

PGR Management and Use – COMPONENT II

(Detailed Evaluation and Utilization)

Progress Report

I. Name of the crop: Wheat

1. Name & address of the lead centre: ICAR-NBPGR, Pusa, New Delhi-110 012
2. Name of the Nodal person & designation : Dr. R. K. Tyagi, Head, GCD & LCPC
Dr. J. C. Rana, Head, GED & Dy. LCPC
Dr. Jyoti Kumari, Senior Scientist, GED,
3. Name of the Nodal persons, designation and address of collaborating centre (s):

Name of centre	Name of nodal person, designation and address of collaborating centre
ICAR-IIWBR, Karnal	Dr. Arun Gupta, Principal Scientist, ICAR-IIWBR, Karnal
PAU, Ludhiana	Dr. Achla Sharma, Assistant Wheat Breeder, Department of Plant Breeding and Genetics, PAU, Ludhiana-141004
BHU, Varanasi	Prof. L.C. Prasad Professor-cum-Sr. Scientist Deptt. of Genetics & Plant Breeding Instt. of Agricultural Sciences Banaras Hindu University, Varanasi 221 005
ICAR-VPKAS, Almora	Dr. B.R Raghu Scientist (Plant Breeding) ICAR-VPKAS, Almora- 263601
GBPUA&T, Pantnagar	Dr. J. P. Jaiswal Professor & Sr. Wheat Breeder Deptt. of Genetics & Plant Breeding G.B. Pant University of Agriculture & Technology Pantnagar- 263 145, U.S. Nagar, Uttarakhand
IARI Regional Station, Wellington	Dr. M. Sivasamy Head, IARI Regional Station Wellington -643231(TN)
ICAR-IIWBR, Karnal	Dr R.K. Gupta PI (Quality) & Dr. MS Saharan PI (Crop Protection) ICAR-IIWBR, Karnal-132001

ICAR-CSSRI, Karnal*	Dr. P. C. Sharma Head, CI Division ICAR-CSSRI, Karnal
UBKVV, Cooch-behar	Dr. Saikat Das Junior Breeder (Assistant Professor) Uttar Banga Krishi Viswavidyalaya Pundibari, CoochBehar, West Bengal-736165
CCS HAU, Hisar	Dr. O.P. Bishnoi Assistant Scientist (Wheat Section) Department of Plant Breeding and Genetics CCSHAU, Hisar-125004
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ICAR-NBPGR, New Delhi	Dr. Jyoti Kumari, Sr. Scientist, GED and Dr. Sandeep Kumar, Sr. Scientist, GED

*Without fund as voluntary centre

Seed multiplication for characterization and evaluation

A total of 2,200 wheat germplasm were grown at GBPUAT, Pantnagar during *rabi* 2013-14 for seed multiplication. In addition, 2,800 and 1,576 accessions were also grown during *rabi* 2014-15 and *rabi* 2015-16 at ICAR-NBPGR, New Delhi for seed multiplication.

Project activities and achievements during *rabi* 2014-15

A total of 1,483 wheat accessions were evaluated during *rabi* 2014-15 for agronomic traits (3 locations), biotic stress traits (foliar blight- 2 locations; brown and black rust (2 locations), yellow and brown rust (3 locations), Karnal bunt (2 locations), powdery mildew and smut (1 location) and abiotic stress (drought stress at NBPGR, New Delhi) (**Fig. 1**) (**Table 1**). The experiment was conducted under field conditions in augmented block design with 3 national checks and 1-2 local checks for agronomic evaluation whereas, in biotic stress evaluation trial resistant and susceptible checks were used in the trial in addition to infector rows. Sowing was done in the last week of November and standard agronomic practices were followed.



Fig. 1: Evaluation of wheat germplasm under rainfed condition at ICAR-NBPGR, New Delhi

Agronomic evaluation

Agronomic evaluations of wheat germplasm were carried out for 16 traits at three locations BHU, Varanasi; PAU, Ludhiana and ARI, Pune. At Varanasi promising accessions were found as grain weight: 6 acc. (>50 g); grains per spike: 16 (>60); days to heading: 5 (<70). Whereas, at Ludhiana promising accessions for different traits were - grain weight: 13 acc. (>50 g), grains per spike: 53 (>70), days to heading: 22 (<80). Similarly, at ARI, Pune promising accessions were obtained as, grain weight: 23 acc. (>50 g), grains per spike: 43 (>60) and days to heading: 15 (<50). Across the locations, 28 accessions were found promising for 1000 grain weight (>51 g), grains per spike (>72) and days to heading (<80 days) (**Table 3**). Some of the promising accessions are: IC542117, IC543413, IC529191, IC539347, IC586034, IC549479, IC393885 and IC564157.

Evaluation for biotic stress

Wheat germplasm were evaluated for tolerance against brown and black rust at 2 locations ARI, Pune and IARI-RS, Wellington. A total of 97 accessions were found tolerant. Screening against yellow and brown rust at 3 locations (Karnal, Ludhiana and Pantnagar) led to identification of 267 acc., 91 acc. and 678 acc. respectively.

Screening against Karnal bunt at 2 locations (Ludhiana and Karnal) under artificially epiphytotic condition resulted into identification of 58 and 21 accessions respectively. Screening against flag smut resulted into identification of 103 lines with no infection.

For loose smut screening at VPKAS, Almora, four ear head each of 1,417 accessions were inoculated during year 2014-15 by using modified 'Go-go' method at growth stage '59' of Zadoks' scale with loose smut teletospores.

In addition, for screening against foliar blight, twenty four wheat accessions, IC524292, IC530025, IC558801, IC547668, IC539312, IC372646, IC529193, IC529171, IC543392, IC75222, IC549358, IC262740, IC529332, IC529348, IC528877, IC402035, IC539549, IC529243, IC529192, IC539275, IC539564, IC542087, IC498433 and IC443761 were found resistant across two locations Coochbehar and Varanasi (**Table 3**).

Table 1. Details of evaluation of wheat germplasm during *rabi* 2014-15

Trait (s)	Centres	No. of acc. evaluated	Checks used	No. of des.	Data received	Promising accessions
Agronomic	BHU, Varanasi	1,483	C306, HD 2967, Raj 3765, HUW 468	16	Yes	Grain weight: 6 acc. (>50 g) Grains per spike: 16 (>60) Days to heading: 5 (<70)
	PAU, Ludhiana	1,483	PBW 343, WH 1105, Raj 3765, C 306 and HD 2967	18	Yes	Grain weight: 13 acc. (>50 g) Grains per spike: 53 (>70) Days to heading: 22 (<80)
	ARI, Pune	1,483	C306, HD 2967, MACS 6222, Raj 3765	18	Yes	Grain weight: 23 acc. (>50 g) Grains per spike: 43 (>60) Days to heading: 15 (<50)
Foliar blight	UBKV, Coochbehar	1,483	DBW 39, Sonalika	3	Yes	28 acc.
	BHU, Varanasi	1,483	C306, HD 2967, Raj 3765, HUW 468	3	Yes	124 acc.
Brown and Black rust	ARI, Pune	1,483	C306, HD 2967, MACS 6222, Raj 3765	3	Yes	97 acc.
	IARI,RS, Wellington	1,483 (Data not received)	-	-	-	-
Yellow and Brown rust	PAU, Ludhiana	1,483	PBW 343, WH 1105, Raj 3765, C 306 and HD 2967	2	Yes	91 acc.

	GBPUA&T, Pant nagar	1,483	WH 1105, DPW621- 50, PBW 343, Agra local	2	Yes	678 acc.
	ICAR- IIWBR, Karnal	1,483	Infectior row by mixing seed of all susceptible line was planted for yellow rust.	2	yes	267 acc.
Karnal bunt	PAU, Ludhiana	1,483	Inoculated for Karnal bunt	1	yes	21 acc.
	ICAR- IIWBR, Karnal	Karnal Bunt (123), Flag smut (200)	Inoculated for Karnal bunt and flag smut.	2	Yes	58 acc.
Powdery mildew and smut	ICAR- VPKAS, Almora	1,427 inoculated for loose smut		-	-	Inoculated
Quality (Protein content, Hectolitre weight and Sedimentation value)	ICAR- IIWBR, Karnal	Quality Evaluation (1,403 from Pune and 614 from Varanasi)	C306, HD 2967, Raj 3765	3	Yes	3 acc.(Protein content)
	ICAR- NBPGR, New Delhi	1,483	C306, HD 2967, Raj 3765			Nine (Hectolitre weight)
Salinity	CSSRI, Karnal	1,483	HD2967, C306, Raj3765, KRL3-4, Kharachia local			Under Compilation
Drought	ICAR- NBPGR, New Delhi	1483	HD2967, C306, Raj3765, WR544			Grain yield: IC375957, IC549377, IC543440, IC519900 (>900 g) Grains per spike : IC560456, IC539527 , IC443663 (>70.00)

Project activities and achievements during *rabi* 2015-16

A total of 1,485 wheat accessions were evaluated during *rabi* 2015-16 for agronomic traits (3 locations), biotic stress traits: foliar blight- (2 locations); brown and black rust (2 locations), yellow and brown rust (3 locations namely GBPUAT, Pantnagar (**Fig. 2**), Karnal and PAU, Ludhiana) Karnal bunt (2 locations), powdery mildew and smut (1 location), abiotic stress traits: drought stress at CCSHAU, Hisar (**Fig. 3**) using augmented block design and checks as specified in Table 2 and for quality traits seeds from 2 locations were used.

Agronomic evaluation

A total of 1,485 accessions were grown for agronomic evaluation at three locations, BHU, Varanasi; PAU, Ludhiana and ARI, Pune. Among agronomic traits, promising accessions for 1000 seed weight at PAU, Ludhiana were IC582710, IC253012, IC539321, IC401979, IC252705, IC531927, IC116276, IC539531, IC539314 and IC547675 with (>46 g); at ARI, Pune were IC415939, IC566635, EC576887 and IC310584 (>50 g); at BHU, Varanasi were EC014107, EC576557, IC111968 and IC535704 (>48 g). In addition, 450 germplasm lines of *durum* and *dicoccum* were grown at UAS, Dharwad for evaluation of agronomic traits and quality evaluation. IC296756, IC252755, IC533677, EC277013, IC252356 and IC309879 were found promising for 1000 grain weight with more than 45 g 1000 seed weight (Table 3).

