT58 is recommended for the cultivation in late Samba and Thaladi seasons of Cauvery Delta Zone and late sown conditions (October-November) in other parts of rice growing regions of Tamil Nadu.

**R. Saraswathi, D. Sassikumar, M. Dhandapani*,
R. Suresh, R. Puspha, R. Manimaran, R. Arulmozhi, K.
Subrahmaniyan, R. Ravikesavan, K. Rajappan,
A. Ramanathan, P. Anandhi, M. Raju, S. Elamathy,
V. Ambethgar and S. Geetha**

Tamil Nadu Rice Research Institute, TNAU,
Aduthurai 612101, Tamil Nadu, India

*Corresponding author's e-mail: dhandapanim@tnau.ac.in

Maize

Pusa HQPM-1 Improved

'Pusa HQPM-1 Improved' is a biofortified single cross maize hybrid with high provitamin-A and protein quality. It was developed through molecular breeding at ICAR-Indian Agricultural Research Institute, New Delhi. It possesses β -carotene hydroxylase (*crtRB1*), lycopene epsilon cyclase (*lcyE*) and opaque2 (*o2*) genes. It contains 7.0 ppm of provitamin-A as compared to 1-2 ppm in traditional hybrids. It is also a quality protein maize (QPM) hybrid with high lysine (4.59%) and tryptophan (0.85%) in endosperm protein compared to traditional maize (lysine: 1.50-2.50%, tryptophan: 0.30-0.40%). It is an essentially derived variety (EDV) of popular single cross QPM hybrid, HQPM-1 developed at CCS-Haryana Agricultural University, Regional Station, Uchani, Karnal. Marker-assisted backcross breeding (MABB) strategy was employed for development of Pusa HQPM-1 Improved by introgressing mutant alleles of *crtRB1* and *lcyE* genes into HQPM-1. The parental inbreds of HQPM-1 hybrid, HKI193-1 and HKI163 were introgressed with mutant allele of *crtRB1* and *lcyE* genes from CIMMYT-HarvestPlus developed donor lines viz., HP704-23 and HP704-22, respectively using molecular markers. The newly developed female parent (PMI-PV7) possesses 92.1% of recurrent parent genome (RPG), while the male parent (PMI-PV6) has 91.3% of RPG. PMI-PV7 and PMI-PV6 did not exhibit symptoms of *Maydis* leaf blight (MLB) and banded leaf and sheath blight (BLSB), and any susceptibility symptom to stem borer infestation under natural field conditions at IARI, New Delhi. Pusa HQPM-1 Improved (PMI-PV7 \times PMI-PV6) possesses similar morphological characteristics of HQPM-1 due to high recovery of RPG except for the anthocyanin pigmentation in the brace roots. It was tested for two years (AVT-I and AVT-II)

under QPM trial of All India Coordinated Research Project on Maize (AICRP-Maize). The average grain yield of Pusa HQPM-1 Improved was 8190 kg/ha in Northern Hill Zone (NHZ), while in North Western Plain Zone (NWPZ), North Eastern Plain Zone (NEPZ), Peninsular Zone (PZ) and Central West Zone (CWZ), it yielded 6974 kg/ha, 5954 kg/ha, 7934 kg/ha, 5093 kg/ha, respectively. Pusa HQPM-1 Improved showed moderate resistant reaction to stem borer infestation. It also responded well to higher fertilizers and planting density compared to the original hybrid HQPM-1. Based on its overall performance, it was identified by the variety identification committee at the meeting held during 64th Annual Maize workshop. It has been further released and notified for cultivation during *khari* season across India vide gazette notification S.O. 8(E), dated 24th December, 2021 in NHZ [Jammu and Kashmir, Himachal Pradesh, Uttarakhand (hills), Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh], NWPZ [Punjab, Haryana, Delhi, Uttarakhand (plains) and Uttar Pradesh (western region)], NEPZ [Bihar, Jharkhand, Odisha, Uttar Pradesh (eastern region) and West Bengal], PZ (Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu) and CWZ (Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan).

F. Hossain*, V. Muthusamy, H.S. Gupta, R.U. Zunjare, J.S. Bhat, R.N. Gadag, M.G. Mallikarjuna, G. Mukri, J. Kaul, S. Saha, K.M. Manjaiah, S. Basu, R. Gogoi, V. Pooniya, C.M. Parihar, R. Kumar, M. Kapasia, D. Pal and B.G. Bhavi

Note: Contributors of original hybrid (HQPM-1) and maintenance of its parental lines: S. Dass¹, P. Arora¹, D. Pal¹, K.S. Dhanju¹, J.C. Mehla¹, M.C. Kamboj¹ and P. Sharma¹
ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India; ¹Chaudhary Charan Singh-Haryana Agricultural University, Uchani, Karnal 132 001, India

