NILGIRIS WHEAT NEWS

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HW 5207
as
COW3

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A high yielding multiple disease resistant wheat variety 'HW 5207' carrying *Lr*24/*Sr*24, *Sr*2 and *Yr*15 released as 'COW3'

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The test entry HW 5207 was tested in AICW&BIP co-ordinated trials from 2005-09 under Southern hill zone comprising of Southern hills and areas adjoining Southern hills. Based on consistent yield performance and response to diseases it was identified for release during the year 2009 in the 48th, Wheat workshop at New Delhi. During the same year it was proposed for release by CVRC. However, the 55th Central sub-committee on crop standards, notification and release of varieties of agricultural crops recommended it for Tamil Nadu state release. Accordingly the multi-location trials, Adaptive Research Trials (ART), On Farm Trials (OFT) were conducted from 2010-2014 and proposed for University Technology Release Screening Committee (UTRSC), TNAU and subsequently released by 45th SVRC, 2015 for the Tamil Nadu as state release and christened as COW3 (=Coimbatore Wellington Wheat-3).

Often inadequate North east monsoon and frequent failures of monsoon resulting in shortage of irrigation water led to decline in productivity of winter crops in parts of Tamil Nadu. This situation forced farmers to look for an alternate viable winter cereal wherein wheat crop variety with short duration, less water requirement and free from pest and diseases could serve the purpose. As per our evaluation the advance wheat culture HW 5207 could be an alternative viable crop to the farmers in 13 districts of Tamil Nadu *viz*., Nilgiris, Coimbatore, Tirupur, Erode, Dindugul, Theni, Salem, Karur, Dharmapuri, Krishnagiri, Vellore, Thiruvannamalai and Villupuram covering hilly regions and areas adjoining hills under restricted irrigation.

The variety HW 5207 is derivative of limited backcross involving HW 3029// V763-2312 (*Yr*15) and matures in 95-100 days in the targeted areas.

Nature and time line of evolution:

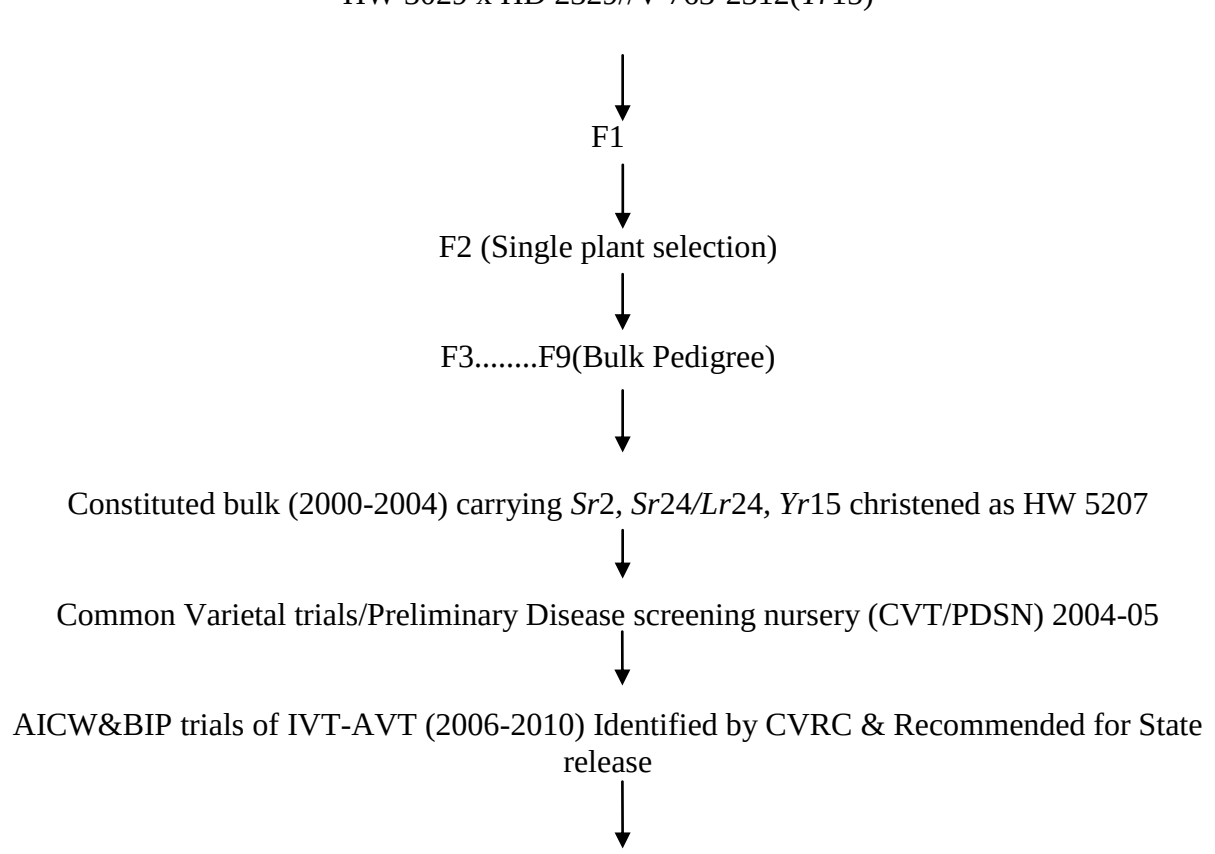
Pedigree/ Flow chart for variety HW 5207