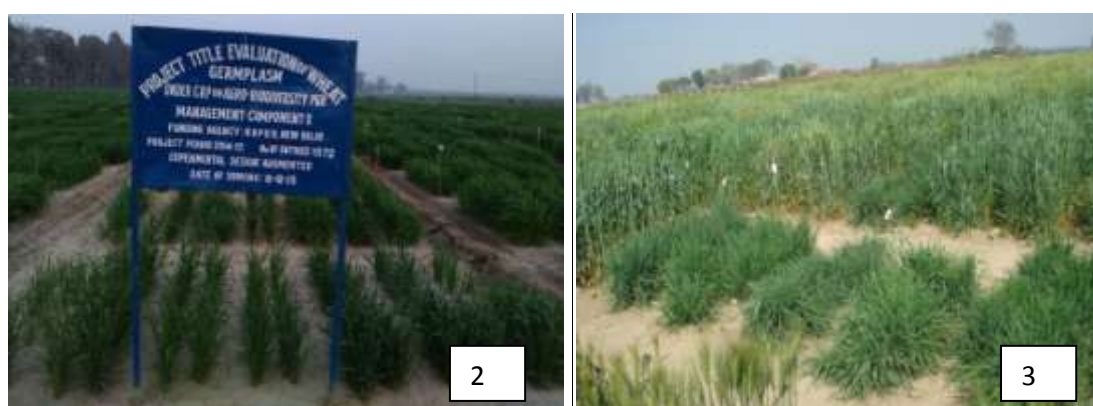


Fig 2 & 3. Evaluation trial at (a) GBPUAT, Pantnagar and (b) CCSHAU, Hisar during rabi 2015-16

Evaluation for biotic stress

Wheat germplasm were evaluated for tolerance against brown and black rust at 2 locations ARI, Pune (**Fig. 4**) and IARI-RS, Wellington, and 213 and 50 accessions were found tolerant respectively. Screening against yellow and brown rust at 3 locations (Karnal, Ludhiana (**Fig. 5**) and Pantnagar) led to identification of 47 acc., 28 acc. and 945 acc. respectively. The disease pressure was low at Pantnagar and hence 945 out of 1,485 lines were found resistant to both the rusts. Fifty two lines were found highly susceptible to yellow rust with severity from 40S to 80S and 290 lines were found highly susceptible to brown rust with severity from 40S to 100S.



Fig. 4: Brown and black rust screening at ARI, Pune during *rabi* 2015-16 under artificially epiphytotic condition



Fig. 5: Screening against yellow and brown rust at PAU, Ludhiana during *rabi* 2015-16 under artificially epiphytotic condition

Screening against Karnal bunt at 2 locations (Ludhiana and Karnal) under artificially epiphytotic condition resulted into identification of 38 accessions (Karnal). At VPKAS, Almora for loose smut screening, four ear head each of 1,417 accessions were inoculated during year 2014-15 and tolerance/susceptible data were recorded during crop season 2015-16. A total of 173 accessions were found tolerant against powdery mildew and loose smut disease (**Fig. 6**).





Fig 6. Screening against powdery mildew and loose smut at VPKAS, Almora during *rabi* 2015-16 under artificially epiphytotic condition

In addition, for screening against foliar blight, 181 and 99 accessions were found resistant across two locations Coochbehar and Varanasi (**Fig. 7**) centres respectively.



Fig 7: Foliar blight screening at BHU, Varanasi during *rabi* 2015-16 under artificially epiphytotic condition

Biochemical analysis of grain samples (1,483 acc.) from two locations (BHU, Varanasi and PAU, Ludhiana) were carried out at IIWBR, Karnal for protein content, sedimentation value and hectolitre weight. Three accessions such as IC177770, IC445359 and EC177825 were found promising for higher protein content (>15% grain protein at Pune and > 13% at Varanasi). Some value rich accessions were identified for test weight/hectolitre weight with values >83.0 including EC178071-555 (84.5), IC443640 (84.5), EC178071-505 (84), IC443627 (84), IC415868 (83.5), IC309885 (83.5), IC542001 (83.5), IC539543 (83.5), IC543356 (83.5), IC281570 (83), IC551376 (83), IC542090 (83), IC329444 (83), IC543443 (83), and IC402039 (83) (Table 4).

Based on evaluation during year 2014-15 at different location promising germplasm were selected and validated during second year (2015-16) for example, agronomic (28 acc.), foliar blight (24 acc.), brown and black rust (58 acc.), yellow and brown rust (87 acc.), yellow rust, brown rust and Karnal bunt (65 acc.). For agronomic traits, superior accessions were as: 18 acc.(grain weight -IC542117, IC543413 etc.), 17 (grains per spike) and 5 (earliness). Thus based on observations recorded at multi-locations and multi-year data, eight wheat accessions IC177785, IC128153, IC530072, IC443736, IC543400, IC529292, IC542127 and IC539162

were found resistant to Karnal bunt both at Karnal and Ludhiana; thirteen wheat accessions such as IC443639, IC542104, IC553914, IC543448, IC549338, IC445489, IC547699, IC539535, IC541996, IC543335, IC543404, IC498431 and EC177734 were found resistant to both yellow and brown rust in multi-location testing at three centres Karnal, Ludhiana and Pantnagar. Twenty four accessions were promising for foliar blight tolerance at two locations, whereas, 16 accessions against brown and black rust diseases across years.

Table 2. Details of evaluation of wheat germplasm during rabi 2015-16

Trait (s)	Centres	No. of accessions evaluated	Checks used	No. of des.	Data received	No. of promising accessions
Agronomic	BHU, Varanasi	1485+ 31*	C306, HD 2967, Raj 3765, HUW 468	16	Yes	10 acc. (1000 grain weight > 45 g)
	PAU, Ludhiana	1485 + 31*	C306, HD 2967, Raj 3765, HD3086	18	Yes	170 acc. (1000 grain weight > 45 g) 80 acc. (Grains per spike >80)
	ARI, Pune	1485	C306, HD 2967, Raj 3765, HD3086	16	yes	48 acc. (1000 grain weight > 45 g) 9 acc. (Grains per spike >70)
Foliar blight	UBKV, Coochbehar	1485 + 28 *	DBW 39, Sonalika	5	Yes	181+24 acc.
	BHU, Varanasi	1485 + 28 *	DBW 39, Sonalika	3	Yes	99 + 24 acc.
Brown and Black rust	ARI, Pune	1485 + 58 *	WL711(SC), GW322 (RC),Infector row	3	Yes	213 + 17acc.
	IARI,RS, Wellington	1485 + 58*	WL711(SC), GW322 (RC),Infector row	3	Yes	50 acc.
Yellow and Brown rust	PAU, Ludhiana	1485 +91*	WL711(SC), WH1105(RC), GW322 (RC)Infector row	3	Yes	28 acc.
	GBPUA&T, Pant nagar	1485 +87*	WL711(SC), WH1105(RC), GW322 (RC)Infector row	3	Yes	945 (disease pressure less)
	IIWBR, Karnal	1445 + 40*	WL711(SC), WH1105(RC), GW322 (RC)Infector row	2	Yes	47 + 19 acc.
Karnal bunt	IIWBR, Karnal	128+200*	WL711(SC), WH1105(RC), GW322 (RC)inoculated	2	Yes	24 +14 acc.
	PAU, Ludhiana	1485	inoculated	2	-	-
Powdery mildew and smut	VPKAS, Almora	1427 552 inoculated				Screened/innoculated

Quality	IWBR, Karnal	1485	-	-	-	-
	NBPGR, New Delhi	1485	-	-	-	-
Drought	CCSHAU, Hisar	1485+28*	C306, HD 2967, Raj 3765, WH1105, WH 1080	15	Yes	Under Compilation
Salinity	CSSRI, Karnal	1485	HD2967, C306, Raj3765, KRL3-4, Kharachia local			Under Compilation
Agronomic (<i>Durum</i> and <i>dicoccum</i>)	UAS, Dharwad	407	DDK1025, DDK1029, UAS415, DWR1006	11	Yes	6 acc. (1000 grain weight >45 g)

***Promising accessions for validation**

Table 3: Promising accessions for various traits across locations and years

Trait(s)	Promising accessions across the locations and years
Agronomic	18 acc.(Grain weight >50: IC542117, IC543413, IC582710, IC253012, IC539321, IC401979, IC252705 etc.), 17 acc.(Grains per spike more than 60): IC529191, IC539347, IC586034, IC543327, IC582706, IC530119, IC445493, IC529757, IC560456, IC539527, IC443663, IC278680, IC128229, EC178071-504, IC443737, IC539165, EC178071-441) 5acc. (Days to spike emergence <80: (IC-549479, IC393885, IC564157, IC443729 and IC539568)
Foliar blight	24 acc. (IC524292, IC530025, IC558801, IC547668, IC539312, IC372646, IC529193, IC529171, IC543392, IC75222, IC549358, IC262740, IC529332, IC529348, IC528877, IC402035, IC539549, IC529243, IC529192, IC539275, IC539564, IC542087, IC498433 and IC443761
Brown and Black rust	16 acc. (IC240797, IC296469, IC415870, IC443640, IC529216, IC529338 etc.)
Yellow and Brown rust	13 acc.(IC443639, IC542104, IC553914, IC543448, IC549338, IC445489, IC547699, IC539535, IC541996, IC543335, IC543404, IC498431 and EC177734)
Yellow , Brown rust and Karnal Bunt	11 acc.(IC529052, IC529902, IC529908, IC530005, IC530058, IC530086, IC533416, IC539162, IC542117, IC543384 and IC543413)
Karnal bunt	14 acc.(IC529052, IC529094, IC529247, IC529902, IC529908, IC530005, IC530025, IC530058, IC530086, IC533416, IC539162 and IC542117)
Powdery mildew and smut	173 accessions were tolerant with no incidence of loose smut and powdery mildew
Quality	3 acc. IC177770, IC445359 and EC177825 (>15% protein content) (based on two locations grain harvest BHU Varanasi and PAU, Ludhiana) 9 acc. EC178071-555, IC443640, EC178071-505, IC443627, IC415868, etc. (>83 Hectolitre weight)
Agronomic (<i>durum</i> and <i>dicoccum</i>)	6 acc. (1000 grain weight >45 g) IC296756, IC252755, IC533677, EC277013, IC252356 and IC309879

4. Details of monitoring:

Monitoring was not done during *rabi* 2014-15.

Monitoring team visited all the centres except IARI, RS, Wellington and UAS, Dharwar during *rabi* 2015-16 (Fig. 7).