*Corresponding author's email: fh_gpb@yahoo.com



Pusa Biofortified Maize Hybrid-1

It is a single cross biofortified maize hybrid developed by ICAR-Indian Agricultural Research Institute, New Delhi through marker-assisted selection (MAS) of β -carotene hydroxylase (*crtRB1*) and *opaque2* (*o2*) genes. It contains high provitamin-A (6.6 ppm,) lysine (3.37%) and tryptophan (0.72%) in the endosperm compared to traditional maize (provitamin-A: 1-2 ppm, lysine: 1.50-2.50%, tryptophan: 0.30-0.40%). Pusa Biofortified Maize Hybrid-1 belongs to medium maturity group with average of 61 days and 50 days for 50% pollen shedding, 65 days and 53 days for 50% silking, and 107 days and 86 days for dry husk across the Northern Hill Zone (NHZ) and North Eastern Plain Zone (NEPZ) regions, respectively. The hybrid was tested for three years (kharif 2017, 2018 and 2019) under QPM trial of All India Coordinated Research Project on Maize (AICRP-Maize) in the NHZ and NEPZ ecologies. The hybrid was also evaluated under a separate quality trial for estimation of quality parameters at two locations viz. Ludhiana and Delhi during kharif 2020. The average grain yield of Pusa Biofortified Maize Hybrid-1 was 7628 kg/ha

and 5438 kg/ha in NHZ and NEPZ, respectively. It showed moderate resistant reaction to stem borer infestation, and is responsive to higher inputs under field conditions. It was identified by the variety identification committee at the meeting held during 64th Annual Maize workshop, and subsequently released and notified for cultivation in irrigated conditions during kharif season vide gazette notification S.O. 8(E), dated 24th December, 2021 in NHZ [Union territory of Jammu and Kashmir, Himachal Pradesh, Uttarakhand (hills) Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur, Arunachal Pradesh] and NEPZ [Bihar, Jharkhand, Odisha, Uttar Pradesh (eastern region) and West Bengal].

F. Hossain*, V. Muthusamy, R. U. Zunjare, H. S. Gupta, J. S. Bhat, G. Mukri, M. G. Mallikarjuna, R. N. Gadag, J. Kaul, S. Saha, S. Basu, A. Kumar, R. Prasanna, R. Gogoi, K. M. Manjaiah, C.M. Parihar, V. Pooniya, R. Kumar, M. Kapasia, D. Pal and B.G. Bhavi
ICAR-Indian Agricultural Research Institute,
New Delhi 110 012, India
*Corresponding author's email: fh_gpb@yahoo.com



Pusa HM4 Male Sterile Baby Corn (Shishu)

Baby corn has emerged as an important food commodity ensuring livelihood security and enhancing the income of farmers. Within India, the popularity of baby corn is on the rise across numerous states, positioning it as a promising vegetable for both export and value addition. Moreover, it brings in supplementary earnings through the sale of green fodder. Among the various cultivation operations, the removal of male flowers, known as detasseling, stands out as the most crucial yet labour-intensive task in baby corn farming. This operation alone demands a substantial expenditure of Rs. 8,000-10,000 per hectare, thereby reducing the net returns for farmers. Male sterility holds immense potential to eliminate the necessity of detasseling. HM4 (HKI1105 × HKI323) is a popular baby corn hybrid developed by CCS-Haryana Agricultural University, Karnal, but possesses male fertility. 'Pusa HM4 Male Sterile Baby Corn (Shishu)' is a male sterile single cross baby corn hybrid developed at ICAR-IARI, New Delhi- first time by a public sector organization. It has been developed through introgression of CMS-T cytoplasm into the female parent (HKI1105) of HM4 using backcross breeding scheme. 'Shishu' was evaluated in BC-II and BC-III during kharif 2019 and 2020, respectively, against the original hybrid, HM4. It showed no anther exertion, while HM4 had full anther exertion with 100% fertile pollens. 'Shishu' had higher baby corn yield with husk (7074 kg/ha), baby corn

yield without husk (2274 kg/ha) and fodder yield of 27.1 t/ha over HM4 (6579 kg/ha, 2192 kg/ha, and 26.4 t/ha, respectively). It also showed moderate resistant reaction to stem borer infestation, resistance to lodging and high response to fertilizer application. Since, it matures in 58-60 days; multiple crops can be taken on a single field in a year. Considering its male sterility and baby corn yield response, it was identified by the variety identification committee at the meeting held during 64th Annual Maize Workshop. CVRC further released and notified the 'Pusa HM4 Male Sterile Baby Corn (Shishu)' for commercial cultivation on high fertile and irrigated fields during kharif season vide gazette notification S.O. 8(E), dated 24th December, 2021 in NWPZ (Punjab, Haryana, Delhi, Uttarakhand and Uttar Pradesh).

