Plant Germplasm Registration Notice*

The Plant Germplasm Registration Committee of ICAR in its XXth meeting held on September 15, 2009 at the National Bureau of Plant Genetic Resources, New Delhi, approved the registration of following 62 germplasm lines out of 146 proposals considered. The information on registered germplasm is published with the purpose to disseminate the information to respective breeders for utilization of these genetic stocks in their crop improvement programmes. Upon request, the developer(s)/ author(s) is/are obliged to distribute the material for crop improvement programs of National Agricultural Research System.

1. RPBio-189 (IET19045) (IC569676; INGR09070), a Paddy (*Oryza sativa*) Germplasm with High Bacterial Blight Resistance, Yield and Fine-grain type

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Samba Mahsuri (BPT5204), released by Acharya NG Ranga Agricultural University (ANGRAU), A.P., in 1986, is a well known quality rice variety which gets high price on account of its high consumer preference and is now considered as a "Mega Variety". It has spread too many Indian states and occupies ~3.3% of the rice area in the country but lacks resistance/tolerance to major pests and diseases. Through a collaborative research project funded by National Agricultural Technology Project (NATP) and executed by the Directorate of Rice Research (DRR), Hyderabad and Centre for Cellular and Molecular Biology (CCMB), Hyderabad. Three bacterial blight (BB) resistance genes- *Xa21, xa13* and *xa5* have been introgressed into the genetic background of Samba Mahsuri from a donor line SS1113 through marker-assisted backcross breeding. At each backcross generation, PCR-based molecular markers linked to the three resistance (R) genes were used to identify plants possessing the R genes.

After identification of resistant plants, parental polymorphic rice microsatellite markers were used to identify the resistant backcross plant possessing maximum introgression from the recurrent parent genome (*i.e.* Samba Mahsuri genome). At BC_4F_1 generation, the best resistant backcross plant selected based on marker analysis was selfed to obtain BC_4F_2 plants. Through marker analysis, five BC_4F_2 plants possessing the three R genes in homozygous condition were identified and progenies of these homozygous lines were later evaluated in limited field trial for yield and agronomic parameters at the experimental farm of DRR. The analysis showed that the homozygous lines resemble the recurrent parent (Samba Mahsuri) in yield, duration and other agro-

Important agro-morphological characteristics of RPBio-189 (IET19045)

Characteristics	Description
Plant height (cm)	89
Plant type	Semi-dwarf
No. of tillers/plant	15-18
No. of panicle per square meter	325
Days to 50% flowering	110 days
Panicle type	Compact
Panicle exertion	Completely exerted
Awning	Awnless
Apiculus colour	Absent
1000-grain weight (g)	22
Kernel length (mm)	4.82
L/B ratio	2.83
Elongation ratio	2.03
Kernel appearance	Medium slender
Hulling recovery (%)	70.8
Head rice recovery (%)	65.0
Alkali value	5.0
Amylose content (%)	24.30
Gel consistency (mm)	39
Water uptake (ml) during cooking	122 ml
Resistance to bacterial blight	Resistant

*Compiled and edited by: Anjali Kak and RK Tyagi, Division of Germplasm Conservation, National Bureau of Plant Genetic Resources, New Delhi-110 012

morphological parameters. Analysis of grain quality revealed that the gene-pyramid lines resemble the recurrent parents closely. Finally, when the plants were exposed to a virulent isolate of the BB pathogen (named DX066), all the three-gene pyramid lines showed complete resistance to the pathogen with lesion lengths less than 3 cm. Four of the promising three-gene pyramid lines derived from BC_4F_5 generation lines (viz. RPBio-170, RPBio-189, RPBio-197 and RPBio-226) were nominated for field evaluation along with parental materials for trait verification in All India Coordinated Rice Improvement Programs during Kharif 2005 and Kharif 2006. One of the three gene pyramid lines, RPBio-189 (IET19045) exhibited high level of bacterial blight resistance and higher grain yield as compared to Samba Mahsuri. Further, the culture was equivalent to all grain and cooking quality parameters except that of water uptake during cooking, wherein RPBio-189 (IET19045) exhibited a unique feature of very low water uptake of only 122 ml. Thus, RPBio-189 is unique and different from Samba Mahsuri in terms of higher yield, bacterial blight resistance and low water uptake during cooking.

2. Culture No: IET 9691 (IC569481; INGR09071), a Paddy (*Oryza sativa*) Germplasm with Resistance to Bacterial Blight (BB) Resistance and Excellent Grain and Cooking Quality

GS Varaprasad, G Padmavathi, N Shobha Rani, P Krishna Murthy, SP Singh and BC Viraktamath

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Soil phosphorus (P) deficiency limits rice yields on a variety of soils that are typically found in the tropics. Hence development of germplasm adopted to such conditions requires in-built mechanisms of high nutrient use-efficiency. Developing genetically enhanced plants with better P use efficiency (PUE) through efficient P absorption, transportation and internal utilization are of paramount importance.

IET 9691 designated as RP 2235-48-54-6 and derived from the cross, IR 50/ Phalguna was developed through pedigree method during 1981 at the Directorate of Rice Research, Hyderabad. It is a mid-early duration culture tolerant to phosphorus deficient soils with higher root volume and root weight and has high yielding ability in phosphorus deficient and normal soils.

IET 9691 is a semi-dwarf with plant height of 95 cm, compact and non-lodging plant type. It possesses intermediate and well exserted panicles. With flowering duration of 88 days and maturity duration of 118 days, IET 9691 records about 400 panicles per square meter. With long slender quality grains, IET 9691 possesses 55% head rice recovery, intermediate amylose content, intermediate alkali spreading value and soft gel consistency. This culture is resistant to gall midge, moderately resistant to stem borer, bacterial leaf blight and brown spot. IET 9691 evaluated under AICRIP during 1985-1987 in variety trials was identified as a promising entry for irrigated areas of Andhra Pradesh, Karnataka and Orissa against released varieties Vikas and Ratna (Draft proceedings, XXIV Annual Rice Workshop, 1989).

IET 9691 exhibited P use efficiency with higher grain yield response to applied P even at higher P levels of 40, 50 and 60 kg P_2O_5 / ha. Grown in p deficient soils, the sensitive check entry IET 17025 recorded low grain yield of 0.02, 1.62, 2.48, 2.65, 2.79, 3.12, 3.32 t/ha while IET 9691 recorded high grain yield of 1.64, 3.54, 4.13, 4.69, 4.94, 5.28, 6.70 t/ha at P0, P10, P20, P30, P40, P50 and P60 kg/ha respectively demonstrating the superiority in p deficit soils. IET 9691 has higher root activity resulting in the higher phosphorous use efficiency (Krishnamurthy *et al*., 2004). Utilisation of IET 9691 in the development of varieties for p deficit soils would enhance the production and accrue high net returns to farmers.

References

DRR (1989) Draft Proceedings, XXIV Annual Rice Group Meetings, Directorate of Rice Research, Hyderabad, India, 119 p.

Krishnamurthy P, SV Subbaiah, Arun Sathe and P Venkat Reddy (2004) Studies on grain yield response and root activity of rice genotypes under marginal soil fertility conditions. Extended Summaries, International Symposium on Rice, Directorate of Rice Research, Hyderabad, pp 329-330.

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3. RP4518-2-6(RPMRE-1) (IC569649; INGR09072), a Paddy (*Oryza sativa*) Germplasm with Resistance to Gall Midge and Brown Plant Hopper

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The breeding line RPMRE-1 (Rice Project Multiple Resistance Entomology – RP4518-2-6) was developed at DRR by making a cross between MR 1523 x Abhaya and subsequently following Pedigree selection method. RPMRE-1 showed resistance to gall midge, brown plant hopper and white backed plant hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trails (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in the table.

Character	Details
Time of heading	104 days (Medium duration)
Basal leaf colour	Green
Stem Length	57 cms (Very short)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Gm4 + Gm11*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	Resistance to DRR

4. RP4621-1842(RPMRE-2) (IC569650; INGR09073), a Paddy (*Oryza sativa*) Germplasm with Multiple Resistances to Gall Midge, Brown Plant Hopper, White Backed Plant Hopper and Green Leaf Hopper

The breeding line RPMRE-2 (Rice Project Multiple Resistance Entomology – RP4621-1842) was developed at DRR by making a cross between Aganni x Bhumansan and subsequently following Pedigree selection method. RPMRE-2 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in the table.

Character	Details
Time of heading	106 days (Medium duration)
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Stem Length	111 cm (Medium)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Unknown*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	At DRR
Resistance to white backed plant hopper (WBPH)[2,3]	At DRR
Resistance to green leaf hopper [2,3]	At Coimbatore

5. RP4621-1845(RPMRE-3) (IC569651; INGR09074), a Paddy (*Oryza sativa*) Germplasm with Multiple Resistance to Gall Midge, Brown Plant Hopper White Backed Plant Hopper and Green Leaf Hopper

The breeding line RPMRE-3 (Rice Project Multiple Resistance Entomology – RP4621-1845) was developed at DRR by making a cross between Aganni x Bhumansan and subsequently following Pedigree selection method. RPMRE-3 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in the table.

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Resistance to brown plant hopper (BPH)[2,3]	At Coimbatore and DRR
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Resistance to brown plant hopper (BPH)[2,3]	Resistance to DRR

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Resistance genes[1]	*Unknown*
Resistance to Gall Midge Biotypes[2,3]	Resistance to biotypes 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	At Coimbatore and DRR
Resistance to white backed plant hopper (WBPH)[2,3]	At DRR
Resistance to green leaf hopper [2,3]	At Coimbatore

6. RP4639-110(RPMRE-4) (IC569652; INGR09075), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum Gall Midge Resistance

The breeding line RPMRE-4 (Rice Project Multiple Resistance Entomology – RP4639-110) was developed at DRR by making a cross between TN1 1523 x Abhaya and subsequently following Pedigree selection method. RPMRE-4 showed resistance to rice Gall midge consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trails (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in the table.

Character	Details
Time of heading	97 days (Medium duration)
Basal leaf colour	Green
Stem Length	78 cm (Very short)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Gm4*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4, 4M & 6

7. RP4642-669(RPMRE-5) (IC569653; INGR09076), a Paddy (*Oryza sativa*) Germplasm with Multiple Resistance to Gall Midge, Brown Plant Hopper White Backed Plant Hopper and Green Leaf Hopper

The breeding line RPMRE-5 (Rice Project Multiple Resistance Entomology – RP4642-669) was developed at DRR by making a cross between ARC 15831 x W 1263 and subsequently following pedigree selection method. RPMRE-5 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho agronomic characters are given in Table 1.

Table 1. Details of morpho-agronomic traits

Character	Details
Time of heading	94 days (Medium duration)
Basal leaf sheath colour	Green
Stem Length	91 cm (Short)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain Aroma	Absent
Resistance genes[1]	*Unknown* + *GM1* Gene
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4,6 & 4M
Resistance to brown plant hopper (BPH)[2,3]	Resistant at Coimbatore and DRR
Resistance to white backed plant hopper (WBPH)[2,3]	Resistant at DRR and Coimbatore
Resistance to green leaf hopper [2,3]	Resistant at Coimbatore

Insect pests cause significant yield loss in rice. Development and cultivation of resistant varieties form an important component of IPM (Bentur, 2007). However, sources of resistance against different pests being diverse and different, it becomes tedious to develop multiple pest resistant varieties. Addressing this problem we made crosses between different donor parents, screening the early generations against gall midge biotypes 1,4 and 4M and selecting few promising lines. These lines were tested under AICRIP against major insect pests of rice during 2006 and 2007. As a result we have identified five cultures that posses multiple insect pest resistance (Table 2). These improved germplasm, now registered with NBPGR and seed multiplied at DRR, are available for the breeders upon request.