Monitoring during 2015-16		
Place	Date of Monitoring	Team
VPKAS, Almora	20 March, 2016	Dr. S. K. Kaushik and Dr. Sandeep Kumar, (NBPGR, New Delhi); Dr. BR Raghu (VPKAS, Almora)
GBPUAT, Pantnagar	21 March, 2016	Dr. S. K. Kaushik and Dr. Sandeep Kumar, (NBPGR, New Delhi) Dr. J.P. Jaiswal (GBPUAT, Pantnagar)
CCSHAU, Hisar	14 March, 2016	Dr. Sandeep Kumar, (NBPGR, New Delhi) Dr. O.P. Bishnoi (CCSHAU, Hisar)
IIWBR, Karnal	7 March, 2016	Dr. Jyoti Kumari, Dr. Ruchi Bansal, Dr. Sandeep Kumar, Dr. S. K. Kaushik (NBPGR, New Delhi) Dr. Arun Gupta and Dr. M. S. Saharan (IIWBR, Karnal)
PAU, Ludhiana	11 March, 2016	Dr. Jyoti Kumari (NBPGR, New Delhi) Dr. Achla Sharma, PAU
BHU, Varanasi	13-14 Feb, 2016	Dr. Sandeep Kumar (NBPGR, New Delhi) Dr. S.S. Vaish (BHU, Varanasi)
ARI, Pune	27 Feb, 2016	Dr. Jyoti Kumari (NBPGR, New Delhi) Dr. B.K. Honrao and Dr. AM Chavan (ARI, Pune)
UBKV, Coochbehar	7-10 March, 2016	Dr. Charan Singh (IIWBR, Karnal) Dr. Saikat Das (UBKV, Coochbehar)



Fig. 7: Monitoring of field trials of wheat germplasm at different centres

5. Publications:

- i. Papers published in peer reviewed journal (NAAS rating may be given):

Jyoti Kumari, T P Singh, Sundeep Kumar, Ruchi Bansal, Sunil Kumar, Surendra K Singh, G K Jha, Sandeep Kumar, Vikender Kaur, Sherry R Jacob, R K Tyagi and J C Rana (2016). Morpho-Physiological Attributes of Cultivated Wheat Germplasm for high yield potential under Rain fed condition. Biotech Today. 6(1): 13-17.
 - ii. Papers presented at scientific meetings/seminar/symposia, etc.: Nil
 - iii. Manuscripts under preparation: One
6. Patents/varieties and products developed or in pipeline: 3
7. Patents/varieties and products developed or in pipeline: Nil

Signature:

Name :

Designation:

Principal Investigator:

Date:

Director/Project Director /Project Coordinator

II. Name of the crop: Rice

1. Name & address of the lead centre: ICAR-NBPGR, Pusa, New Delhi-110 012
2. Name of the Nodal person & designation : Dr. R. K. Tyagi, Head, GCD & LCPC
Dr. J. C. Rana, Head, GED & Dy. LCPC
Dr. N.K. Gautam, Senior Scientist, GED
3. Name of the Nodal persons, designation and address of collaborating centre (s):

S.No	Centre	Nodal Officer
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2	CRRI, Cuttack	Dr. B.C. Patra, Principal Scientist, Crop Improvement Division, Central Rice Research Institute(CRRI), Cuttack-753006, Odisha. Email: bcpatracrri@yahoo.com Mob: 09937171699
3	IGAU, Raipur	Dr. A.K. Sarawgi, Professor & Head, Depot. Of Genetics and Plant Breeding, IGKV, Krishak Nagar, RAIPUR - 492 006, Chhattisgarh Email: sarawgi1@yahoo.co.in Mob:09425507284
4	GBPUAT, Pantnagar	Dr. Surendra Singh, Professor & Senior Rice Breeder, Dept. of Genetics and Plant Breeding, College of Agriculture, GBPUAT, Pantnagar - 263 145, Dist. U.S. Nagar, Uttarakhand. Email: ss_meher@rediffmail.com, Mob: 09410120640
5	CSSRI, Karnal	Dr. S. L. Krishnamurthy, Scientist, Division of Crop Improvement, Central Soil Salinity Research Institute (CSSRI), Karnal – 132 001, Haryana, Email: krishnagene@gmail.com, Mob: 08053726399
6	AAU, Titabar	Dr. Tomizuddin Ahmed, Chief Scientist, Regional Agricultural Research Station, Assam Agricultural University, Titabar 785 630, Assam, Mob: 09435514080 Email: arsttb@yahoo.com
7	TNAU, Coimbatore	Dr. S. Robin, Professor and Head, Dept. Of Rice, TNAU, Coimbatore-641003, Email:robin.tnau@gmail.com, Mob: 09442224409
8	Hazaribagh	Dr. N.P. Mandal, Senior Rice Breeder, Plant Breeding, CRURRS, Post Box 48, HAZARIBAGH – 825 301, Jharkhand, Email: npmandal@hotmail.com, Mob: 09430391164
9	ICAR Res. Complex for NEH	Dr. Avinash Pandey, Scientist, Plant Breeding, ICAR Res. Complex for NEH Region, Umiam-793103, Meghalaya,
10	VPKAS, Almora	Dr. J.P. Aditya, Scientist, Crop Improvement Division, VIHA, ICAR Mall Road, Almora-263601,Uttarakhand, Email: jpaditya4011@rediffmail.com, Mob:09410795850
11	ARS, Sakoli	B. N. Chaudhari, Jr. Entomologist (Rice) , Agricultural Research Station, Dr. P. D. Krishi Vidyapeeth, Sakoli-441802, Maharashtra Email: bncent@rediffmail.com, Mob: 9404080566
12	APRRI, Maruteru	Dr. P.V. Satyanarayana, Principal Scientist & Officer-in- Charge, APRRI, Maruteru-534122, Andhra Pradesh

Seed multiplication for characterization during *kharif* and *rabi* 2014

A total of 12,160 germplasm accessions of rice were sown for seed multiplication and characterisation at four locations *viz.*, IIRR, Hyderabad (2,500), IGAU, Raipur (6,000), NIRR, Cuttack (3,000) and TNAU, Coimbatore (660). The germplasm were sown some in

augmented block design of 3 meter length with 3 rows of each accessions (Fig. 1) keeping spacing of 20 cm x 15 cm. The checks used were Ananda, NDR 97, Jaya, Pusa Basmati, Swarna and IR 64 (Table 1).

Table 1. Details of Multiplication/Characterization (*kharif/rabi* 2014)

Name of the centre	No. of accessions for multiplication/ characterization	No. of multiplied accessions sent to NGB
IIRR, Hyderabad	3,000 sown, 2,500 germinated	2,500
IGAU, Raipur	6,000	6,000
CRRI, Cuttack	3,000	3,000
TNAU, Coimbatore	660	660



Fig 1: Field layout of rice accessions

Project activities and achievements during *Kharif* 2014

A total of 671 rice accessions were evaluated during *Kharif* 2014 for agronomic traits (4 locations), biotic stress (Gall midge - 2 locations); brown plant hopper (2 locations), blast (4 locations), sheath blight (3 locations), brown spot (1 location), bacterial leaf blight (3 locations) and rice Tungro (2 locations) (Table 2).

Table 2: Evaluation of rice germplasm for biotic Stresses

S.No	Centre	Entomology	Pathology
1	IIRR, Hyderabad	Brown plant hopper, White backed plant hopper, Gall midge	Brown spot , Rice tungro disease, Blast, Sheath blight, Bacterial leaf blight
2	NIRR, Cuttack	Brown plant hopper, Stem borer, Gall midge	Blast, Bacterial leaf blight, Rice tungro disease, Sheath blight
3	IGKV, Raipur	Brown plant hopper, White backed plant hopper, Stem borer	-
4	GBPUAT, Pantnagar	Brown plant hopper	Bacterial leaf blight

5	AAU, Assam	Steam borer	Sheath blight
6	CRURRS, Hazaribagh	-	Blast, Brown spot
7	VPKAS, Almora	-	Blast
8	ARS, Sakoli	Gall midge	-
9	TNAU, Coimbatore	-	-
10	APRRI, Maruteru	Brown plant hopper, White backed plant hopper	Sheath blight, Bacterial leaf blight

Evaluation for biotic stress

A total of 671 rice germplasm were evaluated for tolerance against blast at 4 locations (ICAR-VPKAS, Almora, ICAR-IIRR, Hyderabad, NRRI- CRURRS, Hazaribagh, ARS-TNAU, Gudalur), 8 germplasm accessions were found promising *viz.*, IC86025, IC85716, IC67633, IC67729, IC85713, IC70804, IC85737 and IC67630 (**Fig 2**). Under artificial inoculation conditions experiments were conducted for tolerance against sheath blight at 3 locations (IRRI, Hyderabad, GBPU&T Pantnagar, RARS, Titabar). Only one accession (IC462132) was found moderately tolerant at Titabar.



Fig 2: Blast resistant accessions

Screening against brown spot at NRRI-CRURRS, Hazaribagh revealed that one accession IC211206 was found promising with LSI 7.8. In the case of bacterial leaf blight experiments were conducted at 3 locations (ICAR-IIRR, Hyderabad, GBPUA&T, Pantnagar and RARS, Titabar). A very high disease pressure was recorded at all the centres and 2 accessions IC70869 and IC85713 were found promising against BLB. The same 671 germplasm accessions were screened against rice tungro disease at 2 locations (ICAR-IIRR, Hyderabad and ICAR-NRRI, Cuttack) and 11 germplasm accessions were found promising at ICAR-IIRR (with LSI 6.4) namely (IC85720, IC85754, IC86035, IC86091, IC86114, IC145656, IC208050, IC248014, IC276834, IC462040 and IC462121). In the case of brown plant hopper observation were recorded at 2 locations (ICAR-IIRR, Hyderabad, GBPUAT Pantnagar) and 47 accessions were found promising among them a few accessions are IC216788, IC16737, IC75961 and IC75990. Studies on screening against gall midge were taken at 2 locations (ICAR-IIRR, Hyderabad and ICAR-NRRI, Cuttack) 29 accessions were found promising such as IC75756, IC75772, IC75843, IC75877 etc.

Multiple disease resistant germplasm

Two entries had shown resistance to more than one diseases such as IC85713 (resistance against blast and bacterial blight) and IC248014 (bacterial blight and tungro disease).

Project activities and achievements during *Kharif* 2015

Agronomic evaluation

A total of 14,000 accessions were grown for seed multiplication and agronomic evaluation at four locations, ICAR-IIRR, Hyderabad (3000), ICAR-NRRI, Cuttack (3000), IGKV, Raipur (6000) and TNAU, Coimbatore (2000).

Evaluation for biotic stress

A total of 1,000 rice accessions were evaluated during *Kharif* 2015 for agronomic traits (4 locations), biotic stress traits: Blast - (4 locations); Sheath blight (3 locations), Brown spot (1 locations), Bacterial leaf blight (3 locations) (**Fig 3**), Rice tungro disease (2 location) (**Fig 4**) and white backed plant hopper (3 locations), Brown plant hopper (2 locations), Stem borer (3 locations), Leaf folder (1 location), Gall midge (2 location), Drought (1 location), Nitrogen use efficiency (1 location), Salinity/sodicity (1 location) as per Table 2. The promising accessions against various diseases and insect pests are given in Table 3.