R. U. Zunjare, F. Hossain*, V. Muthusamy, J. S. Bhat, J. Kaul, M. G. Mallikarjuna, R. N. Gadag, G. Mukri, R. Gogoi, S. Basu, A. Kumar, S. K. Jha, R. Prasanna, C. M. Parihar, V. Pooniya, R. Kumar, D. Pal, M. Kapasia and B. G. Bhavi

Note: Contributors of development original hybrid (HM4) and maintenance of its parental lines: S. Dass¹, M. Singh¹, P. Arora¹, K. S. Danju¹, D. Pal¹, M. C. Kamboj¹ and P. Sharma¹ ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India; ¹CCS-Haryana Agricultural University, Uchani, Karnal 132 001, India
*Corresponding author's email: fh_gpb@yahoo.com

Pusa Biofortified Maize Hybrid-2

ICAR-Indian Agricultural Research Institute, New Delhi has developed a new single cross maize hybrid 'Pusa Biofortified Maize Hybrid-2' using molecular breeding. The presence of favorable alleles of β -carotene hydroxylase1 (*crtRB1*) gene and *opaque2* (*o2*) resulted in improved provitamin-A (5.9 ppm) and essential amino acids [lysine (3.47%) and tryptophan (0.92%)] in the maize kernel. Traditional hybrids possess low provitamin-A (1-2 ppm), lysine (1.50-2.50%) and tryptophan (0.30-0.40%) in endosperm. Variety identification committee identified the hybrid at the meeting held during 65th Annual Maize workshop held at CCSHAU, Hisar on 19.04.2022 based on three year testing (NIVT: kharif 2018, AVT-I: kharif 2019 & AVT-II: kharif 2021) undertaken by All India Coordinated Research Project on Maize (AICRP-Maize). The hybrid was further released and notified for commercial cultivation during the kharif season, vide notification in the Gazette, S.O. 4065(E) dated August 31, 2022. The area of cultivation includes the North Western Plains Zone (NWPZ: Punjab, Haryana, Delhi, Uttarakhand - plains, Uttar Pradesh - western region), North Eastern Plains Zone (NEPZ: Bihar, Jharkhand, Odisha, Uttar Pradesh - eastern region, and West Bengal), as well as the Central West Zone (CWZ: Gujarat, Madhya Pradesh, Chhattisgarh, and Rajasthan).

Pusa Biofortified Maize Hybrid-2 has demonstrated its potential with an average grain yield of 7544 kg/ha, 5371 kg/ha, and 5113 kg/ha in the NWPZ, NEPZ, and CWZ, respectively. It belongs to medium maturity group with average 53 days (NWPZ), 52 days (NEPZ) and 53 days (CWZ) for 50% pollen shedding, average 54 days (NWPZ), 54 days (NEPZ) and 55 days (CWZ) for 50% pollen silking; and average 91 days (NWPZ), 87 days (NEPZ) and 89 days (CWZ) for 75% dry husk characters. The hybrid was also evaluated under a separate quality testing trial at two locations viz. Ludhiana and Delhi during kharif 2021. Pusa Biofortified Maize Hybrid-2 showed moderate resistant reaction to stem borer infestation across the zones and responded well to fertilizers under field conditions. Pusa Biofortified Maize Hybrid-2 offers a valuable solution to address malnutrition by alleviating nutritional deficiencies and enhancing overall well-being.

F. Hossain*, V. Muthusamy, R. U. Zunjare, H. S. Gupta, J. S. Bhat, M. G. Mallikarjuna, G. Mukri, R. N. Gadag, J. Kaul, S. Basu, A. Kumar, K. M. Manjaiah, R. R. Burman, N. Ahmed, R. Prasanna, R. Gogoi, S. Saha, V. Pooniya, C. M. Parihar, R. Kumar, D. Pal, M. Kapasia, and B.G. Bhavi

ICAR-Indian Agricultural Research Institute,
New Delhi 110 012, India

*Corresponding author's email: fh_gpb@yahoo.com



Pusa Biofortified Maize Hybrid-3

Pusa Biofortified Maize Hybrid-3 developed at ICAR-Indian Agricultural Research Institute, New Delhi is a newly bred single cross biofortified hybrid rich in provitamin-A (5.7 ppm), lysine (3.52 %) and tryptophan (0.87 %). Traditional maize possesses low kernel provitamin-A (1.0-2.0 ppm), lysine (1.50-2.50 %) and tryptophan (0.30-0.40 %) in the endosperm. Variety identification committee meeting held during 65th Annual Maize workshop, CCSHAU, Hisar identified this hybrid based on its performance under three years of testing (NIVT, AVT-I & AVT-II). This hybrid was released and notified for commercial cultivation on irrigated and fertile lands in the *kharif* season vide gazette notification no. S.O. 4065(E) dated August 31, 2022 in North Western Plains Zone [NWPZ: Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region)]; Peninsular Zone (PZ: Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu) and Central West Zone (CWZ: Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan). The hybrid was tested for three years (kharif 2017, 2018 and 2019) under QPM trial of All India Coordinated Research Project on Maize (AICRP-Maize) in the NWPZ, PZ and CWZ. The hybrid yielded 8224 kg/ha, 7160 kg/ha and 5845 kg/ha in the NWPZ, PZ and CWZ,

respectively. It belongs to medium maturity group with average of 52 days (NWPZ), 54 days (PZ), and 51 days (CWZ) for 50% pollen shedding, as well as an average of 54 days (NWPZ), 56 days (PZ), and 54 days (CWZ) for 50% pollen silking. Additionally, it showed an average of 92 days (NWPZ), 94 days (PZ), and 87 days (CWZ) for 75% dry husk development. Pusa Biofortified Maize Hybrid-3 showed moderately resistant reaction against stem borer infestation across the zones, and also showed positive response to fertilizer application under field conditions. This hybrid was evaluated under a separate quality testing trial at two locations viz. Ludhiana and Delhi during kharif 2021. Owing to its multi-nutrient status, the hybrid possessed significant potential to mitigate the hidden hunger.