Broad spectrum of gall midge resistance in RPMRE1 is contributed by the combination of *Gm4* and *Gm11* genes whereas in RPMRE5 Gm1 and Gm8 are the likely genes. In RPMRE2 and RPMRE3 gall midge resistance from Gm8 gene in Aganni is likely to be complemented from an unknown gene of Bhumansan. In RPMRE4, only Gm4 from Abhaya is the known resistance gene against gall midge. Genetics of plant hopper resistance

Table 2. New improved rice germplasm with multiple insect resistance

Designation	Cross	Resistance
RPMRE1(RP4518-2-6)	MR1523 × Abhaya	GM biotypes 1,2,4&4M + BPH
RPMRE2(RP4621-1842)	Aganni × Bhumansan	GM biotypes 1,2,4 & 4M + BPH + WBPH+GLH
RPMRE3(RP4621-1845)	Aganni × Bhumansan	GM biotypes 1,2,4 & 4M +BPH+WBPH+GLH
RPMRE4(RP4639-110)	TN1 × Abhaya	GM biotypes 1,2,4,4M & 6
RPMRE5(RP4642-669)	ARC15831 × W1263	GM biotypes 1,2,4,4M & 6

6. RP4639-110(RPMRE-4) (IC569652; INGR09075), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum Gall Midge Resistance

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Decorticated grain type	Short bold
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Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4, 4M & 6

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Resistance to brown plant hopper (BPH)[2,3]	Resistant at Coimbatore and DRR
Resistance to white backed plant hopper (WBPH)[2,3]	Resistant at DRR and Coimbatore
Resistance to green leaf hopper [2,3]	Resistant at Coimbatore

Insect pests cause significant yield loss in rice. Development and cultivation of resistant varieties form an important component of IPM (Bentur, 2007). However, sources of resistance against different pests being diverse and different, it becomes tedious to develop multiple pest resistant varieties. Addressing this problem we made crosses between different donor parents, screening the early generations against gall midge biotypes 1,4 and 4M and selecting few promising lines. These lines were tested under AICRIP against major insect pests of rice during 2006 and 2007. As a result we have identified five cultures that posses multiple insect pest resistance (Table 2). These improved germplasm, now registered with NBPGR and seed multiplied at DRR, are available for the breeders upon request.

Broad spectrum of gall midge resistance in RPMRE1 is contributed by the combination of *Gm4* and *Gm11* genes whereas in RPMRE5 Gm1 and Gm8 are the likely genes. In RPMRE2 and RPMRE3 gall midge resistance from Gm8 gene in Aganni is likely to be complemented from an unknown gene of Bhumansan. In RPMRE4, only Gm4 from Abhaya is the known resistance gene against gall midge. Genetics of plant hopper resistance

Table 2. New improved rice germplasm with multiple insect resistance

Designation	Cross	Resistance
RPMRE1(RP4518-2-6)	MR1523 × Abhaya	GM biotypes 1,2,4&4M + BPH
RPMRE2(RP4621-1842)	Aganni × Bhumansan	GM biotypes 1,2,4 & 4M + BPH + WBPH+GLH
RPMRE3(RP4621-1845)	Aganni × Bhumansan	GM biotypes 1,2,4 & 4M +BPH+WBPH+GLH
RPMRE4(RP4639-110)	TN1 × Abhaya	GM biotypes 1,2,4,4M & 6
RPMRE5(RP4642-669)	ARC15831 × W1263	GM biotypes 1,2,4,4M & 6

in RPMRE1, RPMRE2 and RPMRE3 is not known.

Reference

Bentur JS (2007) Host-plant resistance to insects as a core of rice IPM. In: PK Aggarwal, JK Ladha, RK Singh, C Devakumar, B Hardy, (eds) Science, Technology, and Trade for Peace. Manila (Philippines): International Rice Research Institute, New Delhi (India): Indian Council of Agricultural Research and New Delhi (India): National Academy of Agricultural Sciences, pp 419-435.

8. DRR 4A & 4B (IC569482 & IC569483; INGR09077), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterility with Higher Rate of Stigma Exsertion, MS Grain Type and High Head Rice Recovery, Semi Dwarf Stature

MS Ramesha, BC Virakatamath and M Ilyas Ahmed
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh
(E-mail: mugalodimsr@yahoo.com)

Higher rate of stigma exsertion on A-line (>84%). Higher rate of out crossing (>62%). Purple coloured basal leaf sheath, apiculus and stigma.

Table1. Salient botanical/morphological traits of DRR-4A and 4B

Character	DRR 4A	DRR 4B
Plant height (cm)	55 cm	60 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-15	14-16
Days of 50% flowering	92-97	89-94
Panicle type	Compact	Compact
Panicle exertion (%)	82	99
Awning	Absent	Absent
Apiculus colour	Purple	Purple
Husk colour	Brown	Brown
1000 grain weight (gm)	23g	23g
Basal leaf sheath	Purple	Purple
Stigma colour	Purple	Purple
Anther colour	Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium slender	Medium slender
Spikelet (colour of tip of lemma)	Purple	Purple
Spikelet (density of pubescence of lemma)	Strong	Strong
Male sterility	100%	Nil
Lemma and Palea colour	Brown furrows on straw	Brown furrows on straw
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	66.0
LB ratio	–	2.54
Grain chalkiness	–	VOC
Alkali spreading value	–	5.0
Amylose content (%)	–	22.77
Gel consistency (mm)	–	44
Water uptake (ml)	–	190

DRR by making a cross between Aganni x Bhumansan and subsequently following Pedigree selection method. RPMRE-2 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in Table 2.

Table 2. Details of morpho-agronomic traits

Character	Details
Time of heading	106 days (Medium duration)
Basal leaf sheath colour	Green
Stem Length	111 cm (Medium)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Unknown*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	At DRR
Resistance to white backed plant hopper (WBPH)[2,3]	At DRR
Resistance to green leaf hopper [2,3]	At Coimbatore

in RPMRE1, RPMRE2 and RPMRE3 is not known.

Reference

Bentur JS (2007) Host-plant resistance to insects as a core of rice IPM. In: PK Aggarwal, JK Ladha, RK Singh, C Devakumar, B Hardy, (eds) Science, Technology, and Trade for Peace. Manila (Philippines): International Rice Research Institute, New Delhi (India): Indian Council of Agricultural Research and New Delhi (India): National Academy of Agricultural Sciences, pp 419-435.

8. DRR 4A & 4B (IC569482 & IC569483; INGR09077), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterility with Higher Rate of Stigma Exsertion, MS Grain Type and High Head Rice Recovery, Semi Dwarf Stature

MS Ramesha, BC Virakatamath and M Ilyas Ahmed
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh
(E-mail: mugalodimsr@yahoo.com)

Higher rate of stigma exsertion on A-line (>84%). Higher rate of out crossing (>62%). Purple coloured basal leaf sheath, apiculus and stigma.

Table1. Salient botanical/morphological traits of DRR-4A and 4B

Character	DRR 4A	DRR 4B
Plant height (cm)	55 cm	60 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-15	14-16
Days of 50% flowering	92-97	89-94
Panicle type	Compact	Compact
Panicle exertion (%)	82	99
Awning	Absent	Absent
Apiculus colour	Purple	Purple
Husk colour	Brown	Brown
1000 grain weight (gm)	23g	23g
Basal leaf sheath	Purple	Purple
Stigma colour	Purple	Purple
Anther colour	Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium slender	Medium slender
Spikelet (colour of tip of lemma)	Purple	Purple
Spikelet (density of pubescence of lemma)	Strong	Strong
Male sterility	100%	Nil
Lemma and Palea colour	Brown furrows on straw	Brown furrows on straw
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	66.0
LB ratio	–	2.54
Grain chalkiness	–	VOC
Alkali spreading value	–	5.0
Amylose content (%)	–	22.77
Gel consistency (mm)	–	44
Water uptake (ml)	–	190

DRR by making a cross between Aganni x Bhumansan and subsequently following Pedigree selection method. RPMRE-2 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in Table 2.

Table 2. Details of morpho-agronomic traits

Character	Details
Time of heading	106 days (Medium duration)
Basal leaf sheath colour	Green
Stem Length	111 cm (Medium)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Unknown*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	At DRR
Resistance to white backed plant hopper (WBPH)[2,3]	At DRR
Resistance to green leaf hopper [2,3]	At Coimbatore

5. RP4621-1845(RPMRE-3) (IC569651; INGR09074), a Paddy (*Oryza sativa*) Germplasm with Multiple Resistance to Gall Midge, Brown Plant Hopper White Backed Plant Hopper and Green Leaf Hopper

JS Bentur and GSV Prasad
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh
(E-mail: gsvprasad@drricar.org)

The breeding line RPMRE-3 (Rice Project Multiple Resistance Entomology – RP4621-1845) was developed at DRR by making a cross between Aganni x Bhumansan and subsequently following Pedigree selection method. RPMRE-3 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho agronomic characters are given in the Table.

Character	Details
Time of heading	106 days (Medium duration)
Basal leaf sheath colour	Green
Stem Length	112 cm (Medium)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain Aroma	Absent
Resistance genes[1]	*Unknown*
Resistance to Gall Midge Biotypes[2,3]	Resistance to bio types 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	At Coimbatore and DRR
Resistance to white backed plant hopper (WBPH)[2,3]	At DRR
Resistance to green leaf hopper [2,3]	At Coimbatore

6. RP4639-110(RPMRE-4) (IC569652; INGR09075), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum Gall Midge Resistance

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The breeding line RPMRE-4 (Rice Project Multiple Resistance Entomology – RP4639-110) was developed at DRR by making a cross between TN1 1523 x Abhaya and subsequently following Pedigree selection method. RPMRE-4 showed resistance to rice Gall midge consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trails (Ref: DRR, Progress Report 2006 & 2007). The morpho agronomic characters are given in the table.

Character	Details
Time of heading	97 days (Medium duration)
Basal leaf colour	Green
Stem Length	78 cm (Very short)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Gm4*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4, 4M & 6

5. RP4621-1845(RPMRE-3) (IC569651; INGR09074), a Paddy (*Oryza sativa*) Germplasm with Multiple Resistance to Gall Midge, Brown Plant Hopper White Backed Plant Hopper and Green Leaf Hopper

JS Bentur and GSV Prasad
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh
(E-mail: gsvprasad@drricar.org)

The breeding line RPMRE-3 (Rice Project Multiple Resistance Entomology – RP4621-1845) was developed at DRR by making a cross between Aganni x Bhumansan and subsequently following Pedigree selection method. RPMRE-3 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho agronomic characters are given in the Table.