Fig 3 & 4: Screening technique against bacterial leaf blight and rice tungro disease

Table 3: Accessions found promising in different years on overall basis

Disease	2014	2015
Blast	IC86025, IC85716, IC67633, IC67729, IC85713, IC70804, IC85737, IC67630, IC89079, IC144581, IC146140, IC67626, IC146093 and IC462136	IC21168, IC757790, IC75965, IC76001, IC76072
Sheath blight	IC462132	IC216801, IC216953, IC216958, IC216990, IC217196
Brown spot	IC211206	IC-211168, IC217012, IC217091, IC217210, IC217196, IC217217
Bacterial leaf blight	IC70869 and IC85713.	IC76015, IC76051, IC76052, IC75802, IC72786, IC75972
Rice tungro disease	IC85720, IC85754, IC86035, IC86091, IC86114, IC145656, IC208050, IC248014, IC276834, IC462040 and IC462121	IC75960, IC76033, IC461079, IC216596, IC216856 and IC218438

Brown plant hopper	IC216788, IC216737, IC75961, IC75990	IC216750, IC216788, IC216737, IC75961
Gall midge	IC75756, IC75772, IC75843, IC75877	IC17118X, IC75772,
White backed plant hopper		IC459770X, IC458768, IC449549X, IC75761
Steam borer		IC75772, IC458770, IC75930
Leaf folder		IC458780, IC75731, IC75770, IC75785, IC75830
Gall midge		Promising accessions 31 (Score 0)
Drought		IC75889, IC455399, IC540676, IC215054, IC217211, IC217496
Nitrogen use efficiency (NUE)		IC206033, IC211169, IC86073, IC85713, IC248011, IC203465, IC248006, IC86136

Multiple disease resistant germplasm

Two entries had shown resistance to more than one diseases such as IC85713 (resistance against blast and bacterial blight) and IC248014 (bacterial blight and tungro disease).

Evaluation for drought resistance, CRURRS, Hazaribag 2015

A total of 1,100 germplasm accession of rice were screened against drought during vegetative stage at Hazaribagh using Kalinga 3 and IR 20 as susceptible checks whereas, CR 143-2-2, Vandana were used as resistant checks. Drought score was based on leaf drying at vegetative stage following IRRI Standard Evaluation System (1996) Stress period from Sept. 1st 2015. Fourteen accession (**Fig 5**) were found promising with a score 3 (IC75889, IC455399, IC540676, IC215054, IC217211, IC217496 etc.).

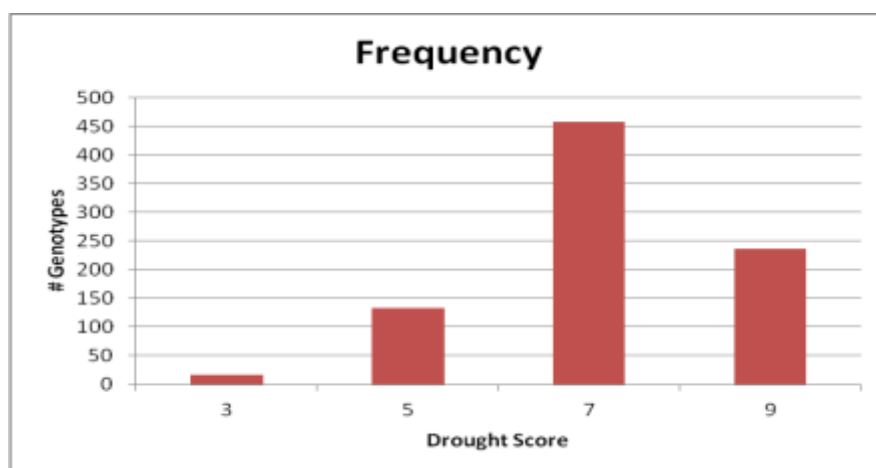


Fig 5: Frequency distribution of accessions against drought at CRURRS, Hazaribag

Nitrogen use efficiency (NUE)

A total of 658 germplasm lines were evaluated for their nitrogen use efficiency (NUE) (**Fig 6**) at ICAR-IIRR Hyderabad by subjecting them to sub optimal (Soil available N only without fertiliser N application) and optimal (recommended N application at 100 kg/ ha)

levels of N application under field experiment during *kharif*, 2015. Around 20 lines were damaged by wild boars.

At N 0 (Zero), the panicle no of these lines ranged from 82 – 330/ m² and at N 100, it ranged from 106- 396/ m². Grain yield at N 0 ranged from 0.2 to 4.0 t/ ha and at N100, it ranged from 0.5 to 5.00 t/ ha. Out of 640 lines, the lines IC248063 and IC85757 were highest yielders at N0 and at N100, lines IC85746 and IC207998 were highest yielders. Among the top 20 lines, the lines IC206033 and IC 211169 recorded higher yields both at N 0 and N 100 and these are considered to be efficient lines in utilizing soil available N and also applied fertilizer N. Other few lines that are considered efficient are: IC86073, IC85713 and IC248011 at N 0 and IC203465, IC248006 and IC86136 at N 100. A total of twenty promising accessions were identified (IC206033, IC211169, IC86073, IC85713, IC248011, IC203465, IC248006, IC86136 etc.)



Fig 6: Screening of rice germplasm for Nitrogen use efficiency

Details of monitoring

Monitoring was not done during *kharif* 2014.

Monitoring team visited ICAR-IIRR, Hyderabad during *kharif* 2015 (**Fig. 7**).



Fig 7: Monitoring of rice field experiments during 2015 at ICAR-IIRR, Hyderabad

4. Publications:

- iv. Papers published in peer reviewed journal (NAAS rating may be given): Nil
- v. Papers presented at scientific meetings/seminar/symposia, etc.: Nil
- vi. Manuscripts under preparation: One

4. Patents/varieties and products developed or in pipeline: Nil

Signature:

Name :

Designation:

Principal Investigator:

Date:

Director/Project Director /Project Coordinator

III. Name of the crop: Chickpea

1. Name & address of the lead centre: ICAR-NBPGR, Pusa, New Delhi-110 012
2. Name of the Nodal person & designation : Dr. R. K. Tyagi, Head, GCD & LCPC
Dr. J. C. Rana, Head, GED & Dy. LCPC
Dr. Ashok Kumar, Principal Scientist, GED
Dr. Gayacharan, Scientist, GED
3. Name of the Name of nodal person, designation and address of collaborating centre (s):

Name of centre	Name of nodal person, designation and address of collaborating centre
ICAR-IIPR, Regional Centre, Bhopal	Dr. Archana Singh, Principal Scientist, ICAR-IIPR, Regional Centre, Bhopal, (MP)
GBPUA&T, Pantnagar	Dr. Ramesh Chandra, Jt. Director Research GB Pant Univ. of Agric. & Tech.
PAU, Ludhiana	Dr. Jagmeet Kaur, Principal Scientist, PAU, Ludhiana
DARS, Gulbarga	Dr. D. M. Mannur, Principal Scientist DARS, Gulbarga
JNKVV, Jabalpur	Dr. A. K. Bhowmick, Principal Scientist JNKVV, Jabalpur
CSKHPKV, Dhaulakuan	Dr. Ashwani K. Basandrai, Principal Scientist CSKHPKV, Dhaulakuan
RARI, Durgapura	Dr. S. J. Singh, Addl. Director Research, RARI, Durgapura

Project activities and achievements during *rabi* 2014-15

The evaluation of chickpea germplasm for different parameters is being undertaken at different centre/hot spots. The details of centres for evaluation against different parameters for chickpea germplasm have been given in table 1. During *rabi*, 2014-15, a total 736 accessions of chickpea were provided to seven AICRP centres for agronomic evaluation and evaluation against

biotic (pod borer, wilt, collar rot, *Botrytis* grey mould, *Ascochyta* blight, dry root rot) and abiotic stresses with special emphasis on drought and cold.

Table 1. Details of evaluation of chickpea germplasm at different centres/hot spots

Purpose of evaluation	Traits of evaluation	Collaborating centres
Agronomic evaluation	Agronomic	JNKV, Jabalpur RAU, Durgapura UAS, Gulbarga
Biotic stress	<i>Ascochyta</i> blight	HPKV, Dhaulakuan
	Wilt	JNKV, Jabalpur
	Dry root rot	RAU, Durgapura
	Collar rot	JNKV, Jabalpur
	<i>Botrytis</i> gray mold	PAU, Ludhiana
	Pod borer	IIPR, Kanpur; GBPUAT, Pantnagar
Abiotic stress	Drought	RAU, Durgapura UAS, Gulbarga
	Cold	HPKV, Dhaulakuan
Quality	Quality traits (Protein)	NBPGR, New Delhi

In most of the centres, the experiment was conducted under field conditions in augmented block design (ABD). The details of experiments of evaluation carried out at different centres like number of accessions, traits of evaluation, checks used etc given in table 2. The promising accessions for different agronomic traits have been identified at JNKV Jabalpur. Thirty accessions have been identified as early flowering (<55 days to 50% flowering). Six accessions namely IC83512, IC83486, IC83818, IC83874, IC116329 and IC83517 found promising for number of pods/plant (>145 pods/plant). Eleven accessions namely EC490039, IC116626, IC117727, IC83997, IC83943, IC84119, EC498827, IC83438, IC83344, IC83990, and EC490014 recorded for bold seediness (>25 g/100 seed weight). Eight accessions viz. IC83346, IC116325, IC73118, IC83486, IC83327, IC83587, IC116337 and IC83592 were found promising for yield/plant (>20 g/plant). For evaluation against pod borer, EC198580, EC198583, EC198707, EC219928 and EC220006 were found tolerant under field condition and two accessions IC83409 and IC116287 were found tolerant using

3rd instar and 4th instar larvae bioassay at IIPR, Bhopal centre and two accessions, IC83519 and IC84053 (Score 2) found promising for pod borer at GBPUA&T, Pantnagar centre. Similarly, 13 accessions and seven accessions had shown zero percent mortality for collar rot and wilt respectively, while three accessions such as IC83330, IC116347 and IC267443 scored zero percent mortality for both the diseases at JNKV, Jabalpur (Table 2). Screening against *Botrytis* grey mould (BGM) at PAU, Ludhiana, six accessions namely IC83522, IC83523, IC83524, IC83525, IC83536, IC83720 scored less than 4. Seventy five accessions found promising (Score 5) for *Ascochyta rabiei*, a local isolate at CSK HPKV, Dhaulakuan and three accessions, EC267154, EC267240 and EC528345B scored less than 5 for *Ascochyta* blight at PAU, Ludhiana (**Fig 1**).



Fig 1: Screening technique for *Ascochyta* blight (AB) (left) and reaction of chickpea accessions to AB at PAU, Ludhiana

At RARI, Durgapura, five accessions such as IC95082, IC83703, IC83854, IC83819 and IC116347 found resistant dry root rot. Ten accessions viz. IC84023, EC442228, IC116341, IC116453, IC84019, IC116336, IC83536, EC442300, IC83870 and IC83545 were identified superior based on their agronomic performance under drought conditions at RARI, Durgapura. Based on the evaluation, the details of promising accessions identified for different traits have been presented in table 2.