F. Hossain*, V. Muthusamy, R. U. Zunjare, H. S. Gupta, J. S. Bhat, J. Kaul, M. G. Mallikarjuna, G. Mukri, R. N. Gadag, S. Basu, A. Kumar, K. M. Manjaiah, R. R. Burman, N. Ahmed, R. Prasanna, R. Gogoi, S. Saha, C. M. Parihar, V. Pooniya, R. Kumar, D. Pal, M. Kapasia and B.G. Bhavi

ICAR-Indian Agricultural Research Institute,
New Delhi 110 012, India

*Corresponding author's email: fh_gpb@yahoo.com

Lentil

Variety LL 1613

Lentil (*Lens culinaris* Medik.) is an important *rabi* season food legume crop with immense nutritional importance. Realization of the optimum yield potential of lentil is limited by several factors including major diseases and insect pests, salinity, drought and heat stress along with sensitivity of the crop to herbicides. In order to fulfill the same, a new lentil variety LL 1613 has been developed by Pulses Section, Department of Plant Breeding & Genetics, Punjab Agricultural University (PAU), Ludhiana. This variety has been developed from the cross, LL 1112 × PL 02-6 following pedigree method of selection. LL 1112 is an advanced breeding line from PAU, while, PL 02-6 is an advanced breeding line from GBPUAT, Pantnagar. This variety was tested in the All India Coordinated Research Programme in Initial Varietal Trials and Advance Varietal Trials during 2019-20 to 2021-22 at a total of 17 locations across the zone. On the basis of weighted mean, new variety recorded an average yield of 1617 kg/ha and showed 14.28 and 23.72 per cent yield superiority over check varieties, Pant L 063 (1415 kg/ha) and L 4147 (1307 kg/ha), respectively. It appeared 10 times in first non-significant group out of 16 trials indicating its wide adaptability. This variety was identified by Variety Identification Committee meeting of AICRP on *rabi* pulses held on 26.09.2022. Subsequently, the variety was released and notified by the Central Sub-Committee

on Crop Standards, Notification and Release of Varieties for Agricultural Crops, Govt. of India vide notification no. 3-85/2023-SD.IV dated 09.06.2023 for commercial cultivation under timely sown irrigated conditions in North Western Plain Zone (NWPZ) including states of Punjab, Haryana, northern Rajasthan, western Uttar Pradesh, plains of Uttarakhand and Jammu & Kashmir.

Its distinguishing morphological characteristics include green stem along with upright and determinate growth habit with average plant height of 37.0 cm. It has dark green leaves, white flowers with violet stripes, and non-pigmented pods. The seeds of this variety are grayish brown in colour with 100-seed weight of 2.2 g. The tendrils are rudimentary. The variety takes 131 days to mature with a range of 114-145 days depending upon locations and production conditions. The variety is moderately resistant to rust and wilt diseases. This variety also possesses good culinary properties. It produces small seeds with 100-seed volume and density of 2.0 ml and 1.14 g/ml, respectively. The water absorption and volume expansion percentage of seeds after soaking are 79.25 and 75.00, respectively. Its water absorption and volume expansion percentage after cooking are 97.68 and 125.00, respectively. The seeds of this variety contain approximately 23.29 per cent protein.

Sarvjeet Singh, R. K. Gill, Ashok Kumar and Suruchi Vij*

Punjab Agricultural University, Ludhiana 141 004

*Corresponding author's email: suruchi09@pau.edu



Bt cotton

Variety ICAR-CICR GJHV 374 Bt

Cotton is an important commercial crop for India, as it is the largest producer and exporter of cotton in the world. The cotton industry provides employment to millions of people across the country, including farmers, laborers, and textile workers. Its cultivation has a significant impact on India's economy. Bt cotton was introduced to India 2002 and was available exclusively in the form of hybrids to Indian cotton farmers. A new Bt variety named as GJHV 374 Bt was developed from the cross GJHV 374 × BikaneriNarmaBt through back cross breeding. This variety was identified in 84th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 10 July, 2020 under the Chairmanship of DDG (Crop Science) for rainfed conditions of Maharashtra and was notified in official gazette of India via S.O. 3482 (E) dated 7th October, 2020 (S. No. 164). This variety has crop duration of 160 to 170 days with average yield potential of 2578 kg/ha. This variety has yielded 2754 kg/ha of seed cotton yield at Nagpur during 2016-17. It produced 11.94 percent increase over the BG II hybrid check during evaluation. This variety possess an average plant height of 119.5cm, boll weight

of 4.2g, ginning outturn of 31.6%. It recorded fibre length 28.2mm, fibre strength of 26.8 g/tex, micronaire of 4.4 µg/in and uniformity index of 83.1%. It provides excellent protection against American bollworm (*Helicoverpa armigera*) with cry toxin expression up to 5.63 ppm in leaves. It possesses *cry1Ac* gene (Mon531) in homozygous conditions. During bioassays, it produced 100% mortality against American bollworm. This combines good tolerance to pests and diseases of cotton. The introduction of this new variety has the potential to enhance yield growth in the rainfed regions of Maharashtra, a significant cotton-producing state in India.