Character	Details
Time of heading	106 days (Medium duration)
Basal leaf sheath colour	Green
Stem Length	112 cm (Medium)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain Aroma	Absent
Resistance genes[1]	*Unknown*
Resistance to Gall Midge Biotypes[2,3]	Resistance to bio types 1,2,4 & 4M
Resistance to brown plant hopper (BPH)[2,3]	At Coimbatore and DRR
Resistance to white backed plant hopper (WBPH)[2,3]	At DRR
Resistance to green leaf hopper [2,3]	At Coimbatore

6. RP4639-110(RPMRE-4) (IC569652; INGR09075), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum Gall Midge Resistance

JS Bentur and GSV Prasad
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh
(E-mail: gsvprasad@drricar.org)

The breeding line RPMRE-4 (Rice Project Multiple Resistance Entomology – RP4639-110) was developed at DRR by making a cross between TN1 1523 x Abhaya and subsequently following Pedigree selection method. RPMRE-4 showed resistance to rice Gall midge consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trails (Ref: DRR, Progress Report 2006 & 2007). The morpho agronomic characters are given in the table.

Character	Details
Time of heading	97 days (Medium duration)
Basal leaf colour	Green
Stem Length	78 cm (Very short)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain aroma	Absent
Resistance genes[1]	*Gm4*
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4, 4M & 6

7. RP4642-669(RPMRE-5) (IC569653; INGR09076), a Paddy (*Oryza sativa*) Germplasm with Multiple Resistance to Gall Midge, Brown Plant Hopper White Backed Plant Hopper and Green Leaf Hopper

JS Bentur and GSV Prasad
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The breeding line RPMRE-5 (Rice Project Multiple Resistance Entomology – RP4642-669) was developed at DRR by making a cross between ARC 15831 x W 1263 and subsequently following pedigree selection method. RPMRE-5 showed resistance to rice gall midge, brown plant hopper, white backed plant hopper and green leaf hopper consistently for the last 2 years in All India Coordinated Rice Improvement Programme (AICRP) trials (Ref: DRR, Progress Report 2006 & 2007). The morpho-agronomic characters are given in Table 1.

Table 1. Details of morpho-agronomic traits

Character	Details
Time of heading	94 days (Medium duration)
Basal leaf sheath colour	Green
Stem Length	91 cm (Short)
Decorticated grain type	Short bold
Decorticated grain colour	Light brown
Decorticated grain Aroma	Absent
Resistance genes[1]	*Unknown* + *GM1* Gene
Resistance to gall midge biotypes[2,3]	Resistance to biotypes 1,2,4,6 & 4M
Resistance to brown plant hopper (BPH)[2,3]	Resistant at Coimbatore and DRR
Resistance to white backed plant hopper (WBPH)[2,3]	Resistant at DRR and Coimbatore
Resistance to green leaf hopper [2,3]	Resistant at Coimbatore

Insect pests cause significant yield loss in rice. Development and cultivation of resistant varieties form an important component of IPM (Bentur, 2007). However, sources of resistance against different pests being diverse and different, it becomes tedious to develop multiple pest resistant varieties. Addressing this problem we made crosses between different donor parents, screening the early generations against gall midge biotypes 1,4 and 4M and selecting few promising lines. These lines were tested under AICRIP against major insect pests of rice during 2006 and 2007. As a result we have identified five cultures that posses multiple insect pest resistance (Table 2). These improved germplasm, now registered with NBPGR and seed multiplied at DRR, are available for the breeders upon request.

Table 2. New improved rice germplasm with multiple insect resistance

Designation	Cross	Resistance
RPMRE1(RP4518-2-6)	MR1523×Abhaya	GM biotypes 1,2,4&4M + BPH
RPMRE2(RP4621-1842)	Aganni×Bhumansan	GM biotypes 1,2,4 & 4M + BPH + WBPH+GLH
RPMRE3(RP4621-1845)	Aganni×Bhumansan	GM biotypes 1,2,4 & 4M +BPH+ WBPH+GLH
RPMRE4(RP4639-110)	TN1×Abhaya	GM biotypes 1,2,4, 4M & 6
RPMRE5(RP4642-669)	ARC15831×W1263	GM biotypes 1,2,4, 4M & 6

Broad spectrum of gall midge resistance in RPMRE1 is contributed by the combination of *Gm4* and *Gm11* genes whereas in RPMRE5 Gm1 and Gm8 are the likely genes. In RPMRE2 and RPMRE3 gall midge resistance from Gm8 gene in Aganni is likely to be complemented from an unknown gene of Bhumansan. In RPMRE4, only Gm4 from Abhaya is the known resistance gene against gall midge. Genetics of plant hopper resistance in RPMRE1, RPMRE2 and RPMRE3 is not known.

Reference

Bentur JS (2007) Host-plant resistance to insects as a core of rice IPM. In: PK Aggarwal, JK Ladha, RK Singh, C Devakumar, B Hardy, (eds) Science, Technology, and Trade for Peace. Manila (Philippines): International Rice Research Institute, New Delhi (India): Indian Council of Agricultural Research and New Delhi (India): National Academy of Agricultural Sciences, pp 419-435.

8. DRR 4A & 4B (IC569482 & IC569483; INGR09077), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterility with Higher Rate of Stigma Exsertion, MS Grain Type and High Head Rice Recovery, Semi Dwarf Stature

MS Ramesha, BC Virakatamath and M Ilyas Ahmed
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh (E-mail: mugalodimsr@yahoo.com)

Higher rate of stigma exsertion on A-line (>84%). Higher rate of out crossing (>62%). Purple coloured basal leaf sheath, apiculus and stigma.

Table1. Salient botanical/morphological traits of DRR-4A and 4B

Character	DRR 4A	DRR 4B
Plant height (cm)	55 cm	60 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-15	14-16
Days of 50% flowering	92-97	89-94
Panicle type	Compact	Compact
Panicle exertion (%)	82	99
Awning	Absent	Absent
Apiculus colour	Purple	Purple
Husk colour	Brown	Brown
1000 grain weight (gm)	23g	23g
Basal leaf sheath	Purple	Purple
Stigma colour	Purple	Purple
Anther colour	Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium slender	Medium slender
Spikelet (colour of tip of lemma)	Purple	Purple
Spikelet: density of pubescence of lemma Strong	Strong	
Male sterility	100%	Nil
Lemma and Palea colour on straw	Brown furrows on straw	Brown furrows
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	66.0
LB ratio	–	2.54
Grain chalkiness	–	VOC
Alkali spreading value	–	5.0
Amylose content (%)	–	22.77
Gel consistency (mm)	–	44
Water uptake (ml)	–	190
Decorticated grain aroma	–	Absent

9. DRR 5A & 5B (IC569484 & IC569485; INGR09078), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterility, Medium Maturity, High Rate of Stigma Exsertion in A & B lines, Medium Slender Grain, High Head Rice Recovery, Higher Rate of out Crossing in A line and Good Tillering Capacity

BC Virakatamath, MS Ramesha and M Ilyas Ahmed
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh (E-mail: mugalodimsr@yahoo.com)

Higher rate of stigma exsertion on A and B lines. Higher rate of out crossing and semi dwarf stature. Medium maturity group and good tillering capacity.

Table1. Salient botanical/morphological traits of DRR-5A and 5B

Character	DRR 5A	DRR 5B
Plant height (cm)	60 cm	63 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-15	13-16
Days of 50% flowering	101-104	98-102
Panicle type	Compact	Compact
Panicle exertion (%)	80	98
Awning	Absent	Absent
Apiculus colour	Yellowish	Yellowish
Husk colour	Brown	Brown
1000 grain weight (gm)	24g	24g
Basal leaf sheath	Green	Green
Stigma colour	Light green	Light green
Anther colour	White/Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium slender	Medium slender
Spikelet (colour of tip of lemma)	Straw	Straw
Spikelet: density of pubescence of lemma	Strong	Strong
Male sterility	100%	Nil
Lemma and Palea colour	Brown furrows on straw	Brown furrows on straw
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	62.90
LB ratio	–	2.57
Grain chalkiness	–	Absent
Alkali spreading value	–	5.0
Amylose content (%)	–	21.26
Gel consistency (mm)	–	66
Water uptake (ml)	–	285
Decorticated grain aroma	–	Absent

8. DRR 4A & 4B (IC569482 & IC569483; INGR09077), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterility with Higher Rate of Stigma Exsertion, MS Grain Type and High Head Rice Recovery, Semi Dwarf Stature

MS Ramesha, BC Virakatamath and M Ilyas Ahmed
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Higher rate of stigma exsertion on A-line (>84%). Higher rate of out crossing (>62%). Purple coloured basal leaf sheath, apiculus and stigma.

Table1. Salient botanical/morphological traits of DRR-4A and 4B

Character	DRR 4A	DRR 4B
Plant height (cm)	55 cm	60 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-15	14-16
Days of 50% flowering	92-97	89-94
Panicle type	Compact	Compact
Panicle exertion (%)	82	99
Awning	Absent	Absent
Apiculus colour	Purple	Purple
Husk colour	Brown	Brown
1000 grain weight (gm)	23g	23g
Basal leaf sheath	Purple	Purple
Stigma colour	Purple	Purple
Anther colour	Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium slender	Medium slender
Spikelet (colour of tip of lemma)	Purple	Purple
Spikelet: density of pubescence of lemma Strong	Strong	
Male sterility	100%	Nil
Lemma and Palea colour on straw	Brown furrows on straw	Brown furrows
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	66.0
LB ratio	–	2.54
Grain chalkiness	–	VOC
Alkali spreading value	–	5.0
Amylose content (%)	–	22.77
Gel consistency (mm)	–	44
Water uptake (ml)	–	190
Decorticated grain aroma	–	Absent

9. DRR 5A & 5B (IC569484 & IC569485; INGR09078), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterility, Medium Maturity, High Rate of Stigma Exsertion in A & B lines, Medium Slender Grain, High Head Rice Recovery, Higher Rate of out Crossing in A line and Good Tillering Capacity

BC Virakatamath, MS Ramesha and M Ilyas Ahmed
Directorate of Rice Research, Rajendranagar, Hyderabad-500 030, Andhra Pradesh (E-mail: mugalodimsr@yahoo.com)

Higher rate of stigma exsertion on A and B lines. Higher rate of out crossing and semi dwarf stature. Medium maturity group and good tillering capacity.

Table1. Salient botanical/morphological traits of DRR-5A and 5B

Character	DRR 5A	DRR 5B
Plant height (cm)	60 cm	63 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-15	13-16
Days of 50% flowering	101-104	98-102
Panicle type	Compact	Compact
Panicle exertion (%)	80	98
Awning	Absent	Absent
Apiculus colour	Yellowish	Yellowish
Husk colour	Brown	Brown
1000 grain weight (gm)	24g	24g
Basal leaf sheath	Green	Green
Stigma colour	Light green	Light green
Anther colour	White/Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium slender	Medium slender
Spikelet (colour of tip of lemma)	Straw	Straw
Spikelet: density of pubescence of lemma	Strong	Strong
Male sterility	100%	Nil
Lemma and Palea colour	Brown furrows on straw	Brown furrows on straw
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	62.90
LB ratio	–	2.57
Grain chalkiness	–	Absent
Alkali spreading value	–	5.0
Amylose content (%)	–	21.26
Gel consistency (mm)	–	66
Water uptake (ml)	–	285
Decorticated grain aroma	–	Absent

10. DRR 9A & 9B (IC569486 & IC569487; INGR09079), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterile line Medium Maturity Group and Higher Rate of Stigma Exsertion, Higher Rate of out Crossing in A line Plants with Semi Dwarf Stature, High Head Rice Recovery and Intermediate Amylose Content

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Higher rate of stigma exsertion on A and B lines. Higher rate of out crossing and semi dwarf stature. Medium maturity group and good tillering capacity.