Table 2: Evaluation of chickpea germplasm during *rabi* (2014-15)

Trait(s)	Centres	No. of acc. evaluated	Checks used	No. of promising acc.	Promising accessions
Agronomic	IIPR, Bhopal	736		5 acc.	EC198580, EC198583, EC198707, EC219928, EC220006
	JNKV, Jabalpur	736		12 acc.	Days to flowering (IC84021, IC84000); Days to Maturity (IC83830); Plant height (IC83991, IC83997); No of pods/plant (IC83512, IC83486); 100 seed weight (EC 490039); Biological yield (IC83512); Seed yield (IC83346, IC116325); Harvest index (IC83587)
<i>Ascochyta</i> blight	HPKV, Dhaulakuan	736	ILC263, L293	5 acc.	EC267265, EC267272, EC267293, EC489910 and EC554996
	PAU, Ludhiana	736	L550, C214	3 acc.	EC267154, EC267240 and EC528345B
Wilt	JNKV, Jabalpur	736	JG 62 (Infector row)	4 acc.	IC83330, IC116347, IC267443 and IC83791
Dry root rot	RAU, Durgapura	736	RSG-888, RSG-973	5 acc.	IC95082, IC83703, IC83854 and IC83819, IC116347
Collar rot	JNKV, Jabalpur	736	JG62	4 acc.	EC555195, IC83330, IC83363 and IC83395
<i>Botrytis</i> gray mould	PAU, Ludhiana	736	G543/H208	6 acc.	IC83522, IC83523, IC83524, IC83525, IC83536 and IC83720
Pod borer	IIPR, Kanpur	736	JG-16, JG-11, Ujjwala	2 acc.	IC83409 and IC116287
	GBPUAT, Pantnagar	736	PG186, L550	4 acc.	IC83519, IC84053(B), IC27236 and EC490030
Drought	RAU, Durgapura	736	RSG-888, RSG-973	5 acc.	EC442228, IC43545, IC83536 and IC583534, IC83531
	UAS, Gulbarga	736	A-1, JG-11	3 acc.	
Cold	HPKV, Dhaulakuan	736			
Quality traits (Protein)	NBPGR, New Delhi	736			

Project activities and achievements during *rabi* 2015-16

During *rabi* 2015-16, a total of 250 accessions of chickpea were supplied to different seven centres for their evaluation against biotic and abiotic stresses. The experiments were conducted in augmented block design (ABD) at almost all the centres. Out of seven centres, four have provided the data, those centres are, PAU, Ludhiana, JNKV, Jabalpur, GBPUA&T, Pantnagar, CSKHPKV, Dhaulakuan. The centre wise details of experiments like number of accessions, traits of evaluation, checks used and promising accessions etc given in table 3. For evaluation against pod borer, 13 accessions, IC259398, IC269553, IC269605, IC269629,

IC270723, IC272471, IC272678, IC275234, IC275328, IC275550, IC275853, IC299232 and IC299264 (Score 2) found promising for pod borer at GBPUA&T, Pantnagar centre (Table 3). Eighteen accessions namely, IC244600, IC 244614, IC267112, IC269307, IC275402, IC297324, IC327563, IC328299, IC347907, IC486170, IC486759, IC487002, IC487359 and IC512059 had shown 0 to 10 per cent mortality for wilt in both the replications at JNKV, Jabalpur centre. Similarly, ten accessions, namely IC209375, IC269297, IC270930, IC275406, IC328299, IC347907, IC350829, IC486170, IC486759 and IC487359 have shown 0 to 10 percent mortality for collar rot at JNKV, Jabalpur centre. While, five accessions, IC328299, IC347907, IC486170, IC486759 and IC487359 scored zero to 10 percent mortality for both the diseases at JNKV, Jabalpur. Screening against Botrytis grey mould (BGM) at PAU, Ludhiana, (**Fig. 2**) seven accessions namely IC350842, IC350838, IC350846, IC327527, IC327534, IC487033 and IC350844 scored less than 4. For Ascochyta blight resistance, 22 accessions viz. IC244382, IC244384, IC269073, IC275853 (DR=2); IC244366, IC244505, IC244515, IC244584, IC268873, IC348481, EC 267240, IC275447 (DR=3); IC209334, IC244433, IC248133, IC486959, IC244465 and IC335964 (DR=4); IC244365, IC251670, IC251855 and IC334287 (DR=5) showed varying level of resistance for *Ascochyta* blight at CSK HPKV, Palampur and 34 accessions viz.. IC348562, ICC9074, ICC2271, ICC3937, IC506936, IC486625, IC487200, ICC3956, EC267186, IC269675, IC26957, IC269293, IC268963, ICIC251727, IC249572, IC265298, IC244627, ICC3848, IC248149, IC244269, IC209633, EC219997, IC270469, ICC4009, ICC3660, IC248133, IC251816, IC269247, IC244384, IC251732, IC275694, IC244267, IC261223 and IC244619 were found resistant at CSK HPKV Dhaulakuan centre. For screening against abiotic stresses, 250 accessions screened for cold at CSK HPKV Dhaulakuan centre and out of them 150 accessions have no cold injury and susceptibility symptoms. Based on the evaluation, the details of promising accessions identified for different traits have been presented in table 4.



Fig 2: Screening of chickpea germplasm against Botrytis grey mould (BGM) at PAU, Ludhiana

Table 3: Evaluation of chickpea germplasm during *rabi* 2015-16

Trait(s)	Centres	No. of acc. evaluated	Checks used	No. of promising acc.	Promising accessions
<i>Ascochyta</i> blight	CSKHPKV, Dhaulakuan	250	ILC263	42 acc.	IC348562, ICC9074, ICC2271, ICC3937, IC506936, IC486625, IC487200, ICC3956, EC267186, IC269675, IC26957, IC269293, IC268963, IC251727, IC249572, IC265298, IC244627, IC248149, IC244269, IC209633, EC219997, IC270469, ICC4009, IC248133, IC251816, IC269247, IC244384, IC251732, IC275694, IC244267, IC261223, IC244619
	HPKV, Malan	250	Pb.7, ILC263	16 acc.	IC244382, IC244384, IC269073, IC275853, IC244366, IC244505, IC244515, IC244584, IC268873, IC348481, EC267240, IC275447
	PAU, Ludhiana	250	L550/C214 (Infector row)	8 acc.	IC275447, IC209641, IC209317, IC209355, IC 209375, IC244185
Wilt	JNKV, Jabalpur	250	JG315(R) JG63(R) JG74(S) JG315(S)	18 acc.	IC244600, IC 244614, IC267112, IC269307, IC275402, IC297324, IC327563, IC328299, IC347907, IC486170, IC486759, IC487002, IC487359, IC512059
Dry root rot	RAU, Durgapura	250			
Collar rot	JNKV, Jabalpur	250	JG315(R) JG63(R) JG74(S) JG315(S)	10 acc.	IC209375, IC269297, IC270930, IC275406, IC328299, IC347907, IC350829, IC486170, IC486759, IC 487359,
<i>BGM</i>	PAU, Ludhiana	250	L550(S)	7 acc.	IC350842, IC350838, IC350846, IC327527, IC327534, IC487033, IC350844
Pod borer	IIPR, Kanpur	250			
	GBPUAT, Pantnagar	250	ICCL 86111, ICC 3137	13 acc.	IC259398, IC269553, IC269605, IC269629, IC270723, IC272471, IC272678, IC275234, IC275328, IC275550, IC275853, IC299232, IC299264
Drought	RAU, Durgapura	250			
	UAS, Gulbarga	250			
Cold	HPKV, Dhaulakuan	250		167 acc.	IC348562, ICC2271, ICC3937, IC506936, IC486625, ICC3956, IC269675, IC269293, ICC3848, IC248149, IC244269, EC219997, IC251816, IC269247, IC275694, IC244619
Quality traits	NBPGR, New Delhi	250			

5. Details of monitoring

No monitoring was conducted during *rabi* 2014-15 due to non availability of funds during the crop season. The monitoring was done during the *rabi*, 2015-16 at JNKVV, Jabalpur and RARI, Durgapura (Fig. 3 & 4) .

The details of monitoring like place of visit, date of visit etc. given below.

Place	Date of Monitoring	Team
JNKVV, Jabalpur	23 Feb., 2016	Dr. Ashok Kumar, NBPGR, New Delhi; Dr. AK Bhowmik, JNKVV, Jabalpur; Dr. Anita Babbar, JNKVV, Jabalpur
GBPUAT, Pantnagar		
RARI, Durgapura	14 March, 2016	Dr. Gaya Charan, NBPGR, New Delhi Dr. S J Singh, RARI, Durgapura (Raj.)
PAU, Ludhiana		
CSKHPKV, Dhaulakuan		



Fig 3 & 4: Monitoring of field trials chickpea germplasm at JNKVV, Jabalpur and RARI, Durgapura

6. Publications:

- vii. Papers published in peer reviewed journal (NAAS rating may be given): Nil
- viii. Papers presented at scientific meetings/seminar/symposia, etc.: Nil
- ix. Manuscripts under preparation: One

7. **Patents/varieties and products developed or in pipeline:** Nil

Signature:

Name :

Designation:

Principal Investigator:

Date:

Director/Project Director /Project Coordinator

IV. Name of the crop: Indian mustard

1. Name & address of the lead centre: ICAR-NBPGR, Pusa, New Delhi-110 012
2. Name of the Nodal person & designation : Dr. R. K. Tyagi, Head, GCD & Dy. LCPC
Dr. J. C. Rana, Head, GED & Dy. LCPC
Dr. Rashmi Yadav, Senior Scientist, GED
3. Name of the Nodal persons, designation and address of collaborating centre (s):

Name of centre	Name of nodal person, designation and address of collaborating centre
ICAR-DRMR, Bharatpur	Dr. J. Nanjundan, Scientist SS (Genetics & Plant Breeding) Directorate of Rapeseed-Mustard Research, Bharatpur -321 303
PAU, Ludhiana	Dr. Shravan Kumar/ Dr PS Sandhu Sr. Breeder Department of Plant Breeding and Genetics, Punjab Agricultural University Ferozpur Road, Ludhiana -141 004 Punjab
PAU, RARS Bhatinda	Dr. Paramjeet Singh Director Research, Regional Research Station (PAU) Bathinda -151 001 Punjab
GBPUA&T, Pantnagar	Dr. Usha Bhatt Assistant Professor, Deptt. of Genetics & Plant Breeding, G.B. Pant University of Agriculture & Technology, Pantnagar- 263 145, U.S. Nagar, Uttarakhand
SAREC, Kangra	Dr. KS Thakur Sr. Breeder, CSK HPKV, Palampur -176 062, Himachal Pradesh
CCS HAU, Hisar	Dr. Ram Avtar Assistant Scientist (Oilseeds Section), CCSHAU, Hisar-125004
ICAR-NBPGR, New Delhi	Dr. Rashmi Yadav, Sr. Scientist, GED Dr. Sandeep Kumar, Sr. Scientist, GED

Achievements during *rabi* 2014-15

A total of 1,000 Indian mustard accessions were evaluated during *rabi* 2014-15 for agronomic traits (2 locations); biotic stress traits (*Alternaria* blight- 2 locations; white rust -2 locations, aphid -2 locations); abiotic stress (cold tolerance-1 locations) (Table 1). The experiment was conducted in augmented block design with 3 national checks and 2 local

checks for agronomic evaluation whereas in biotic stress evaluation trial resistant and susceptible checks were used. Sowing was done in the second week of October and standard agronomic practices were followed.