Suman Bala Singh*, K. R. Kranthi¹, Sandhya Kranthi¹, V. Santhy, K. P. Raghavendra, B. Fande, S. Bhawe, U. Satija, A. H. Prakash², S. Manickam², Blaise Desouza, M. Saravanan, H.B. Santosh and M. D. Khanpara³

ICAR-Central Institute for Cotton Research (CICR), Wardha Road, Nagpur 440040, Maharashtra, India; ¹Present address: International Cotton Advisory Committee (ICAC), Washington DC, USA; ²ICAR-CICR, Regional Station, Coimbatore 641003, Tamil Nadu, India; ³Junagadh Agricultural University (JAU), Jamnagar 361 001, Gujarat, India;

*Corresponding author's email: sumanbalasingh2009@gmail.com

Variety ICAR-CICR PKV 081 Bt

Bt cotton has been instrumental in managing the bollworm pest in India. Before the introduction of Bt cotton, bollworm infestations were a major problem for cotton farmers in the country. Bt cotton's resistance to bollworm has reduced the need for pesticide applications, resulting in lower input costs, higher yields, and improved livelihoods for cotton farmers. Upland cotton (*Gossypium hirsutum*) Cv. PKV081 is one of the important non-Bt varieties of central India, a region which contributes maximum to India's cotton production. This non-Bt variety was selected for Bt introgression wherein Bikaneri Narma Bt with cry1Ac gene (Mon531 event) was used as transgene donor in a backcross method of breeding. This Bt introgressed variety PKV 081 Bt was identified in the 84th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 10 July, 2020 under the Chairmanship of DDG (Crop Science) and was gazette notified vide S.O. 3482 (E) dated 7th October, 2020 (S. No. 161). This variety is recommended for commercial cultivation in rainfed conditions of Maharashtra. The duration of this variety is 140 to 150 days with a yield of 2744 kg/ha. This variety recorded seed

cotton yield of 2874 kg/ha at Akola during evaluation in AICRP trial. It produced 22.39 percent increase over the BGII hybrid check. This variety possess an average plant height of 121.3cm, boll weight of 3.4g, ginning outturn of 35.1%. It recorded fibre length 28.5mm, fibre strength of 27.9 g/tex, micronaire of 3.9 µg/in and uniformity index of 82.8%. It possesses cry1Ac gene in homozygous conditions with Cry toxin expression up to 6.95 ppm in leaves and recorded 100% mortality against American bollworm (*Helicoverpa armigera*) in bioassay. This variety also combines good tolerance to diseases of cotton and agronomic traits which will be helpful in increasing yields in rainfed conditions of Maharashtra.

Suman Bala Singh*, **K. R. Kranthi¹**, **Sandhya Kranthi¹**,
V.N. Waghmare, **K. P. Raghavendra**, **Punit Mohan**,
B. Fande, **P. R. Vijayakumari**, **H. B. Santosh**,
T. H. Rathod² and **V. V. Ujjainkar²**

ICAR-Central Institute for Cotton Research (CICR), Wardha Road, Nagpur 440 040, Maharashtra, India;

¹International Cotton Advisory Committee (ICAC), Washington DC, USA; ²Dr. PDKV, Akola, Maharashtra India

*Corresponding author's email: sumanbalasingh2009@gmail.com



Variety ICAR-CICR Rajat Bt

Bt cotton has been a game-changer for bollworm management in India. Before its introduction in 2002, farmers had to rely heavily on insecticides to control bollworm infestations, leading to high costs and environmental damage. Bt cotton produces a toxin that specifically targets bollworms, significantly reducing the need for insecticide use and improving crop yields. Rajat, a popular non-Bt variety of upland cotton was introgressed with Bt gene (cry1Ac gene and Mon531 event) through marker assisted backcross breeding. Upland cotton cv. BikaneriNarmaBt with cry1Ac gene (Mon531 event) was used as transgene donor in a backcross method of breeding and Btintrogression was monitored through Enzyme-linked immunosorbent assay (ELISA) at every backcross generations. This backcross derived version of Rajat was identified for rainfed conditions of Maharashtra in 84th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 10 July, 2020 under the Chairmanship of DDG (Crop Science). Subsequently, it was notified in official gazette of India vide S.O. 3482 (E) dated 7th October, 2020 (S. No. 163).