Table 1. Salient botanical/morphological traits of DRR-9A and 9B

Character	DRR 9A	DRR 9B
Plant height (cm)	65 cm	68 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	14-16	15-18
Days of 50% flowering	101-106	99-103
Panicle type	Compact	Compact
Panicle exertion (%)	83	98
Awning	Absent	Absent
Apiculus colour	Yellowish	Yellowish
Husk colour	Brownish	Brownish
1000 grain weight (gm)	23g	23g
Basal leaf sheath	Green	Green
Stigma colour	Light green	Light green
Anther colour	Straw	Yellow
Anther type	Shriveled	Plumpy
Grain type	Short bold	Short bold
Spikelet (colour of tip of lemma)	Yellowish	Yellowish
Spikelet: density of pubescence of lemma	Strong	Strong
Male sterility	100%	Nil
Lemma and Palea colour	Brownish	Brownish
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	61.5
LB ratio	–	2.42
Grain chalkiness	–	VOC
Alkali spreading value	–	4.0
Amylose content (%)	–	23.13
Gel consistency (mm)	–	65
Water uptake (ml)	–	310
Decorticated grain aroma	–	Absent

11. DRR 10 A & 10B (IC569488 & IC569489; INGR09080), a Paddy (*Oryza sativa*) Germplasm with Cytoplasmic Male Sterile line with Higher Rate of Stigma Exsertion, Higher out Crossing Ability of A line, Medium Maturity Group with Semi Dwarf Plant Type, Medium Slender Grain Type with Good Tillering Ability

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CMS line with stable complete male sterility. Higher rate of stigma exsertion and out crossing. Medium maturity group.

Table1. Salient botanical/morphological traits of DRR-10A and 10B

Character	DRR 10A	DRR 10B
Plant height (cm)		58 cm 61 cm
Plant type	Semi-dwarf	Semi-dwarf
Number of tillers/plant	12-16	13-18
Days of 50% flowering	104	100-102
Panicle type	Compact	Compact
Panicle exertion (%)	84	98
Awning	Absent	Absent
Apiculus colour	Yellow	Yellow
Husk colour	Brownish	Brownish
1000 grain weight (gm)	24g	24g
Basal leaf sheath	Green	Green
Stigma colour	Light green	Light green
Anther colour	Straw/white	Yellow
Anther type	Shriveled	Plumpy
Grain type	Medium selender	Medium selender
Spikelet (colour of tip of lemma)	Yellow	Yellow
Spikelet: density of pubescence of lemma	Strong	Strong
Male sterility	100%	Nil
Lemma and Palea colour	Dark Brown	Dark Brown
Sterile lemma colour	Straw	Straw
Head Rice Recovery (%)	–	62.3
LB ratio	–	2.51
Grain chalkiness	–	VOC
Alkali spreading value	–	4.0
Amylose content (%)	–	20.99
Gel consistency (mm)	–	69
Water uptake (ml)	–	295
Decorticated grain aroma	–	Absent

12. RPHR-2 (IC569490; INGR09081), a Paddy (*Oryza sativa*) Germplasm, Japonica Plant Type with Long and Heavy Panicles and Dark Green Thick Leaves, Strong and Broad Spectrum of Fertility Restoration with Medium Slender Grain Type and High Head Rice Recovery. High Pollen Load and 36-45 days of Grain Filling Period

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Table1. Salient botanical/morphological traits of restorer line (RPHR-2)

Character	Description
Plant height (cm)	90-95 cm
Plant type	Japonica type
Number of tillers/plant	15-18
Days of 50% flowering	108-112
Panicle type	Compact and very long
Panicle exertion (%)	Just exerted (100%)
Awning	Occasionally present
Apiculus colour	Yellowish
Husk colour	Golden
1000 grain weight (gm)	22
Basal leaf sheath	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium slender
Spikelet (colour of tip of lemma)	Yellowish
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Lemma and Palea colour	Golden
Leaf senescence	Late
Flag leaf: attitude of blade	Erect
Leaf: width of blade	Broad
Decorticated grain aroma	Absent
Culm: attitude	Erect
Head Rice Recovery (%)	65.7
LB ratio	2.56
Grain chalkiness	VOC
Alkali spreading value	5.0
Amylose content (%)	24.77
Gel consistency (mm)	70
Water uptake (ml)	275

13. RPHR-12 (IC569491; INGR09082), a Paddy (*Oryza sativa*) Germplasm with Strong and Broad Spectrum of Restoration, Tropical Japonica Plant Type with Sturdy Clum, Dark Green and Thick Leaves with Late Senescence, High Pollen Load, Long and Heavy Panicles and Prolonged Grain Filling Period

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Table 1. Salient botanical/morphological traits of restorer line (RPHR-12)

Character	Description
Plant height (cm)	90-95 cm
Plant stature	Semi tall (Japonica)
Number of tillers/plant	10-12
Days of 50% flowering	106-110
Panicle type	Compact and long
Panicle exertion (%)	Just exerted (99%)
Awning	Nil
Leaf: width of blade	Broad
Husk colour	Golden brown
1000 grain weight (gm)	23
Basal leaf sheath colour	Green
Ligule shape	Acute
Ligule colour	Light purple
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium bold
Spikelet (colour of tip of lemma)	Purple
Spikelet: density of pubescence of lemma	Strong
Sterile lemma colour	Straw
Lemma and Palea colour	Golden brown
Flag leaf: attitude of blade	Erect
Leaf senescence	Late
Decorticated grain aroma	Absent
Culm: attitude	Erect
Stem: Anthocyanine colouration of node	Absent

12. RPHR-2 (IC569490; INGR09081), a Paddy (*Oryza sativa*) Germplasm, Japonica Plant Type with Long and Heavy Panicles and Dark Green Thick Leaves, Strong and Broad Spectrum of Fertility Restoration with Medium Slender Grain Type and High Head Rice Recovery. High Pollen Load and 36-45 days of Grain Filling Period

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Table1. Salient botanical/morphological traits of restorer line (RPHR-2)

Character	Description
Plant height (cm)	90-95 cm
Plant type	Japonica type
Number of tillers/plant	15-18
Days of 50% flowering	108-112
Panicle type	Compact and very long
Panicle exertion (%)	Just exerted (100%)
Awning	Occasionally present
Apiculus colour	Yellowish
Husk colour	Golden
1000 grain weight (gm)	22
Basal leaf sheath	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium slender
Spikelet (colour of tip of lemma)	Yellowish
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Lemma and Palea colour	Golden
Leaf senescence	Late
Flag leaf: attitude of blade	Erect
Leaf: width of blade	Broad
Decorticated grain aroma	Absent
Culm: attitude	Erect
Head Rice Recovery (%)	65.7
LB ratio	2.56
Grain chalkiness	VOC
Alkali spreading value	5.0
Amylose content (%)	24.77
Gel consistency (mm)	70
Water uptake (ml)	275

13. RPHR-12 (IC569491; INGR09082), a Paddy (*Oryza sativa*) Germplasm with Strong and Broad Spectrum of Restoration, Tropical Japonica Plant Type with Sturdy Clum, Dark Green and Thick Leaves with Late Senescence, High Pollen Load, Long and Heavy Panicles and Prolonged Grain Filling Period

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Table 1. Salient botanical/morphological traits of restorer line (RPHR-12)

Character	Description
Plant height (cm)	90-95 cm
Plant stature	Semi tall (Japonica)
Number of tillers/plant	10-12
Days of 50% flowering	106-110
Panicle type	Compact and long
Panicle exertion (%)	Just exerted (99%)
Awning	Nil
Leaf: width of blade	Broad
Husk colour	Golden brown
1000 grain weight (gm)	23
Basal leaf sheath colour	Green
Ligule shape	Acute
Ligule colour	Light purple
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium bold
Spikelet (colour of tip of lemma)	Purple
Spikelet: density of pubescence of lemma	Strong
Sterile lemma colour	Straw
Lemma and Palea colour	Golden brown
Flag leaf: attitude of blade	Erect
Leaf senescence	Late
Decorticated grain aroma	Absent
Culm: attitude	Erect
Stem: Anthocyanine colouration of node	Absent

14. RPHR-517 (IC569492; INGR09083), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum of Fertility Restoration and with Good Plant Type, High Rate of Pollen Production with Medium Slender Grain Type, Tall Stature with High Heterotic Potential and Late Maturity Duration

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Table 1. Salient botanical/morphological traits of restorer line (RPHR-517)

Character	Description
Plant height (cm)	105-110 cm
Plant type	Tall
Number of tillers/plant	12-15
Flowering duration (days)	116-118
Panicle type	Compact and long
Panicle exertion (%)	99%
Awning Absent	
Apiculus colour	Yellow
Husk colour	Straw
1000 grain weight (gm)	19
Basal leaf sheath colour	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium slender
Spikelet (colour of tip of lemma)	Yellow
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Lemma and Palea colour	Straw
Flag leaf: attitude of blade	Erect
Leaf senescence	Late
Decorticated grain aroma	Absent
Culm: attitude	Erect
Leaf: width of blade	Medium

15. RPHR-619 (IC569493; INGR09084), a Paddy (*Oryza sativa*) Germplasm with Strong and Broad Spectrum of Fertility Restoration. Tall Stature, Intermediate Plant Type with Synchronous Tillering, High Pollen Load and Slow Leaf Senescence with Medium Maturity

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Table1. Salient botanical/morphological traits of restorer line (RPHR-619)

Character	Description
Plant height (cm)	102-105 cm
Plant stature	Tall (Intermediate type)
Number of tillers/plant	15-18
Flowering duration (days)	105-108
Panicle type	Compact
Panicle exertion (%)	Just exerted (100%)
Awning	Absent
Apiculus colour	Yellowish
Husk colour	Golden brown
1000 grain weight (gm)	22
Basal leaf sheath colour	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium bold
Spikelet (colour of tip of lemma)	Yellowish
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Flag leaf: attitude of blade	Semi-Erect
Leaf senescence	Late
Decorticated grain aroma	Absent
Culm: attitude	Erect
Leaf: width of blade	Medium

14. RPHR-517 (IC569492; INGR09083), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum of Fertility Restoration and with Good Plant Type, High Rate of Pollen Production with Medium Slender Grain Type, Tall Stature with High Heterotic Potential and Late Maturity Duration

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Table 1. Salient botanical/morphological traits of restorer line (RPHR-517)

Character	Description
Plant height (cm)	105-110 cm
Plant type	Tall
Number of tillers/plant	12-15
Flowering duration (days)	116-118
Panicle type	Compact and long
Panicle exertion (%)	99%
Awning Absent	
Apiculus colour	Yellow
Husk colour	Straw
1000 grain weight (gm)	19
Basal leaf sheath colour	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium slender
Spikelet (colour of tip of lemma)	Yellow
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Lemma and Palea colour	Straw
Flag leaf: attitude of blade	Erect
Leaf senescence	Late
Decorticated grain aroma	Absent
Culm: attitude	Erect
Leaf: width of blade	Medium

15. RPHR-619 (IC569493; INGR09084), a Paddy (*Oryza sativa*) Germplasm with Strong and Broad Spectrum of Fertility Restoration. Tall Stature, Intermediate Plant Type with Synchronous Tillering, High Pollen Load and Slow Leaf Senescence with Medium Maturity

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Table1. Salient botanical/morphological traits of restorer line (RPHR-619)