Seed multiplication for characterization and evaluation

A total of 1,000 Indian mustard germplasm were grown at ICAR- NBPGR, New Delhi during *rabi* 2013-14 for seed multiplication. In addition, 800 accessions were also grown during *rabi* 2014-15 ICAR-NBPGR, New Delhi for seed multiplication.

Agronomic evaluation

Agronomic evaluations of Indian mustard germplasm were carried out at two locations GBPUA&T, Pantnagar; DRMR, Bharatpur for 21 traits. The superior 104 Indian mustard accessions were selected based on their performance for yield component traits viz. days to maturity (<114 days), plant height (< 152 cm), main shoot length (>80 cm), No. of siliquae on main shoot (>80 cm), siliquae density (>1), siliqua length (>5.0 cm), number of seeds/siliqua(> 17), 1000 seed weight (>7.0 g), harvest index (>28%) and oil content(> 42 %).). Promising accessions for different agro-morphological traits across all the locations like dwarf plant habit (19 accs.- IC341108, IC546946, IC342749, IC355313 IC355348, IC491250, IC355369, EC766136 EC766141 EC766127); early flowering (42 accs.), no. of silique on main branch (6 accs.- EC247855, EC347857, EC333564); seeds per silique (15 accs.- IC491455 IC520754 IC491483 IC491565 IC495534 IC491548 IC491554 IC520767), early maturing (19 accs.- IC571687 IC491414 IC491135 IC570287 IC571669 IC571648 EC766560 EC766028 IC399809 EC766136 EC766141 EC766127), 100 seed wt. (25accs.- IC560700 IC491402 IC571668 IC426337 IC399853 IC589653 IC399797 EC766495 IC491096 EC766265), Oil Content (8 accs.- EC766064 (42.3) EC766067 (42.2) EC766070 (42.5) EC766071 (42.1) EC766097 (42.4) EC766203 (42.2) EC766286 (42.2) EC766440 (42.2)) were selected and sown for validation during *rabi* 2015-16.

Evaluation for biotic stress

Indian mustard germplasm were also evaluated for biotic stress (white rust, *Alternaria* blight and aphid) at 2 locations GBPUA&T, Pantnagar and PAU, Ludhiana. Some promising accessions based on 2 locations were identified: white rust (tolerant -7 acc. EC399296 EC491607 IC01727 IC07128 IC07129 IC07132 IC264131), *Alternaria* blight (Moderately tolerant- 43 acc- IC11765, IC10965 IC10976 IC113146 IC113148), Aphid (Moderately tolerant - 10 acc.). No accession was found resistant to aphid in all the locations.

Table 1. Details of evaluation of Indian mustard germplasm during *rabi* 2014-15

Trait(s)	Centres	No. of acc. evaluated	Checks used	Data received	Promising accessions
Agronomic	GBPUA&T, Pantnagar	1000	RGN 73, Kranti, Maya, NPJ-112	Yes	704: days to maturity (<130 days) 30: plant height (< 125 cm) 6: no. of siliquae on main shoot (>80) 96: siliqua length (>5.0 cm) 17: no. of seeds/siliqua (> 16) 21: 1000 seed weight (>6.5 g),
	DRMR, Bharatpur	1000	RGN 73, Kranti, Maya, Pusa Bold Pusa mustard 25, DRMRIJ 31		177: days to maturity (<130 days), 22: plant height (< 140 cm) 5: No. of siliquae on main shoot (>80) 4: siliqua length (>5.0 cm), 9: number of seeds/siliqua (> 16) 14: 1000 seed weight (>6.5 g) 10: oil content (> 42 %)
Alternaria blight	PAU, RARS, Bhatinda	1000	Kranti, PBR 357, PBR 91, PBR 210	Yes	47 acc. (Moderately resistant <5%)
	GBPUA&T, Pantnagar	1000	RGN 73, Kranti, Maya, NPJ-112	Yes	65 acc. (Moderately resistant <5%)
White rust	PAU, RARS, Bhatinda	1000	Kranti, PBR 357, PBR 91, PBR 210	Yes	32 acc. (Highly resistant -0 infection)
	GBPUA&T, Pantnagar	1000	RGN 73, Kranti, Maya, NPJ-112	-	13 acc. (Highly resistant -0 infection)
Aphid	PAU, Ludhiana	1000	PBR 357, RLC 3 and RL 1359	Yes	187 acc. (Highly tolerant: 0.1-1 scale)
	GBPUA&T, Pantnagar	1000	Kranti, PBR 357, PBR 91, PBR 210	Yes	43 acc. (Tolerant: 1-2 scale)
Cold Tolerance	CSK HPKV, Palampur	1000	Kranti, RH-749, RCC-4	Yes	21 acc.
Quality (Oil Content)	DRMR, Bharatpur	1000		Yes	11 acc. (High oil content >42%)
	NBPGR, New Delhi	1000		Yes	12 acc. (High oil content >42%)

Achievements during *rabi* 2015-16

A total of 1,112 Indian mustard accessions were evaluated during *rabi* 2015-16 for agronomic traits (3 locations), biotic stress traits (*Alternaria* blight- 2 locations; white rust -2 locations,); abiotic stress (cold tolerance-1 locations) using augmented block design. For quality traits seeds from 2 locations were used.

Agronomic evaluation

A detailed evaluation of 1,000 accessions and validation of 112 accessions of Indian mustard was carried out at 2 locations for different agro-morphological traits. Promising genotypes were identified for different agro-morphological traits over the location. About 20 accessions i.e. IC20167, IC58388, IC122414, IC267691, IC541052, EC199744, EC204233, EC206714, EC206724, EC322093, EC766084, EC766087, EC766134, EC766304, EC766306, EC766311, EC766312, IC491469, IC520747, IC426383 were found superior for day to 50% flowering in <65 days, 11 accessions i.e. IC121667, IC58388, IC122300, IC122346,

IC122431, IC122442, IC253077, IC310804, IC520375, EC322093, EC620075 were superior for plant height (< 130 cm), about 20 accessions namely IC20167, IC58388, IC122414, IC267691, IC541052, EC199744, EC204233, EC206714, EC206724, EC322093, EC766051, EC766084, EC766087, EC766134, EC-766304, EC766306, EC766311, EC766312, IC491469, IC520747, IC426383 were matured in <130 days (**Fig 1**); 20 accessions i.e. IC12209, IC122235, IC122319, IC249624, IC253063, IC253066, IC296684, IC482968, IC589689, EC414319, EC620088, EC698998, EC699030, EC766325, EC766330, EC766444, EC766600, IC491200, IC491342, IC491461 were superior for number of siliqua on main branch (>80) (**Fig 2**); twenty accessions i.e. IC121700, IC121715, IC121718, IC122197, IC122231, EC400082, EC766033, EC766205, EC766214, EC766234, EC766412, IC491294, IC491454, IC491580, IC426383, IC491457, IC491007, IC491211, IC121700, IC121715 were promising for siliqua length (>5.0 cm) and accessions namely IC482968, EC620075, EC699055, EC766198, EC766234, EC766336, IC491114, IC491506, IC426383, IC570302, IC571646, IC571672, IC589669, IC589674, IC253063, IC296507, IC398765, EC720967, EC766037, IC491294 were having >17 seeds/siliqua over the location.



Fig 1 & 2: Screening of Indian mustard germplasm for early maturity and more no. of siliqua on main branches

Some genotypes were superior for multiple traits viz; IC58388, EC322093 for plant height, days to maturity; IC426383 for days to maturity, siliqua length (>5.0 cm), seeds/siliqua (>17); EC766325 for siliqua on main shoot (>80), seed yield/Plant; EC766198 for seeds/siliqua (>17) and seed yield/plant over the location.

Under quality analysis for oil content, 8 mustard accessions viz. EC766064, EC766067, EC766070, EC766071, EC766097, EC766203, EC766286, EC766440 were found rich in oil content ranging from 43.2 to 44.2% over the location.

Evaluation for biotic stress

Indian mustard germplasm were also evaluated for biotic stress (White rust, *Alternaria* blight and aphids) at 2 locations GBPUA&T, Pantnagar and PAU, Ludhiana. A total of 21 accessions i.e. IC020167, EC657030, EC699003, EC766091, EC766133, EC766134, EC766136, EC766140, EC766142, EC766143, EC766144, EC766145, EC766148, EC766152, EC766164, EC766191, EC766192, EC766193, EC766230, EC766232, EC766402 were found resistant to white rust over the locations (**Fig 3**). None of germplasm line was found completely free from *Alternaria* blight at all the locations. Sixty three germplasm lines showed moderately resistant reaction (<10% disease severity) against *Alternaria* leaf blight under artificial inoculation conditions.



Fig 3: Indian mustard accessions free from white rust and accession susceptible to white rust

Some of the unique traits like smooth stem (IC491410), broom type silique arrangement (IC355410), erect plant type (IC571661), creamish flower colour (IC337391, IC491648 and IC399840), pigmented silique (IC401578), non-waxy type (EC720977), bold seeded (IC570324) and appressed type silique (IC312541 and IC385632) in *Brassica* germplasm were observed under CRP programme during 2014-15 at different locations and grown for second year validation also.