The duration of this variety is 160-170 days with a yield of 2661 kg/ha. This variety recorded seed cotton yield of 2718 kg/ha at Akola during evaluation in AICRP trial. It produces 18.69 percent increase over the BGII hybrid check. This variety possess an average plant height of 124.1cm, boll weight of 2.9g, ginning outturn of 34.4%. It recorded fibre length 26.8mm, fibre strength of 26.1 g/tex, micronaire of 4.5 µg/in and uniformity index of 81.7%. It produced 100% mortality against American bollworm (*Helicoverpa armigera*) with cry toxin expression up to 7.37 ppm in leaves. This new variety has the potential to enhance crop yields under rainfed conditions in Maharashtra, a significant cotton-producing state within India.

Suman Bala Singh*, **K. R. Kranthi¹**, **Sandhya Kranthi¹**,
B. Fande, **S. S. Mahajan**, **V. Gotmare**, **G. Balasubramani**,
T. R. Lokanthan, **S.B. Nandeshwar**, **T. H. Rathod²** and
V. V. Ujjainkar²

ICAR-Central Institute for Cotton Research (CICR), Wardha Road, Nagpur 440 040, Maharashtra, India; ¹International Cotton Advisory Committee (ICAC), Washington DC, USA;

²Dr. PDKV, Akola, Maharashtra India;

*Corresponding author's email: sumanbalasingh2009@gmail.com

Variety ICAR-CICR Suraj Bt

Bt cotton was developed to tackle the menace of bollworms in cotton. In contrast to other countries, Bt was introduced to India in the form of Bt hybrids, presently occupying more than 90 % of the cotton area. Despite of wider adoption of Bt Hybrids, the cotton productivity in India is stagnated at around 500 kg lint per hectare and lower compared to the world average (>750 kg/hectare). Productivity enhancement in India can come through deployment of Bt cotton varieties under high-density planting in rainfed ecosystem. Popular non-Bt variety of upland cotton *Gossypium hirsutum* cv. Suraj was crossed with BikaneriNarmaBt as transgene donor and F₁ thus produced was continuously backcrossed to recurrent parent (var. Suraj) to eventually introgress Bt gene. At each backcrossing, introgression of transgene was monitored through *Cry1Ac* - ELISA. This variety was identified in 84th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 10 July, 2020 under the Chairmanship of DDG (Crop Science) for rainfed conditions of Maharashtra state and was notified in official gazette of India via S.O. 3482 (E) dated 7th October, 2020 (S. No. 164). This variety has crop duration of 160-170 days with average yield potential of

2528 kg/ha. This variety possess an average plant height of 130 cm, boll weight of 3.2g, ginning outturn of 36.1%. It recorded fibre length 29.1mm, fibre strength of 26.0 g/tex, micronaire of 4.3 µg/in and uniformity index of 82.9%. It provides excellent protection against American bollworm (*Helicoverpa armigera*) with cry toxin expression up to 6.72 ppm in leaves. It possesses *cry1Ac* gene with Mon531 transgenic event in homozygous conditions. During bioassays, it produced 100% mortality against American bollworm. This combines good tolerance to pests and diseases of cotton. This new variety can help in increasing yields in rainfed conditions of Maharashtra, one of the major cotton growing state of India.

Suman Bala Singh, K. R. Kranthi¹, Sandhya Kranthi¹, V. N. Waghmare, K.P. Raghavendra, B. Fande, A. H. Prakash², S. Manickam², V. Santhy, H. B. Santosh, Joy Das and Rakesh Kumar

ICAR-Central Institute for Cotton Research (CICR), Wardha Road, Nagpur 440040, Maharashtra, India; ¹International Cotton Advisory Committee (ICAC), Washington DC, USA; ²ICAR-Central Institute for Cotton Research (CICR), Regional Station, Coimbatore 641 003, Tamil Nadu, India; *Corresponding author's email: sumanbalasingh2009@gmail.com

Variety ICAR-CICR 16 Bt

Bt cotton is a significant technological advancement in bollworm management, as it contains genes from the bacterium *Bacillus thuringiensis* that produce a protein toxic to bollworms. This has led to a reduction in the use of chemical pesticides and a decrease in bollworm damage to cotton crops, resulting in higher yields and increased profits for farmers. Bt cotton has, therefore, played a critical role in sustainable agriculture and food security in India. This ground-breaking technology was initially introduced to Indian cotton farmers exclusively as Bt hybrids to ensure continued value capture. To enhance productivity in India, it is recommended to increase yield levels in rainfed ecologies through the use of Bt varieties. The development of Bt variety ICAR-CICR 16Bt was initiated at ICAR-Central Institute for Cotton Research (ICAR-CICR) in 2006-07. The genotype CNDS16 was crossed with Bikaneri Narma Bt as transgene (*cry1Ac* with Mon531 event) donor, and the resulting F₁ was backcrossed with the recipient parent (CNDS16) and stabilized as high yielding, homozygous line of Mon531 event. Bt protein expression and introgression was monitored using ELISA during the backcrossing process. This entry was identified in 84th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 10 July, 2020 upon its superior performance during 2017-18 and 2018-19. This is recommended for commercial cultivation under irrigated conditions of central zone comprising the states of Maharashtra, Madhya Pradesh and Gujarat through gazette notification (vide S.O. 3482 (E) dated 7th