Character	Description
Plant height (cm)	102-105 cm
Plant stature	Tall (Intermediate type)
Number of tillers/plant	15-18
Flowering duration (days)	105-108
Panicle type	Compact
Panicle exertion (%)	Just exerted (100%)
Awning	Absent
Apiculus colour	Yellowish
Husk colour	Golden brown
1000 grain weight (gm)	22
Basal leaf sheath colour	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium bold
Spikelet (colour of tip of lemma)	Yellowish
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Flag leaf: attitude of blade	Semi-Erect
Leaf senescence	Late
Decorticated grain aroma	Absent
Culm: attitude	Erect
Leaf: width of blade	Medium

16. `RPHR-1005 (IC569494; INGR09085), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum of Fertility Restoration and with Good Plant Type, High Rate of Pollen Production and Good Combining Ability. BPT5204 Derivative with Short Slender Grain, Lower Panicle Position and Prominent Top Leaves

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Table1. Salient botanical/morphological traits of restorer line (RPHR-1005)

Character	Description
Plant height (cm)	86-95 cm
Plant type	Semi-dwarf
Number of tillers/plant	15-18
Days of 50% flowering	104-108
Panicle type	Compact and long
Panicle exertion (%)	Just exerted (99%)
Awning	No
Spikelet (colour of tip of lemma)	Yellowish
Husk colour	Straw
1000 grain weight (gm)	17
Basal leaf sheath	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium slender
Sterile lemma colour	Straw
Spikelet: density of pubescence of lemma	Medium
Flag leaf: attitude of blade	Erect
Leaf senescence	Late
Culm: attitude	Erect
Decorticated grain aroma	Absent
Stem: anthocyanin colouration of node	Absent
Head Rice Recovery (%)	54.2
LB ratio	2.64
Grain chalkiness	VOC
Alkali spreading value	4.0
Amylose content (%)	24.66
Gel consistency (mm)	68
Water uptake (ml)	305

17. RPHR-1096 (IC569495; INGR09086), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum of Fertility Restoration and Easily Observable Morphological Marker Purple Basal Leaf Sheath and Purple Apiculus, High Rate of Pollen Production, Slow Leaf Senescence and High Head Rice Recovery, Tall Stature and Intermediate Plant Type with Late Maturity

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Table 1. Salient botanical/morphological traits of restorer line (RPHR-2)

Character	Description
Plant height (cm)	100-105 cm
Plant stature	Tall
Number of tillers/plant	15-20
Days of 50% flowering	112-115
Panicle type	Compact and very long
Panicle exertion (%)	Well exerted
Awning	Absent
Apiculus colour	Purple
Husk colour	Straw
1000 grain weight (gm)	24
Basal leaf sheath colour	Purple
Leaf: Ligule shape	Split
Leaf: Ligule colour	Purple
Leaf: Anthocyanin coloration of Auricles	Purple
Stigma colour	Purple
Anther colour	Yellow
Anther type	Plumpy
Grain type	Short bold
Spikelet (colour of tip of lemma)	Purple
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Leaf senescence	Late
Flag leaf: attitude of blade	Erect
Leaf: width of blade	Broad
Decorticated grain aroma	Absent
Culm: attitude	Erect
Stem: anthocyanin colouration of nodes	Absent
Head Rice Recovery (%)	63.5
LB ratio	2.14
Grain chalkiness	VOC
Alkali spreading value	4.0
Amylose content (%)	20.48
Gel consistency (mm)	52
Water uptake (ml) 260	

16. `RPHR-1005 (IC569494; INGR09085), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum of Fertility Restoration and with Good Plant Type, High Rate of Pollen Production and Good Combining Ability. BPT5204 Derivative with Short Slender Grain, Lower Panicle Position and Prominent Top Leaves

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Table1. Salient botanical/morphological traits of restorer line (RPHR-1005)

Character	Description
Plant height (cm)	86-95 cm
Plant type	Semi-dwarf
Number of tillers/plant	15-18
Days of 50% flowering	104-108
Panicle type	Compact and long
Panicle exertion (%)	Just exerted (99%)
Awning	No
Spikelet (colour of tip of lemma)	Yellowish
Husk colour	Straw
1000 grain weight (gm)	17
Basal leaf sheath	Green
Leaf: Ligule shape	Split
Leaf: Ligule colour	White
Leaf: Anthocyanin coloration of Auricles	Colourless
Stigma colour	White
Anther colour	Yellow
Anther type	Plumpy
Grain type	Medium slender
Sterile lemma colour	Straw
Spikelet: density of pubescence of lemma	Medium
Flag leaf: attitude of blade	Erect
Leaf senescence	Late
Culm: attitude	Erect
Decorticated grain aroma	Absent
Stem: anthocyanin colouration of node	Absent
Head Rice Recovery (%)	54.2
LB ratio	2.64
Grain chalkiness	VOC
Alkali spreading value	4.0
Amylose content (%)	24.66
Gel consistency (mm)	68
Water uptake (ml)	305

17. RPHR-1096 (IC569495; INGR09086), a Paddy (*Oryza sativa*) Germplasm with Broad Spectrum of Fertility Restoration and Easily Observable Morphological Marker Purple Basal Leaf Sheath and Purple Apiculus, High Rate of Pollen Production, Slow Leaf Senescence and High Head Rice Recovery, Tall Stature and Intermediate Plant Type with Late Maturity

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Table 1. Salient botanical/morphological traits of restorer line (RPHR-2)

Character	Description
Plant height (cm)	100-105 cm
Plant stature	Tall
Number of tillers/plant	15-20
Days of 50% flowering	112-115
Panicle type	Compact and very long
Panicle exertion (%)	Well exerted
Awning	Absent
Apiculus colour	Purple
Husk colour	Straw
1000 grain weight (gm)	24
Basal leaf sheath colour	Purple
Leaf: Ligule shape	Split
Leaf: Ligule colour	Purple
Leaf: Anthocyanin coloration of Auricles	Purple
Stigma colour	Purple
Anther colour	Yellow
Anther type	Plumpy
Grain type	Short bold
Spikelet (colour of tip of lemma)	Purple
Spikelet: density of pubescence of lemma	Medium
Sterile lemma colour	Straw
Leaf senescence	Late
Flag leaf: attitude of blade	Erect
Leaf: width of blade	Broad
Decorticated grain aroma	Absent
Culm: attitude	Erect
Stem: anthocyanin colouration of nodes	Absent
Head Rice Recovery (%)	63.5
LB ratio	2.14
Grain chalkiness	VOC
Alkali spreading value	4.0
Amylose content (%)	20.48
Gel consistency (mm)	52
Water uptake (ml) 260	

18. KRL 3-4 (IC408331; INGR09087), a Wheat (*Triticum aestivum*) Germplasm with Salt Tolerance, Water Logging Tolerance, Red Grain, Low Sodium Uptake under Salinity

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KRL 3-4 is a salt and water-logging tolerant genotype developed at CSSRI, Karnal, through recombination breeding involving the parentage HD 1982/Kharchia 65. The genotype is unique with respect to red grain colour and very high level of tolerance to salinity, sodicity and water-logging stresses.

Morpho-agronomic Characteristics

The genotype has light green foliage with erect growth habit. The plants are very long with non waxy blade and ear. Ears are parallel and white in colour with spreading awns. The grains are red and elliptical with medium size. KRL 3-4 is being used as a tolerant check for All India Salinity/Alkalinity Tolerance screening Nursery and has out yielded Kharchia 65 (this has the reputation of the most salt tolerant genotype) from 2004-05 to 2008-09 crop seasons in different salt affected locations (Karnal, Hisar, Bawal, Faizabad, Kanpur, Lucknow, Bhilwara and Bharuch).

Associated Characters and Cultivated Practices

The genotype KRL 3-4 is much improved from Kharchia 65 (red grains) on account of high yielding ability along with high level of salinity, sodicity and water logging tolerance. The genotype is characterized by low sodium uptake under salinity. The sodium uptake of KRL 3-4 (300±12 µmol/g) has been found to be lower than Kharchia 65 (525±55 µmol/g) in saline soils (Kulshreshtha, 2008). The salt tolerance of KRL 3-4 along with low sodium uptake makes it highly useful for incorporating salt tolerance trait. In addition to having better regulation over the uptake of Na and K in sodicity and Na and Cl in salinity, KRL 3-4 possesses higher tissue tolerance for Al, B and Fe. These regulatory mechanisms are maintained even when sodic or saline stress situations are accompanied by waterlogging stress.

KRL 3-4 gives its best expression in sodic/reclaimed sodic soils. However under high sodic conditions (pH more than 9.3), the genotype can provide much better yield than the prevalent variety PBW 343. Standard agronomical cultural practices are required to raise the crop.

Reference

Kulshreshtha N (2008) Breeding wheat varieties for salt tolerance in India: Present status and future prospects. In: NPS Yaduvansh, RK Yadav, DS Bundela, N Kulshreshtha and G Singh (eds) Chemical Changes and Nutrient Transformation in Sodic/poor Quality Water Irrigated Soils, pp 269-274.

19. NRCSFR-06-1 (IC569675; INGR09088), a Sorghum (*Sorghum bicolor*) Germplasm with Source of Shoot Fly Tolerance with Multiple Resistances to Leaf Diseases and also Agronomic Superiority and Yield

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NRCSFR 06-1 (SPV 1518 X IS 2122) is the outcome of breeding for shoot fly resistance. The line possesses shoot fly resistance compared to resistant check, IS 2312 as tested across location during 2006, 2007 and 2008 under AICSIP. It was found to have better plant type with tan back ground compared to the resistant sources.

18. KRL 3-4 (IC408331; INGR09087), a Wheat (*Triticum aestivum*) Germplasm with Salt Tolerance, Water Logging Tolerance, Red Grain, Low Sodium Uptake under Salinity

KN Singh[1], Neeraj Kulshreshtha[1], Ravish Chatrath[2], SK Sharma[1] and NPS Yaduvanshi[1]
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[2]*Directorate of Wheat research, Karnal-132 001, Haryana*
(E-mail: neeraj@cssri.ernet.in)

KRL 3-4 is a salt and water-logging tolerant genotype developed at CSSRI, Karnal, through recombination breeding involving the parentage HD 1982/Kharchia 65. The genotype is unique with respect to red grain colour and very high level of tolerance to salinity, sodicity and water-logging stresses.

Morpho-agronomic Characteristics

The genotype has light green foliage with erect growth habit. The plants are very long with non waxy blade and ear. Ears are parallel and white in colour with spreading awns. The grains are red and elliptical with medium size. KRL 3-4 is being used as a tolerant check for All India Salinity/Alkalinity Tolerance screening Nursery and has out yielded Kharchia 65 (this has the reputation of the most salt tolerant genotype) from 2004-05 to 2008-09 crop seasons in different salt affected locations (Karnal, Hisar, Bawal, Faizabad, Kanpur, Lucknow, Bhilwara and Bharuch).

Associated Characters and Cultivated Practices

The genotype KRL 3-4 is much improved from Kharchia 65 (red grains) on account of high yielding ability along with high level of salinity, sodicity and water logging tolerance. The genotype is characterized by low sodium uptake under salinity. The sodium uptake of KRL 3-4 (300±12 µmol/g) has been found to be lower than Kharchia 65 (525±55 µmol/g) in saline soils (Kulshreshtha, 2008). The salt tolerance of KRL 3-4 along with low sodium uptake makes it highly useful for incorporating salt tolerance trait. In addition to having better regulation over the uptake of Na and K in sodicity and Na and Cl in salinity, KRL 3-4 possesses higher tissue tolerance for Al, B and Fe. These regulatory mechanisms are maintained even when sodic or saline stress situations are accompanied by waterlogging stress.