Table 2. Details of evaluation of Indian mustard germplasm during *rabi* 2015-16

Trait(s)	Centres	No. of acc. evaluated	Checks used	Data received	Promising accessions
Agronomic	CCS HAU, Hisar	1112	Kranti, Pusa Bold, Pusa Mustard-25, Giriraj, RH 0749	Yes	19: days to maturity (<130 days) 11: plant height (< 125 cm) 20: no. of siliquae on main shoot (>80) 20: siliqua length (>5.0 cm) 20: no. of seeds/siliqua (> 16) 21: 1000 seed weight (>6.5 g),
	DRMR, Bharatpur	1112	RGN 73, Kranti, Maya, Pusa Bold, Pusa mustard 25, DRMRIJ 31	-	-
<i>Alternaria</i> blight	PAU, RARS, Bhatinda	1112	Kranti, PBR 357, PBR 91, PBR 210	Yes	05 acc. (Moderately resistant <5%)
	GBPUA&T, Pantnagar	1112	RGN 73, Kranti, Maya, NPJ-112	Yes	65 acc. (Moderately resistant <5%)
	CCS HAU, Hisar	1112	Kranti, Pusa Bold, Pusa Mustard-25, Giriraj, RH 0749	Yes	63 acc. (Moderately resistant <5%)

White rust	PAU, RARS, Bhatinda	1112	Kranti, PBR 357, PBR 91, PBR 210	Yes	177 acc. (Highly resistant -0 infection)
	GBPUA&T, Pantnagar	1112	RGN 73, Kranti, Maya, NPJ-112	-	13 acc. (Highly resistant -0 infection)
	CCS HAU, Hisar	1112	Kranti, Pusa Bold, Pusa Mustard-25, Giriraj, RH 0749	Yes	182 acc. (Highly resistant -0 infection)
Cold Tolerance	CSK HPKV, Palampur	304	Kranti, RH-749, RCC-4	Yes	28 acc.
Quality (Oil Content)	DRMR, Bharatpur	1000	Pusa Bold	-	-
	NBPGR, New Delhi	1000	Pusa Bold	Yes	08 acc. (High oil content >42%)

Table 3. Promising Indian mustard germplasm for white rust

Traits	Name of centre	Promising germplasm at centre (Nos.)	Promising germplasm over the location
White rust resistant	GBPUTA&T, Pantnagar	35	21 acc. (IC020167, EC657030, EC699003, EC766091, EC766133, EC766134,
	HAU, Hisar	182	EC766136, EC766140, EC766142,
	PAU, Ludhiana	165	EC766143, EC766144, EC766145, EC766148, EC766152, EC766164, EC766191, EC766192, EC766193, EC766230, EC766232 and EC766402)

Table 4. Promising Indian mustard germplasm for agronomic traits across the locations

Traits	Promising germplasm over the location	
	2014-15	2015-16
Day to 50% flowering (<65 days)	IC491483, IC491554, IC521381, IC560719, IC570287, IC570302, IC570320, IC589650, IC589653, IC589660, IC626317, EC766514, EC766518, IC246635, IC248995	IC20167, IC58388, IC122414, IC267691, IC541052, EC199744, EC204233, EC206714, EC206724, EC322093, EC766084, EC766087, EC766134, EC766304, EC766306, EC766311, EC766312, IC491469, IC520747, IC426383
Plant height (< 130 cm)	IC341108, IC546946, IC342749, IC355313 IC355348, IC491250, IC355369, EC766136 EC766141 EC766127	IC121667, IC58388, IC122300, IC122346, IC122431, IC122442, IC253077, IC310804, IC520375, EC322093, EC620075
Days to maturity (<130 days)	IC571687 IC491414 IC491135 IC570287 IC571669 IC571648 EC766560 EC766028 IC399809 EC766136 EC766141 EC766127	IC20167, IC58388, IC122414, IC267691, IC541052, EC199744, EC204233, EC206714, EC206724, EC322093, EC766051, EC766084, EC766087, EC766134, EC-766304, EC766306, EC766311, EC766312, IC491469, IC520747, IC426383
Siliqua on main shoot (>80),	EC247855, EC347857, EC333564	IC12209, IC122235, IC122319, IC249624, IC253063, IC253066, IC296684, IC482968, IC589689, EC414319, EC620088, EC698998, EC699030, EC766325, EC766330, EC766444, EC766600, IC491200, IC491342, IC491461
Siliqua length (>5.0 cm)	EC199744, IC342778, IC491438, IC329705, EC399293, IC261670, IC-261633, IC-491482, IC-420528, IC-571692, IC-491473	IC121700, IC121715, IC121718, IC122197, IC122231, EC400082, EC766033, EC766205, EC766214, EC766234, EC766412, IC491294, IC491454, IC491580, IC426383, IC491457, IC491007, IC491211, IC121700, IC121715

Seeds/ siliqua (> 17)	IC491455 IC520754 IC491483 IC491565 IC495534 IC491548 IC491554 IC520767	IC482968, EC620075, EC699055, EC766198, EC766234, EC766336, IC491114, IC491506, IC426383, IC570302, IC571646, IC571672, IC589669, IC589674, IC253063, IC296507, IC398765, EC720967, EC766037, IC491294
Seed yield/Plant	IC560700 IC491402 IC571668 IC426337 IC399853 IC589653 IC399797 EC766495 IC491096 EC766265	IC121718, IC122022, IC122288, IC122363, IC122441, IC249001, IC249624, IC491311, EC206712, EC491579, EC766190, EC766198, EC766258, EC766325, IC491147, IC491200, IC491342, IC491461, IC491510, IC589660
Cold tolerance	IC251661, IC261627, IC424755, IC447794, IC421293, IC571665, IC571668, IC961632, IC491085, IC491234, IC491203, IC355327, IC355456, IC361509, IC385632, IC401570, IC398025, IC424420, IC491527, IC491482, EC399308, EC399312, EC414315, EC491601, EC766383, EC766397, EC766433	-
High oil content (>42%)	IC10963, EC766487, IC267696, IC491137, IC355327, EC491607, IC491115, IC491229, IC312524	EC766064, EC766067, EC766070, EC766071, EC766097, EC766203, EC766286 EC766440

Details of monitoring

Monitoring was done at GBPUA&T, Pantnagar during *rabi* 2014-15.

Monitoring team visited all the centres during *rabi* 2015-16 (**Fig 4**).

Monitoring during 2015-16		
Place	Date of Monitoring	Team
GBPUAT, Pantnagar	28 February, 2016	Dr. Rashmi Yadav, NBPGR, New Delhi Dr. Usha Bhatt, GBPUAT, Pantnagar Dr. AK Tripathi, GBPUAT, Pantnagar
CCSHAU, Hisar	27 February, 2016	Dr. Sandeep Kumar, NBPGR, New Delhi Dr. Ram Avtar, CCS HAU, Hisar
DRMR, Bharatpur	01 February, 2016	Dr. Rashmi Yadav, NBPGR, New Delhi Dr. JC Rana, NBPGR, New Delhi Dr. J Nanjundan, DRMR, Bharatpur





Fig 4. Monitoring of field trials of Indian mustard germplasm at different centres

8. Publications:

- x. Papers published in peer reviewed journal (NAAS rating may be given): Nil
- xi. Papers presented at scientific meetings/seminar/symposia, etc.: Nil
- xii. Manuscripts under preparation: One

9. Patents/varieties and products developed or in pipeline: Nil

Signature:

Name :

Designation:

Principal Investigator:

Date:

Director/Project Director /Project Coordinator

V. Name of the crop: Okra

1. Name & address of the lead centre: ICAR-NBPGR, Pusa, New Delhi-110 012
2. Name of the Nodal person : Dr. R. K. Tyagi, Head, GCD & LCPC;
& designation Dr. J. C. Rana, Head, GED & Dy. LCPC
Dr. K. K. Gangopadhyay, Principal Scientist, GED
3. Name of the Name of nodal person, designation and address of collaborating centre (s):

Name of centre	Name of nodal person, designation and address of collaborating centre
GBPUAT, Pantnagar	Dr. Y. V. Singh, Head, Department of Vegetable Sciences GBPUAT, Pantnagar-263145 Dt. Udham Singh Nagar Uttarakhand
PAU, Ludhiana	Dr. Mamta Pathak Senior Breeder, Department of Vegetable Crops, Punjab Agricultural University, Ludhiana-141004, Punjab
BCKV, Kalyani	Dr. Arup Chattopadhyay Officer Incharge (AICRP on Vegetable Crops), Directorate of Research, BCKV, Kalyani-741235, Nadia, West Bengal
CHES, Bhubaneswar	Dr. H. S. Singh Head, Central Horticultural Experiment Station, Aiginia Bhubaneswar-751019, Odisha
MPKV, Rahuri	Dr. M. Bhalekar Sr. Vegetable Breeder, AICRP (Vegetable Crops) Department of Vegetable Crops MPKV, Rahuri-413722, Maharashtra
ICAR-IIVR, Varanasi	Dr. G P Mishra Senior Scientist ICAR-Indian Institute of Vegetable Research P.O. Box # 01, PO- Jakhini (Shahanshahpur) Varanasi - 221 305, Uttar Pradesh

Project activities and achievements during *kharif* 2015

A total of 725 accessions of okra germplasm along with 4 checks (Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani) were characterized and evaluated during *kharif* 2015 for agronomic traits at GBPUAT, Pantnagar; Yellow vein mosaic disease (YVMD) and Enation leaf curl disease (ELCD) at BCKV, Kalyani; IIVR, Varanasi; CHES, Bhubaneswar and Jassid, whitefly and fruit borer at PAU, Ludhiana and MPKV, Rahuri (Table 1). At all the centres characterization and evaluation was done under field conditions using augmented block design (ABD).

At GBPUAT, Pantnagar; out of 725 accessions of okra germplasm 513 accessions germinated. Fifteen accessions were found promising for agronomic traits including 3 accessions for YVMD (Table 1). No accessions were found resistant to YVMD (Fig 1 and 2) at BCKV, Kalyani. Out of 724 accessions evaluated at IIVR, Varanasi for YVMD and ELCD; 8 genotypes were found almost free from both YVMD and ELCD, 7 accessions with early fruiting and 3 accessions having thin fruit. In CHES, Bhubaneswar; 24 accessions were found free from Yellow vein mosaic disease at 90 days stage and one accession showed no incidence of cercospora leaf spot (0-9 scale) (Fig 3 and 4). In PAU, Ludhiana and MPKV, Rahuri; no accession was found to be resistant against jassid, whitefly and fruit borer (Table 1). Monitoring of 2 centres viz. BCKV, Kalyani and IIVR, Varanasi were undertaken *kharif* 2015.