October, 2020 (S. No. 160). During the trials, it has recorded an average yield of 1346 kg/ha across different locations of central zone. A seed cotton yield of 2961 kg/ha was harvested at Junagadh centre during 2017-18. It takes 140-150 days from sowing to harvesting. It produced a yield superiority of 4.84% over Zonal Check (Bt), 37.76% over Zonal Check (NBt) and 15.23% over Local Check. It recorded ginning outturn of 34.15%, lint index of 4.45 µg/in and seed index of 8.75g. It is a medium staple cotton variety with a fibre length of 25.3mm, fibre strength of 26.1 g/tex, micronaire of 4.3, and uniformity index of 81.5%. It provides excellent protection against American bollworm (*Helicoverpa armigera*) with cry toxin expression up to 6.79 ppm in leaves at 60 days after sowing. It possesses *cry1Ac* gene with Mon531 transgenic event in homozygous conditions. During bioassays conducted at 90 days after sowing, it produced more than 97% mortality against American bollworm. Apart from resistance to bollworms, it was also found tolerant to bacterial leaf blight, *Alternaria* leaf blight and tobacco streak virus. This new variety can help in increasing yields in rainfed conditions of central zone of India.

Suman Bala Singh*, V. N. Waghmare, K. P. Raghavendra, B.Fande, H. B. Santosh, G. Balasubramani, V. Shah, D.Blaise, V. Santhy, J. Amudha and G. I. Ramkrushna

ICAR-Central Institute for Cotton Research (CICR), Wardha Road, Nagpur 440 040, Maharashtra, India; *Corresponding author's email: sumanbalasingh2009@gmail.com

Variety ICAR-CICR 23 Bt

Bt cotton commercialized and widely adapted since 2002 has led to reduced insecticides usage against bollworm and helped in increasing cotton production in India. This revolutionary technology was made available to Indian cotton farmers exclusively in the form of Bt hybrids for recurrent value capture. Though India ranked first in cotton acreage and production, the productivity of cotton in India is very low compared to other major cotton growing countries of the world. One of the reasons attributed to this low productivity is exploration of Bt technology in hybrid background which are not adaptable to rainfed conditions of India. It is advocated that productivity enhancement in India can come from increasing yield levels in rainfed ecologies through Bt varieties. Development of Bt variety ICAR- CICR 23Bt was initiated at ICAR-Central Institute for Cotton Research (ICAR-CICR) during 2006-07. The genotype CNDS23 was crossed with Bikaneri Narma Bt (*cry1Ac* with Mon531 event) and the resultant F1 was backcrossed with the recipient parent (CNDS23) three times and forwarded for five generations to develop homozygous lines of Mon 531 event. Bt introgression was monitored using ELISA during the process of backcrossing. This entry was identified for release in 84th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 10 July, 2020 upon its superior performance in ICAR-AICRP on Cotton trials conducted during 2017-18 and 2018-19. This is recommended for commercial cultivation in for rainfed conditions of south zone comprising the states of Andhra Pradesh, Karnataka, Tamil Nadu and Telangana through gazette notification (vide S.O. 3482 (E) dated 7th October, 2020 (S. No. 159).

The variety ICAR-CICR 23 Bt has recorded a mean seed cotton yield of 1459 kg/ha based on the average of two years (five locations each) of testing in AICRP on cotton in south zone comprising states of Tamil Nadu, Karnataka, Telangana and Andhra Pradesh and ranked first in both the years. The non-Bt zonal check recorded a mean seed cotton yield of 1302 kg/ha. Sowing of this variety is advised from

15th August to 15th September. The variety ICAR-CICR 23 Bt has recorded 12.06 % increase over non-Bt zonal check. It recorded an increase seed cotton yield of 26.39% in year 1 (2017-18) and 0.76% in year 2 (2018-19), respectively over non-Bt zonal check. ICAR- CICR 23 Bt showed 29.1, 11.6 and 89.4 percent increase over local check in Telangana, Andhra Pradesh and Tamil Nadu, respectively in first year. The mean number of bolls per plant for five locations was found to be higher in the variety (11.9 & 21.6 no/plant) when compared to zonal check variety (8.9 & 18.9 no/plant) during 2017-18 and 2018-19 respectively. The variety ICAR-CICR 23 Bt recorded lint index 4.60g and 4.1g during 2017-18 and 2018-19 which is at par with the non-Bt zonal check variety. It recorded mean ginning outturn of 34.1% across years and locations. The variety ICAR-CICR 23 Bt recorded lint yield of 497.52 kg/ha while the non-Bt zonal check variety recorded lint yield of 476.53 kg/ha. The Bt variety ICAR-CICR 23 Bt recorded fibre quality viz., fibre length of 27.6 mm, micronaire of 3.7 µg/inch, fibre strength of 26.8 g/tex and uniformity index 83.0% which is at par with the zonal checks. The variety ICAR-CICR 23 Bt recorded cry protein expression of 4.7 ppm in leaves at 120 days old crop during 2017-18 and 4.62 and 4.46 ppm in boll at 90- and 120-days crop during 2018-19. During bioassays conducted at 120 days after sowing, it produced 100% mortality against American bollworm. This is the first ever Bt variety developed and released for rainfed conditions of south zone. This Bt variety can benefit the cotton farmers in rainfed ecologies of south India for increased yields and economic returns.