KRL 3-4 gives its best expression in sodic/reclaimed sodic soils. However under high sodic conditions (pH more than 9.3), the genotype can provide much better yield than the prevalent variety PBW 343. Standard agronomical cultural practices are required to raise the crop.

Reference

Kulshreshtha N (2008) Breeding wheat varieties for salt tolerance in India: Present status and future prospects. In: NPS Yaduvansh, RK Yadav, DS Bundela, N Kulshreshtha and G Singh (eds) Chemical Changes and Nutrient Transformation in Sodic/poor Quality Water Irrigated Soils, pp 269-274.

19. NRCSFR-06-1 (IC569675; INGR09088), a Sorghum (*Sorghum bicolor*) Germplasm with Source of Shoot Fly Tolerance with Multiple Resistances to Leaf Diseases and also Agronomic Superiority and Yield

C Aruna, PG Padmaja, Vittal Sharma, T Hussain, VR Bhagwat, S Audilakshmi and N Seetharama
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NRCSFR 06-1 (SPV 1518 X IS 2122) is the outcome of breeding for shoot fly resistance. The line possesses shoot fly resistance compared to resistant check, IS 2312 as tested across location during 2006, 2007 and 2008 under AICSIP. It was found to have better plant type with tan back ground compared to the resistant sources.

20. PEC 17 (IC392140; INGR09089), a Sorghum (*Sorghum bicolor*) Germplasm, Source of High Grain Yield and High Biomass under *Rabi* Conditions and Shallow Soil

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24. ICU–7 (IC573438; INGR09107), a Blackgram (*Vigna mungo*) Germplasm with Exceptionally Large Seed Size. 100-Seed Weight 4.65 g (35.2% Higher than Pant Urd-19)

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

25. PG 063 (IC573446; INGR09108), a Chickpea (*Cicer arietinum*) Germplasm with High Yield (24.9 g/Plant) and Dwarf and Bushy Plant Type

DP Singh and Anju Arora
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PG 063 has been derived from a wide cross (PG 92-97 × *C. reticulatum*) between cultivated and wild species. The line PG 063 is high yielding with dwarf and bushy plant type.

26. PM 06-34 (IC573449; INGR09109), a Mung bean (*Vigna radiata*) Germplasm with High Iron (9.18 mg/100 g) Content and High Pods (48.7)/Plant and High Resistance to MYMV

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-34 has been derived from a wide cross (BDYR-1 x DPU 88-31) between mung bean and black gram. Iron content and pod per plant of this line are 16.5 and 52.2% higher, respectively, than the check Pant M-4. The line is also highly resistant to mung bean yellow mosaic virus disease.

27. PM 06-36 (IC573450; INGR09110), a Mung Bean (*Vigna radiata*) Germplasm with High Iron (11.70 mg/100 g) Content, with High Resistant to MYMV

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-36 has been derived from a wide cross (BDYR-1 x DPU 88-31) between mung bean and black gram. Iron content of this line is 48.5% higher, respectively, than the check Pant M-4. The line is also highly resistant to mung bean yellow mosaic virus disease.

28. PM 06-37 (IC573451; INGR09111), a Mung bean (*Vigna radiata*) Germplasm with High Iron (11.18 mg/100 g) Content with High Resistance to MYMV

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-37 has been derived from a wide cross (BDYR-1 × DPU 88-31) between mung bean and black gram. Iron content of this line is 41.9% higher, respectively, than the check Pant M-4. The line is also highly resistant to mung bean yellow mosaic virus disease.

29. PM 06-40 (IC573453; INGR09112), a Mung bean (*Vigna radiata*) Germplasm with High Zinc (3.56 mg/100 g) Content with High Pods (47.0)/Plant, Early Maturity (24.7 days of Initial Flowering) and High Resistance to MYMV

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-40 has been derived from a wide cross (BDYR-1 x DPU 88-31) between mung bean and black gram. Zinc content and pod per plant of this line are 7.2 and 46.9% higher than the check Pant M-4. Besides, the line is 25.2% early than the check for days to initial flowering. The line is also highly resistant to mung bean yellow mosaic virus disease.

30. PM 06-43 (IC573454; INGR09113), a Mung bean (*Vigna radiata*) Germplasm with High Iron (10.59 mg/100 g) Content, Higher Pods (4.7)/Cluster with High Resistance to MYMV

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-43 has been derived from a wide cross (BDYR-1 x DPU 88-31) between mung bean and black gram. Iron content and pod per plant of this line are 34.4 and 42.2% higher than the check Pant M-4. The line is also highly resistant to Mung bean yellow mosaic virus disease.

31. PM 06-44 (IC573455; INGR09114), a Mung bean (*Vigna radiata*) Germplasm with High Iron (Fe) (11.35 mg/100 g) Content and High Resistance to MYMV

DP Singh, RK Khulbe and CS Kar
GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-44 has been derived from a wide cross (BDYR-1 × DPU 88-31) between mung bean and black gram. Iron content of this line is 44.1 higher than the check Pant M-4. The line is also highly resistant to mung bean yellow mosaic virus disease.

32. PM 06-50 (IC573456; INGR09115), a Mung bean (*Vigna radiata*) Germplasm with High Iron (8.29 mg/100 g), Zinc (4.19 mg/100 g) and Protein (25.8%) Content and High Resistance to MYMV

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GB Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand
(E-mail: dhanpalsingh@indiatimes.com)

The germplasm line PM 06-50 has been derived from a wide cross (BDYR-1 × DPU 88-31) between mungbean and blackgram. Iron, Zinc and protein content of this line are 5.2, 26.2 and 8.6.9% higher, respectively, than the check Pant M-4. Besides, the line is 25.2% early than the check for days to initial flowering. The line is also highly resistant to Mungbean yellow mosaic virus disease.

33. AKS/S 41 (IC570613; INGR 09116), a Safflower (*Carthamus tinctorius*) Germplasm with Dwarf Plant Type and Basal Branching Starting at Elongation

SN Deshmukh and MM Wakode
Oilseeds Research Unit, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola-444 104, Maharashtra
(E-mail: srsoilseedspdkv@rediffmail.com)

Safflower is one of the most important oilseed crops of *rabi* season having high quality oil. The dwarf genotype with good yield is rare in safflower. The registered genotype AKS/S 41 is having dwarf stature plant along with the branching very close to the ground giving bushy appearance. The average height of this genotype is 66 cm. The genotype AKS/S 41 is developed at Crop Research Unit (Oilseeds), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) by selection in safflower variety PBNS 12.

Morpho-agronomic Characters

Though the genotype AKS/S 41 is a dwarf with basal branching starting at elongation it is not early maturing. It took 86 days to 50% flowering, 133 days to mature. It produces 15 q/ha seed yield with oil content 27 %, hull content 48%, test weight of 5.5 g (Table 1) and having spiny nature (Anonymous, 2008). The flowers are yellow and turn to orange and remain orange after fading.

Associate Characters and Cultivated Practices

AKS/S 41 showed drought tolerant nature with high drought tolerant efficiency (88%). The reaction to *Alternaria* and wilt diseases is comparable to the nationally released safflower varieties. For aphid the genotype showed tolerant to moderately tolerant grade which is comparable to the national varieties.

The required cultivation practices as usual, sowing time, from Last week of September to first week of

31. PM 06-44 (IC573455; INGR09114), a Mung bean (*Vigna radiata*) Germplasm with High Iron (Fe) (11.35 mg/100 g) Content and High Resistance to MYMV

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32. PM 06-50 (IC573456; INGR09115), a Mung bean (*Vigna radiata*) Germplasm with High Iron (8.29 mg/100 g), Zinc (4.19 mg/100 g) and Protein (25.8%) Content and High Resistance to MYMV

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Table 1. Morpho-agronomic description of AKS/S 41

Characters	Mean of Eleven AICRP Centers			CD (P=0.05)	CV (%)
	AKS/S 41	A-1 (National Check)	PBNS-40 (National Check)		
Seed yield (Kg/ha)	1521	1620	1562	72	12.7
Oil content (%)	27	27	27		
Oil yield (Kg/ha)	415	439	432		
Hull content (%)	48.5	49.6	48.9		
Days to 50% flowering	86	86	85		
Days to maturity	133	132	132		
No. of effective capitula/plant	24.9	24.0	23.6		
No. of seeds/capitulum	24	25	23		
100 seed weight (g)	5.5	6.2	58		
Volume weight (g/l)	638	649	674		
Harvest index	31	31	29		
Biological yield (Kg/ha)	4917	5732	5586		
Plant height (cm)	66	82	115		

October. The seed rate required is 10-12 kg/ha, with spacing of 45 x 20 cm row to row and plant to plant respectively. The recommended dose of fertilizer is 25:25:0 kg NPK/ha for rain fed conditions of Vidarbha region of Maharashtra state.

References

Anonymous (2008) Annual Report Safflower 2007-08. Directorate of Oilseeds Research, Rajendranagar, Hyderabad, India.

34. "30814" (IC439707; INGR09117), a Cotton (*Gossypium arboreum*) Germplasm with Immunity to Grey Mildew (*Ramularia areola*) "30826" (IC439721; INGR09118), a Cotton (*Gossypium arboreum*) Germplasm with Immunity to Grey Mildew (*Ramularia areola*) "30856" (IC439749; INGR09119), a Cotton (*Gossypium arboreum*) Germplasm with Immunity to Grey Mildew (*Ramularia areola*)

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(E-mail: punitmohan@gmail.com)

Gossypium arboreum L. germplasm lines are immune to *Ramularia areola* Atk. the Grey mildew areolate disease of cotton. The immune lines can be used in resistance breeding programme.

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35. SS 2040 (EC460686; INGR09120), a Potato (*Solanum tuberosum* ssp. *andigena*-cultivated species) clone with Frost Tolerance of Cultivated Tetraploid Potato Species *Solanum tuberosum* ssp. *andigena*

SK Luthra[1], J Gopal[2], P Manivel[2], Vinod Kumar[3], BP Singh[1] and SK Pandey[2]
[1]*CPRI Campus, Modipuram, Meerut-250 110, Uttar Pradesh*
[2]*Central Potato Research Institute, Shimla-171 001, Himachal Pradesh*
[3]*Central Potato Research Station, Kufri, Shimla-171 012, Himachal Pradesh*
(E-mail: skluthra@hotmail.com)

SS 2040 an elite potato genetic stock with frost tolerance has been registered as unique germplasm by the Plant Germplasm Registration Committee of the Indian Council of Agricultural Research vide Registration No INGR 09121. SS 2040 is a clonal selection from the segregating progeny of the accession SS 2040 (EC460686) of cultivated tetraploid potato species *Solanum tuberosum* ssp. *andigena*

In India, 85-90% of potatoes are grown during short winter days from October to February in sub-tropical plains. In north-western and west-central plains, the crop is prone to frost during December and January, and losses vary from year to year depending upon the intensity of the frost. The development of frost tolerant varieties may be helpful for sustainable production of potatoes. A severe incidence of frost was observed during January 7-9, 2006 in northern plains of India and potato crop was damaged significantly. This natural opportunity was effectively utilized to screen 30 clones of cultivated species *Solanum tuberosum* ssp. *andigena* for frost tolerance at CPRI Campus, Modipuram, Meerut. The genotype SS 2040 a clone of cultivated tetraploid potato species *Solanum tuberosum* ssp. *andigena* was found highly tolerant (only 10% foliage injury due to frost) to frost during the severe spell of frost (Luthra *et al*., 2007). The clone SS 2040 has good tuberization with acceptable tuber characters.