Fig 1 & 2: Okra germplasm infected with yellow vein mosaic disease (YVMD) and accession showing YVMD symptom



Fig 3 & 4: Okra accession (IC523720) free from *Cercospora* leaf spot and accession infected with *Cercospora* leaf spot

Table 1: Details of okra characterization and evaluation in *kharif* (2015)

Centre	Purpose of evaluation	Number of accessions received from ICAR-NBPGR	Checks used	No. of des.	No. of promising accessions	Promising accessions across the locations and years
GBPUAT, Pantnagar	Agronomic evaluation & characterization	725	Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani	24	15	<p>i) Fruit length (cm): IC117066 (25.02), IC282265 (18.4), IC117025 (16.6), IC282275 (15.1), IC588163 (15.1).</p> <p>ii) Fruit weight (g): IC588163 (21.5), IC361258 (21.4), IC128107 (21), IC296854 (20.8).</p> <p>iii) Marketable yield/ plant (g): EC305616 (309)</p> <p>iv) Days to 50% flowering: EC169339 (32), EC169430 (32), IC027875-A (32) and IC027821-A (34).</p> <p>v) YVMD at 90 days: EC169430 and EC169435 were found free from Yellow vein mosaic disease at 90 days stage.</p>
PAU, Ludhiana	Jassid, whitefly and fruit borer	725	Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani	2	-	<p>8 acc. for jassids (IC093900, IC117012, IC117025, IC117234, IC117262-I, IC117328, IC117329 and IC128147)</p> <p>9 acc. for whitefly (IC093900, IC117012, IC117234, IC117262-I, IC117328, IC117329, IC128147, EC169459 and IC090249)</p>
BCKV, Kalyani	YVMD	725	Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani	2	-	Nil

IIVR, Varanasi	YVMD	725	Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani	2	8	Eight genotypes (IC024904-A, IC117027, IC117247, IC117321, IC117336, EC169408, EC16941, IC033206) were found almost free from both YVMV and OELCV diseases.
CHES (IIHR), Bhubaneswar	YVMD & OELCD	725	Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani	2	25	24 acc. were found free from Yellow vein mosaic disease at 90 days stage. (EC169335, EC169339, EC169363, EC169380, EC169396, EC169409, EC169453, EC169464, IC018544, IC018553-A, IC027875-A, IC029136, IC034124-AX, IC042451, IC093848, IC093850, IC010256-A, IC042484-B, IC116970, IC117323, IC382991, IC413039, IC506071 and IC523720) One accession (IC523720) showed no incidence of cercospora leaf spot (0-9 scale).
MPKV, Rahuri	Jassids, whitefly and fruit borer	725	Arka Anamika, VRO-6, Parbhani Kranti, Pusa Sawani	3		56 acc. for jassids (IC 117328, EC169474, IC 117094, IC034132, IC024904-A, EC169479, IC 117237 , IC112230, IC 117246 , IC003759, IC045836 , IC018553-A etc.,) 17 acc. for whitefly (IC117321, EC169361, EC305613 , IC027878-B, IC 117211, IC090169 , EC169346, IC058708, IC090288, IC099730, IC090201, IC117296, IC117351, IC034124-A IC117328, IC117008 and IC090208) 24 acc. for fruit borer (IC045995, IC 117263, IC031340-C , EC169493, EC 305634, IC117301, IC510677, IC031398, IC112494, IC116993, IC 117286, IC 510695, EC305625, IC117297, IC506142, IC093885, IC042456-S, IC128140, IC050418, IC117093, EC169506, IC117265, IC029359-A and IC588162)

Details of monitoring: Monitoring team visited BCKV, Kalyani during *kharif* 2015 (Fig. 5)

Monitoring during 2015		
Place	Date of Monitoring	Team
BCKV, Kalyani	07/09/2015	Dr. K K Gangopadhyay (NBPGR, New Delhi), Dr. Arup Chattopadhyay (BCKV, Kalyani), Dr. Subrata Dutta (BCKV, Kalyani), Dr. Asit Kumar Manda, (BCKV, Kalyani).
IIVR, Varanasi	09/10/2015	Dr. K K Gangopadhyay (NBPGR, New Delhi), Dr. J K Ranjan (IIVR, Varanasi), Dr S K Tiwari (IIVR, Varanasi), Dr Tania Seth (IIVR, Varanasi)



Fig 5: Monitoring of field trials of okra germplasm at BCKV, Kalyani during *kharif* 2015

4. Publications:

- i. Papers published in peer reviewed journal (NAAS rating may be given): Nil
- ii. Papers presented at scientific meetings/seminar/symposia, etc.: Nil
- iii. Manuscripts under preparation: One

5. Patents/varieties and products developed or in pipeline: Nil

Signature:

Name :

Designation:

Principal Investigator:

Date:

Director/Project Director /Project Coordinator

VI. Name of the crop: Finger millet

1. Name & address of the lead centre: ICAR-NBPGR, Pusa, New Delhi-110 012
2. Name of the Nodal person & designation : Dr. R. K. Tyagi, Head, GCD & LCPC
Dr. J. C. Rana, Head, GED & Dy. LCPC
Dr. Rakesh Bhardwaj, Sr. Scientist, GED
3. Name of the Name of nodal person, designation and address of collaborating centre (s):

Name of centre	Name of nodal person, designation and address of collaborating centre
Bangalore	Dr. P. Ravishankar, PC Unit on Small millets, UAS, GKVK
Mandya	Dr. C.R. Ravishankar, Professor & Breeder UAS, Mandya
Ranichauri,	Dr. Arun Bhat University of Horticulture & Forestry, Ranichauri, Uttarakhand
Jagdapur	Dr. Abhinav Sao/ Dr. Prafull Kumar IGAU, Jagdalpur, Chattisgarh
Almora	Dr. Salej Sood, Sr. Breeder VPKAS, Almora, Uttarakhand
ARS Vizianagaram	Dr. TSSK Patro Associate Professor ARS, Vizianagaram Andhra Pradesh

Project activities and achievements

During 2015-16 total of 966 accessions were evaluated for traits of agronomic importance and biotic stress. At Mandya, Jagdalpur and Almora centers (**Fig. 1**) evaluation was done for agronomically important traits such as early flowering, early maturity, tillers per plant, plant height, finger length, fingers per ear and grain weight. Whereas, at Vizianagaram (**Fig.2**) and Almora centers evaluation was done for leaf blast, neck blast and finger blast and at Ranichauri center accessions were evaluated for *Cercospora* leaf spot.



Fig. 1 Field view of finger millet germplasm at VPKAS, Almora



Fig. 2 Field layout of finger millet germplasm ARS, Vizianagaram

Accessions with early flowering were identified at Almora (< 55 days) IC53764, IC477871, IC478288, IC478600, IC478189, IC478486, IC477994, IC477808; at Jagdalpur (<55 days) IC478980, IC479088, IC473459, IC474649, IC474942, IC473154, EC130935 and at Mandya (<50 days) IC478503, IC478297, IC478631, IC478794, IC478843, IC478071, IC478266 and IC478505. Early maturing accessions were identified on the basis of maturity at < 90 days. At Almora IC475126, IC473322, IC478977, IC479038, IC473411, IC473380, IC473460, IC479132, IC473231; at Jagdalpur IC478980, IC479088, IC474684, IC474622, EC130935, IC479161, IC479207, IC479197, IC473461 and at Mandya IC478297, IC478631, IC478794, IC478843, IC478071, IC478266, IC478505, IC478754, IC478048, IC478463 were identified.

Accessions with high tillering were identified on the basis of productive tillers more than five. At almora IC-478067, IC-477589, IC-477566, IC-477511, IC-474285, IC-478505, IC-41806, IC-477724, IC-587936, IC-53716; at Jagdalpur IC-41806, IC-53764, IC-478478, IC-477611, IC-478302, IC-478772, IC-478338, IC-478450, IC-478486 and at Mandya

IC0477261, IC0477025, IC0476728, IC0476782, IC0476816, IC0477193, IC0477216, IC0477246, IC0477380 were identified for high tillering.

Accessions with fingers more than or equal to 10 were identified, Almora center identified IC-478062, IC-478496, IC-478048, IC-477832, IC-478354, IC-478736, IC-477374, IC-477991, IC-478057, IC-478217 ; Jagdalpur center identified IC-478492, IC-478331, NC-58235, IC-477448, IC-477579, IC-478400, IC-477358, IC-478254, IC-478668, IC-477749 and Mandya center identified IC0477006, IC0477095, IC0476873, IC0477260, IC0476724, IC0477259, IC0476975, IC0477658, IC0587969 were identified.

Accessions with grain test weight of more than or equal to 4 were identified, Almora center identified IC477834, IC478326, IC478560, IC41813, IC478125, IC478165, IC53749, IC477358, IC478320, IC478353; Jagdalpur center identified IC478344, IC78151, IC478612, IC-41806, IC587937, IC478546, IC478002, IC478436, IC478008, IC478663 and Mandya center identified IC0476740, IC0476969, IC0476760, IC0476809, IC0477644, IC0477522, IC0477617, IC0477152, IC0477905 and IC0477629 accessions.

In evaluation for biotic stresses accessions with less than 10% infestation for finger blast and neck blast were identified. Almora centre identified resistant accessions such as IC477803, IC477716, IC477872, IC478179, IC477899, IC478404, IC477434, IC478058, IC477348, IC477986 for finger blast and IC478794, IC587932, IC477256, IC478956, IC477248, IC477758, IC477785, IC479008, IC478079, IC477849 for neck blast. Vizianagaram centre identified IC477600, IC478615, IC478755, IC478452, IC477813, IC478194, IC478241, IC477791, IC53728, IC478333 for finger blast and IC478187, IC41807, IC477133, IC478900, IC477375, IC478365, IC477595, IC478755, IC477653, IC478615 for neck blast. Ranichauri centre identified resistant accessions for *Cercospora* leaf spot having zero incidence on infection and the resistant accessions are IC478759, IC473258, IC473260, IC473279, IC473283, IC473284, IC473292, IC473293, IC478900, IC478925, IC478926, IC478932, IC478953, IC478960, IC478963, IC478527, IC478566, IC478754. Number of promising accessions across the locations and years identified is given in table1.

Table 1: Number of the promising accessions of finger millet across the locations and years

Trait(s)/centres	Traits	No. of promising accessions	Some of the promising accessions across the locations and years
Agronomic (2)	Days to maturity (\leq 90 days)	109	8
	No. fingers/ear (\geq 10)	26	10
	Grain weight per plant (\geq 200g)	36	8
Biotic (2)	Leaf blast (\leq 1%)	129	8
	Finger blast (\leq 10 %)	88	9
	Neck blast (\leq 10 %)	281	9

6. Details of monitoring

7. Details of monitoring: The monitoring team visited all the centres during the *kharif*, 2015 (Fig. 3) .

Centre	Date	Monitoring Team
Almora	21/09/2015	Dr. P. Ravishankar, Dr. A. K. Jain and Sheela Mary from NBPGR, New Delhi
Ranichauri	23/09/2015	Dr. P. Ravishankar and Sheela Mary from NBPGR, New Delhi
Mandya	12/12/2015	Dr. P. Ravishankar and Dr. Sushil Pandey from NBPGR, New Delhi
Vizianagaram	-	Dr. Sushil Pandey from NBPGR, New Delhi
Jagadapur	-	Dr. Sushil Pandey from NBPGR, New Delhi



Fig. 3 Monitoring of field trials of finger millet at ARS, Vizianagaram during *kharif* 2015

4. Publications:

- i. Papers published in peer reviewed journal (NAAS rating may be given): Nil
- ii. Papers presented at scientific meetings/seminar/symposia, etc.: Nil
- iii. Manuscripts under preparation: One

5. Patents/varieties and products developed or in pipeline: Nil

Signature:

Name :

Designation:

Principal Investigator:

Date:

Director/Project Director /Project Coordinator