**Suman Bala Singh*, V. N. Waghmare,
K. P. Raghavendra, B. Fande, H. B. Santosh,
G. Balasubramani, V. Shah, D. Blaise, S. Manickam¹ and
K. Baghyalakshmi¹**

ICAR-Central Institute for Cotton Research (CICR), Wardha Road, Nagpur 440 040, Maharashtra, India; ¹ICAR-Central Institute for Cotton Research (CICR), Regional Station, Coimbatore, Tamil Nadu, India;

*Corresponding author's email: sumanbalasingh2009@gmail.com



Finger Millet

Variety VL Mandua 400 (CFMV 5)

The brown seeded early duration finger millet (*Eleusine coracana* L.) variety, VL Mandua 400 was developed at ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora from the cross between VL-352 (early maturing finger millet cultivar) and GPU 48 (blast resistant finger millet variety) followed by pedigree method of selection in the segregating generations. Based on its superior performance for grain yield and grain quality recorded in All India Coordinated varietal trials, VL Mandua 400 was recommended by Varietal Identification Committee for Sorghum and Small Millets on 29th April 2022. Subsequently, it was released and notified by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agricultural Crops vide notification number S.O.1056 (E); dated 06th March, 2023. The specific area of adaptation of this variety is the rainfed kharif ecology condition of Madhya Pradesh, Karnataka, Chhattisgarh, Bihar, Jharkhand, Gujarat and Andhra Pradesh.

In India, finger millet is a traditional nutri-crop grown from millennia and specifically suited to rainfed kharif agro-ecology condition. Farmers generally cultivate traditional type blast susceptible and low yielding landraces with loose panicles which has rendered poor productivity levels of the crop. Therefore, an improved cultivar of finger millet was needed to cater the need of the area. Considering this, a cross was made between VL352 and GPU 48. During the segregating generation of the progenies (F_2 to F_5) derived from the cross VL 352 x GPU 48, selections were made with an emphasis on early duration, resistance to both finger and neck blast diseases, compact panicles and high grain yield. Uniform lines were bulked and tested in station trial. This strain was nominated to All India Coordinated Varietal Trial-2019 and was evaluated in multi-locations from 2019-2021.

VL Mandua 400 has recorded an average grain yield of 3,476.76 kg/ha over 3 years (kharif2019 to kharif 2021) of testing under rainfed kharif ecology condition and registered an average yield superiority of 11.50% over the elite early check variety, VL Mandua 376 (3,111.72kg/ha) during all India coordinated trials of small millets

conducted in inorganic conditions across the mentioned seven states. VL Mandua 400 is an early duration variety 101-103 days (mean 102 days), which is at par with early duration national check VL Mandua 376 (101 days). VL Mandua 400 recorded low incidence to leaf blast (grade score 3.4), neck blast (13.48%) and finger blast (12.0%), banded leaf blight (29.5%) and foot rot (12.06%) and fell in the same disease scale category of moderately resistant with early duration national check variety (VL Mandua 376) in all India coordinated trials conducted across over the above seven states.

The new variety possesses excellent grain quality characteristics. Its grains possess higher calcium (399.5 mg/100g) with the superiority of 25.3%, 15.8% and 11.8% than elite early check VL Mandua 376 (318.9 mg/100g), medium duration check GPU 45 (344.8 mg/100g) and popular local early duration variety VL Mandua352 (357.5 mg/100g), respectively. It also possesses high protein (8.5%), total polyphenols (0.52 mg GAE/g) and high antioxidant activity (10.93 mMtrolox equivalent/g dw) compared to VL Mandua 376.

VL Mandua 400 also has excellent phenotypic acceptability with medium plant height (90.27 cm), non-pigmented node and semi compact ear heads with top incurved fingers. VL Mandua 400 is being conserved at the National Bureau of Plant Genetic Resources, New Delhi with IC No. 644844. VL Mandua400 will add to finger millet diversity for organic farming in the country as a whole and in the state of Uttarakhand in particular. Being an early maturing variety (102 days), this variety will also suit to those areas, where monsoon gets delayed or drought is a common phenomenon, where crop growth period is limited. By virtue of its high grain yield, semi-compact ear heads, resistance to neck and finger blast, early maturity duration and excellent grain quality, VL Mandua 400 will provide a new option to farmers growing traditional landraces and old variety of finger millet in the recommended seven states.

Salej Sood, D. C. Joshi*, Arun Gupta, M. S. Bhinda, G. S. Bisht and H. Rajashekara
ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan,
Almora 263 601, Uttrakhand, India
*Corresponding author's email: Dinesh.Joshi@icar.gov.in