The plant of SS 2040 is tall, open canopy structure, open leaf structure, leaflets are ovate lanceolate with medium waviness and flower is red purple. The clone SS 2040 is late maturing and possesses small sized tubers with yellow skin, round shape, medium-deep eyes and yellow flesh. The genotypes having yellow flesh are known to be nutritionally superior. The clone SS 2040 can be used for diversifying the source of tolerance to frost in cultivated potatoes since it is easily and directly crossable with the other predominant cultivated group Tuberosum.

References

Luthra SK, J Gopal, P Manivel, Vinod Kumar, BP Singh and SK Pandey (2007) Screening of wild and cultivated species of potato for frost tolerance in north-central plains of India. *Potato J.* **34**: 45-46.

36. SS 1725-22 (EC412923; INGR 09121), a Potato (*Solanum spegazzinii* - Diploid wild species) Germplasm with Frost Tolerance of Wild Potato Diploid Species *Solanum spegazzini*

SK Luthra[1], J Gopal[2], P Manivel[2], Vinod Kumar[3], BP Singh[1] and SK Pandey[2]
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The plant of SS 2040 is tall, open canopy structure, open leaf structure, leaflets are ovate lanceolate with medium waviness and flower is red purple. The clone SS 2040 is late maturing and possesses small sized tubers with yellow skin, round shape, medium-deep eyes and yellow flesh. The genotypes having yellow flesh are known to be nutritionally superior. The clone SS 2040 can be used for diversifying the source of tolerance to frost in cultivated potatoes since it is easily and directly crossable with the other predominant cultivated group Tuberosum.

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36. SS 1725-22 (EC412923; INGR 09121), a Potato (*Solanum spegazzinii* - Diploid wild species) Germplasm with Frost Tolerance of Wild Potato Diploid Species *Solanum spegazzini*

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(EC412923) of diploid potato wild species *Solanum spegazzinii*.

The potato crop grown in north-western and west-central plains is prone to frost during December and January, and losses vary from year to year depending upon the intensity of the frost. The development of frost tolerant varieties may be helpful for sustainable production of potatoes. A severe incidence of frost was observed during January 7-9, 2006 in northern plains of India and potato crop was damaged significantly. This natural opportunity was effectively utilized to screen 86 accessions of 21 tuber bearing wild *Solanum* species for frost tolerance at CPRI Campus, Modipuram, Meerut. The genotype SS 1725-22 a clone of wild diploid species *Solanum spegazzinii* was found highly tolerant (only 10% foliage injury due to frost) to frost during the severe spell of frost (Luthra *et al*., 2007). Hijmans *et al.* (2003) also reported a high extent (38 out of 40 clones) of frost tolerance in *S. spagazzinii*. The clone SS 1725-22 has the good tuberization with acceptable tuber characters.

The plant of SS 1725-22 is short, semi-compact canopy structure, open leaf structure, leaflets are narrow lanceolate with weak waviness and flower is blue violet. The clone SS1725-22 is late maturing and possesses attractive small sized tubers with white cream skin, ovoid, tapering, shallow eyes and white cream flesh. The wild diploid clone SS 1725-22 can be used for diversifying the source of tolerance to frost in cultivated potatoes by crossing it cultivated types following ploidy manipulation.

References

Hijmans RJ, M Jacob, JB Bamberg and DM Spooner (2003) Frost tolerance in wild potato species: Assessing the productivity of taxonomic, geographic and ecological factors. *Euphytica* **130**: 47-59.

Luthra SK, J Gopal, P Manivel, Vinod Kumar, BP Singh and SK Pandey (2007) Screening of wild and cultivated species of potato for frost tolerance in north-central plains of India. *Potato J.* **34**: 45-46.

37. P-61 (IC249349; INGR09122), a Brinjal (*Solanum melongena*) Germplasm with Resistance to Bacterial Wilt

KK Gangopadhyay, P Sadhan Kumar, SK Mishra, Gunjeet Kumar, SK Yadav, Chitra Pandey, BL Meena, RK Mahajan, Mathura Rai, SK Sharma, DS Yadav and Manoj Singh

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In India, brinjal is one of the important vegetable crops and known for its different shape and colour and this has distinct preference in cultivation is restricted due to bacterial wilt attack. The disease completely damages the crop in 2-3 days after attack. This disease is prevalent in hot and high rainfall areas. Therefore, identification of disease resistant genotypes will enhance its scope of cultivation in hot and humid areas. The brinjal germplasm was evaluated at Kerala Agricultural University (KAU), Vellanikkara, as a part of multilocation rvaluation of germplasm under AICRP (Vegetable crops) in March 2005. The evaluation site *i.e*. KAU, Vellanikkara, is a known bacterial wilt sick plot area and the above line has shown resistance to the bacterial wilt disease.

(EC412923) of diploid potato wild species *Solanum spegazzinii*.

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38. Dholi-5 (IC090982; INGR09123), a Brinjal (*Solanum melongena*) Germplasm with Source of Resistance to Bacterial Wilt in Different Genetic Background

KK Gangopadhyay, P Sadhan Kumar, SK Mishra, SK Yadav, Gunjeet Kumar, Chitra Pandey, BL Meena, RK Mahajan, Mathura Rai, SK Sharma, DS Yadav and Manoj Singh
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39. Terminal flower mutant phenotype (IC565527; INGR09124), a Palak (*Beta palonga*) Germplasm with Terminal Flower, Thick Leaf, Big Seed Mutant of Palak

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Determinacy/indeterminacy of the inflorescence are usually a stable character and are often used in species identification. In several species, occasional conversions of an indeterminate into determinate ones have been reported. There has been a marked advance in the understanding of floral initiation and inflorescence development from studies of mutant plants displaying altered inflorescence development. Terminal flowers, are found in the *Arabidopsis* terminal flower1 (*TFL1*) mutant (Shannon and Meeks-Wagner 1991,1993; Alvarez *et al.*,1992; Ohshima *et al.*, 1997; Bradley *et al.*,1997) and in the *Antirrhinum centroradialis* (*CEN*) mutants (Bradley *et al.*,1996). The inflorescence of *Beta palonga* is indeterminate. In an earlier attempt the terminal flower mutant of *Beta palonga* was isolated (Mukherjee and Basu, 1985).

Morpho-agronomic Characters

Beta palonga (*palak* in Hindi, *palong* in Bengali) (Basu and Mukherjee, 1975) consumed as a leafy vegetable, is cultivated during the winter under tropical climatic condition throughout India. The lifecycle of *Beta palonga* has four distinct phases, juvenile phase (JV), adult vegetative (AV), early reproductive phase (ER) and late reproductive phase, (LR). During transition to flowering (ER), a primary inflorescence is produced (Bolting). Late inflorescence (LR) primordia exclusively give rise to flowers. During flowering, apical dominance decreases allowing the secondary inflorescences (from the meristems in the axils of the rosette leaves) to develop. After maturation of the seeds, depending upon the temperature mature plants gradually dries up.

B. palonga is a long day plant and completes its lifecycle within 120 to 140 days. The mutant of *Beta* flowers early and completes its lifecycle comparatively in short time span (90 to 110 days). The data of day length and temperature of last five year (2000-2005) shows that there is a relationship among day length, temperature and bolting of the normal plant (Datta *et al.*, 2008). In *B. palonga*, bolting occurs during the end of December to first week of January under this agro climatic condition (in between 70 to 80 days), when the day length and temperature gradually increased day by day. But in case of mutant, it bolts early (in between 50 to 55 days). In a stagger plantation experiment (three

38. Dholi-5 (IC090982; INGR09123), a Brinjal (*Solanum melongena*) Germplasm with Source of Resistance to Bacterial Wilt in Different Genetic Background

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In India, brinjal is one of the important vegetable crops and known for its different shape and colour and this has distinct preference in cultivation is restricted due to bacterial wilt attack. The disease completely damages the crop in 2-3 days after attack. This disease is prevalent in hot and high rainfall areas. Therefore, identification of disease resistant genotypes will enhance its scope of cultivation in hot and humid areas. The brinjal germplasm was evaluated at Kerala Agricultural University (KAU), Vellanikkara, as a part of multilocation evaluation of germplasm under AICRP (Vegetable crops) in March 2005. The evaluation site *i.e.* KAU, Vellanikkara, is a known bacterial wilt sick plot area and the above line has shown resistance to the bacterial wilt disease.

39. Terminal flower mutant phenotype (IC565527; INGR09124), a Palak (*Beta palonga*) Germplasm with Terminal Flower, Thick Leaf, Big Seed Mutant of Palak

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different plots were sown at 10 days interval) of the mutant showed that it bolts in between 50 to 55 days irrespective of date of showing, day length and temperature.

Associated Characters

To understand the conversion of indeterminate growth of inflorescence into a determinate type of inflorescence, the control of floral development of the mutant phenotype and to investigate the regulation of meristem identity and control of flower development of the mutant phenotype, degenerated primers were designed from the highly conserved region of floral identity gene TFL1/CEN. This resulted to 238 base pair specific amplified cDNA product by RT-PCR, named as PTC-1. Sequence analysis followed by BLAST showed high homology of the PTC with TFL1/CEN like gene indicating presence of TFL1/CEN homologue in *B. palonga*. Southern analysis indicates alteration of the genomic sequence of the mutant of *B. palonga*.

Importance of Terminal Flower Mutant

The terminal flower mutant of *B. palonga* passes through its life cycle very rapidly but produces relatively small amount of seed. In contrast normal *B. palonga* grows much longer and eventually produces much large quantity of seed. It remains to be seen whether up or down regulation of *TFL1* like gene expression through transgenic technologies could induce or reduce the vegetative phage of diverse crop plants. It, will therefore, be interesting to assess how *TFL1/ CEN* like genes function in diverse plant species; the present investigation paved the way in this direction.

The production of terminal flower is thought to be an ancestral state from which the indeterminate condition evolved (Stebbins, 1974). By accelerating progression through phases, the terminal flower mutant, in effect, recapitulates the ancestral form. The evolution of an indeterminate inflorescence from an ancestor with a determinate inflorescence might be regarded as an example of neoteny (De Beer, 1940), a process in which juvenile traits persists into later periods of the life cycle. According to this view, the indeterminate growth of the wild-type apex may have arisen from *TFL1/CEN* or its' homologue activity, retarding its progression and ensuring that it never reaches the mature determinate floral phase, exhibited by the ancestor (Ratcliffe *et al.*, 1998). *TFL1/CEN* and its' homologues are closely related and belong to a small gene family (*CETS*) that encodes ~23 kDa proteins (Pnueli *et al.*, 2001). Thus the genomic information of *TFL1/CEN* homologue from different plant species plays a major role in construction of phylogenetic relationship among diverse flowering plants.

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40. BS 35 (IC565533; INGR09125), an Okra (*Abelmoschus esculentus*) Germplasm with Thin (0.9 cm) and Long Fruit (26 cm)

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41. CHIG-15 (IC553244; INGR09126), a Ivy gourd (*Coccinia grandis*) Germplasm with Fruit Length (8.5-9 cm) and Uniform Cylindrical Shape

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CHIG-15 (IC553244) was identified from a collection of twenty ivy gourd genotypes for its culinary quality and yield. This is an early fruiting variety which starts fruit production 40 days after transplanting. The variety produces light green, long slender cylindrical fruits of 7.5-8.5 cm length with soft texture and has attractive stripes in skin. The variety has sequential fruiting habit and fruits develop by means of vegetative parthenocarpy hence, there is no need of male plant for pollination and more number of female plants can be accommodated/ unit areas. A single plant of CHIG-15 produces a yield of 20 kg fruits in a year. On the basis of superior performance, it has been sent for multi-location testing in Orissa.

42. NRCG09-1 (IC567685; INGR09127), a Ground nut (*Arachis hypogaea*) Germplasm with Multiple Phenotypic Marker Stock with Crinkle Leaf and White Testa Color. Near- Isogenic Line of Crinkle Leaf with Rose Testa Mutant NRCG09-2 (IC567686; INGR09128), a Ground nut (*Arachis hypogaea*) Germplasm with Multiple Phenotypic Marker Stock with Crinkle Leaf and Red Testa Color, Near-Isogenic Line of Crinkle Leaf with Rose Testa Mutant

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'Crinkle leaf-white testa' mutant (INGR09127; IC567685) of groundnut was developed from the cross involving 'crinkle leaf-rose testa' mutants × 'normal leaf-white testa' germplasm. Similarly, 'crinkle leaf-red testa' mutant (INGR09128; IC567886) of groundnut was developed from the cross involving 'crinkle leaf-rose testa' mutant x 'normal leaf-red testa' germplasm. F_1 progeny was 'crinkle leaf and rose testa' in both the crosses indicating that rose testa colour is dominant over both white and red testa colour and crinkle leaf is dominant over normal leaf in these two crosses. 'Crinkle leaf and testa colour segregated into 9:3:3:1 in the F_2 populations of these two crosses indicating that crinkle leaf and testa colour (rose, red and white) are controlled by two different loci and segregate independently. These newly developed two mutants were evaluated for both qualitative and quantitative traits and were found to be agronomically similar to their female parent except testa colour. Such near-isogenic lines (NILs) with both recessive and dominant traits are important genetic stocks (multiple phenotypic markers) for investigating the function and regulation of genes.

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43. PANDAV (IC569194; INGR09129), a Chilli (*Capsicum annuum*) Germplasm with Erect Cluster Bearing De-stalking Nature of Fruits, Low Pungency and Bright Colour

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The Chilli (*Capsicum annuum* L.) germplasm accession "PANDAV" assume importance in view of combination of a number of desirable morphological and agronomic traits. The most unique and distinguishing morphological traits are erect and clustered habit and de-stalking nature of fruits. The other advantage of this particular entry are uniformity and reduce time for drying of fruits as the fruits get dried on the plant itself as they are erect and exposed to direct sun light. Another advantage is the ease of harvesting of fruits without their pedicels as this genotype bears erect fruits with de-stalking nature which reduce the labour cost to a great extent with almost zero aflotoxins. The significant biochemical traits like capsaicin and capsanthin are at desirable level with 0.5% and 150 ASTA units analyzed by the Spice Board making this genotype suitable for export market. This particular accession has generated lot of interest and is in great demand among the farming community around Tarulawada.

44. Co 0120 (IC565020; INGR09130), a Sugarcane (*Saccharum* spp. Hybrid) Germplasm with High Juice Quality Early in the Season (in 240 days) and High Sugar Recovery

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Co 0120 was derived from a general cross Co 89003 GC at Sugarcane Breeding Institute, Regional Centre, Karnal. The parent (Co 89003) is known for its high juice quality at 300 days, which is in cultivation in Punjab and Haryana states. The genotype flowers late during flowering season (November second fortnight) and is used as a female parent (pollen fertility below 20 %) as a source for juice quality. The clone has medium field habit. It has thin greenish yellow canes with cylindrical internodes, erect leaves and small dentoid auricle. Bud groove prominent extending to atleast $3/4^{th}$ of internode. The clone is free from spines, splits, pith and bud cushion. It was better for CCS% (240 days), CCS% (300 days) and sucrose 5 (300 days) than CoJ 64 and CoPant 84211 (early standards in North Western Zone) in Initial Varietal Trials in the zone. Co 0120 was tested during last 2001–02 to 2005–06 years at SBI, Regional Centre, Karnal for its juice quality in comparison to the best early standard CoJ 64 in the North-Western Zone (Table 1). Improvement in Co 0120 over CoJ 64 with respect to Pol% in juice was 18.66% during October, which reduced to 6.51% during March. These results indicated that Co 0120 is a potential donor for better juice quality especially for earliness. There is more or less linear sugar accumulation in Co 0120 from November to March. Pol% in Co 0120 on 3^{rd} November was 18.20, 18.21 and 17.40 in autumn (12^{th} October), spring (13^{th} March) and summer (15^{th} April) planted canes, respectively. It showed that there was very little effect of planting dates on pol% juice of Co 0120. Its potential was also evaluated at different sugar mills like Modinagar and Ajbapur in UP, and Dasua and Fazilka in Punjab which confirmed the superiority of Co 0120 over CoJ 64 and other early varieties.

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The Chilli (*Capsicum annuum* L.) germplasm accession "PANDAV" assume importance in view of combination of a number of desirable morphological and agronomic traits. The most unique and distinguishing morphological traits are erect and clustered habit and de-stalking nature of fruits. The other advantage of this particular entry are uniformity and reduce time for drying of fruits as the fruits get dried on the plant itself as they are erect and exposed to direct sun light. Another advantage is the ease of harvesting of fruits without their pedicels as this genotype bears erect fruits with de-stalking nature which reduce the labour cost to a great extent with almost zero aflotoxins. The significant biochemical traits like capsaicin and capsanthin are at desirable level with 0.5% and 150 ASTA units analyzed by the Spice Board making this genotype suitable for export market. This particular accession has generated lot of interest and is in great demand among the farming community around Tarulawada.

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Table 1. Pol % in juice in Co 0120 in comparison to CoJ 64 during 2001–2002 to 2005–2006 season at Sugarcane Breeding Institute, Regional Centre, Karnal

Variety	Year	October	November	December	January	February	March
Co 0120	2001-2002	–	18.21	–	19.02	20.13	19.98
	2002-2003	16.09	17.95	19.21	19.77	20.04	20.27
	2003-2004	16.67	17.96	18.54	19.37	19.46	20.04
	2004-2005	14.21	17.08	19.09	20.96	20.98	21.73
	2005-2006	17.62	18.86	19.24	19.42	20.35	21.86
	Mean	16.15	18.01	19.02	19.71	20.19	20.78
% Improvement over CoJ 64	18.66	10.63	9.25	8.54	7.00	6.51	
CoJ 64	2001-2002	–	15.06	–	17.91	18.81	19.30
	2002-2003	12.94	15.07	15.84	16.80	17.57	18.21
	2003-2004	16.12	16.76	18.13	18.50	18.80	19.36
	2004-2005	10.74	16.48	17.58	19.23	19.74	19.84
	2005-2006	14.63	18.02	18.08	18.35	19.44	20.82
	Mean	13.61	16.28	17.41	18.16	18.87	19.51

45. Co 91002 (IC565021; INGR09131), a Sugarcane (*Saccharum* spp. Hybrid) Germplasm with Good Sugar Accumulation (300 days of age, AVT) for Both Peninsular and East Coast Regions and Resistance to Smut and Drought

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(E-mail: sugaris@vsnl.com)

Co 91002 was evaluated during 1996-1998 in AICRP(S) trails of both Peninsular and East Coast zones of India. Based on the mean of two plant crops Co 91002 was among top three in 8 trails for CCS% and in 6 trails for Sucrose% expressing its advantage for juice quality. This clone has the potential for early high sugar accumulation (at 300 days of crop age) with an improvement of 9.29% over Co 85004 and 5.57% over CcC 671 in three centers of peninsular zone (Coimbatore, Pune and Pravaranagar).

The clone also performed well in Mandya (Karnataka) and in the high recovery regions of Maharashtra. In addition, the clone also performed well in three centers of East Coast Zone *viz.*, Anakapalle, Chiplima and Cuddalore for early high sugar (300 days) with an overall improvement of 14.46% compared over Co 6907 and 4.95% over Co 7508.

Due to moderate yield levels, this clone could not be considered for release as a variety for the zone, hence proposed as a genetic stock for early high sugar. The clone possess resistant to smut and drought. The genotype has field habits like tall, medium thick canes without spines or splits. The genotype flowers during mid season (during November) under Coimbatore conditions. The clone is used as a female parent as a source for juice quality, smut resistant and drought resistant by the breeders of the Institute and its use in breeding programmes is expected to produce early high quality genotypes in sugarcane.

Table 1. Pol % in juice in Co 0120 in comparison to CoJ 64 during 2001–2002 to 2005–2006 season at Sugarcane Breeding Institute, Regional Centre, Karnal

Variety	Year	October	November	December	January	February	March
Co 0120	2001-2002	–	18.21	–	19.02	20.13	19.98
	2002-2003	16.09	17.95	19.21	19.77	20.04	20.27
	2003-2004	16.67	17.96	18.54	19.37	19.46	20.04
	2004-2005	14.21	17.08	19.09	20.96	20.98	21.73
	2005-2006	17.62	18.86	19.24	19.42	20.35	21.86
	Mean	16.15	18.01	19.02	19.71	20.19	20.78
% Improvement over CoJ 64	18.66	10.63	9.25	8.54	7.00	6.51	
CoJ 64	2001-2002	–	15.06	–	17.91	18.81	19.30
	2002-2003	12.94	15.07	15.84	16.80	17.57	18.21
	2003-2004	16.12	16.76	18.13	18.50	18.80	19.36
	2004-2005	10.74	16.48	17.58	19.23	19.74	19.84
	2005-2006	14.63	18.02	18.08	18.35	19.44	20.82
	Mean	13.61	16.28	17.41	18.16	18.87	19.51

45. Co 91002 (IC565021; INGR09131), a Sugarcane (*Saccharum* spp. Hybrid) Germplasm with Good Sugar Accumulation (300 days of age, AVT) for Both Peninsular and East Coast Regions and Resistance to Smut and Drought

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Co 91002 was evaluated during 1996-1998 in AICRP(S) trails of both Peninsular and East Coast zones of India. Based on the mean of two plant crops Co 91002 was among top three in 8 trails for CCS% and in 6 trails for Sucrose% expressing its advantage for juice quality. This clone has the potential for early high sugar accumulation (at 300 days of crop age) with an improvement of 9.29% over Co 85004 and 5.57% over CcC 671 in three centers of peninsular zone (Coimbatore, Pune and Pravaranagar).

The clone also performed well in Mandya (Karnataka) and in the high recovery regions of Maharashtra. In addition, the clone also performed well in three centers of East Coast Zone *viz.*, Anakapalle, Chiplima and Cuddalore for early high sugar (300 days) with an overall improvement of 14.46% compared over Co 6907 and 4.95% over Co 7508.

Due to moderate yield levels, this clone could not be considered for release as a variety for the zone, hence proposed as a genetic stock for early high sugar. The clone possess resistant to smut and drought. The genotype has field habits like tall, medium thick canes without spines or splits. The genotype flowers during mid season (during November) under Coimbatore conditions. The clone is used as a female parent as a source for juice quality, smut resistant and drought resistant by the breeders of the Institute and its use in breeding programmes is expected to produce early high quality genotypes in sugarcane.