Step-1:
Back-cross method
Kalyansona*5//TR 380-14*7/3Ag#14 (White glumes) christened as HW 2002 carrying *Thinopyrum ponticum*-derived linked genes *Lr*24/*Sr*24 (1990-1994)

Step-2:
Pedigree method
HW 2002//VEERY's #5 christened as HW 3029 (1994-1996) carrying *Thinopyrum ponticum*-derived linked genes *Lr*24/*Sr*24 and *Secale cereal*-derived linked genes *Sr*31/*Lr*26/*Y*9/*Pm*8

Step-3:
Modified Bulk pedigree
HD 2329//V 763-2312(*Yr*15) carrying *Yr*15
(1997-2000)

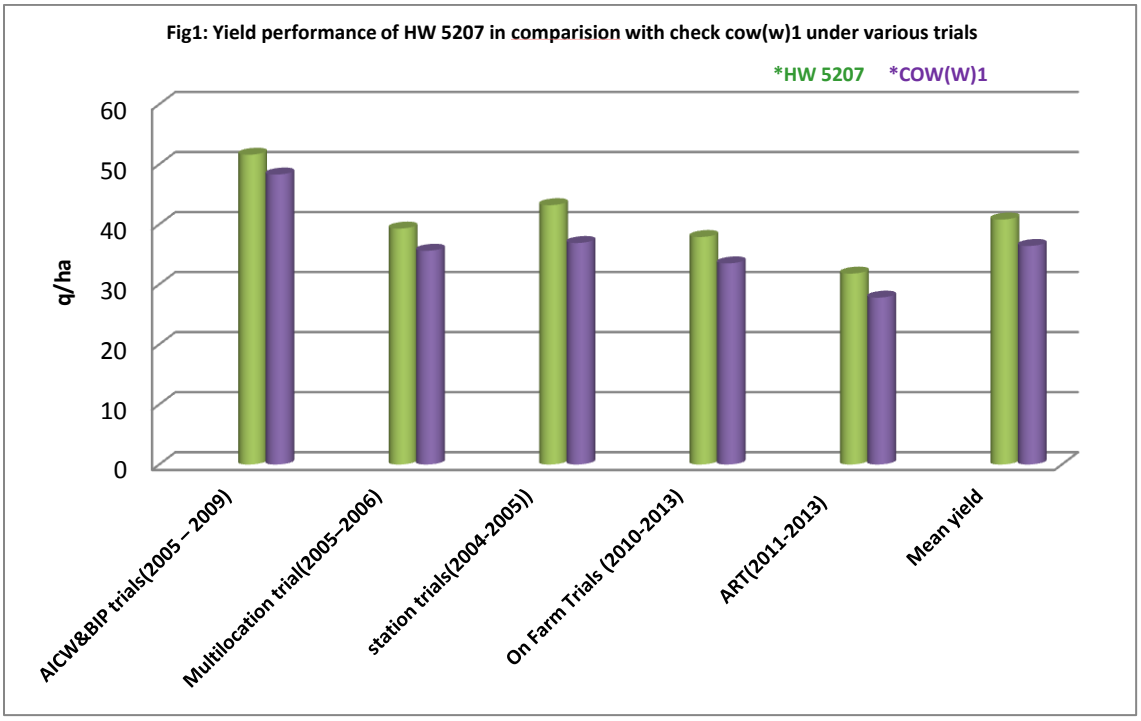
Step-4: Modified bulk pedigree- Marker assisted selection
HW 3029//*Yr*15



The released wheat culture, HW 5207 has recorded the highest mean grain yield (4076 kg/ha) which is 12 per cent increase over the check COW (W) 1 (3641 kg/ha) in a total of 131 trials involving AICW&BIP trials, MLT, ART, ST and OFT (Table-2, Fig-1).The variety, HW 5027 has the ideal plant height (90 cm) with erect plant type, strong and resilient stem providing resistance to lodging. Recorded 32.5 per cent increased grain yield (5870 kg/ha) with two additional irrigations.

Table 1. Overall yield performance of Bread wheat culture HW 5207 (COW3)

Sl.No.	Name of the trial	No. of trials	Grain yield (kg/ha)	
			HW 5027	COW(W)1 (C)
1.	Research station trials(2004-2005)	3	4318	3690
2.	Multi-location trials (2005–2006)	31	3930	3555
3.	All India Coordinated trials (2005 – 2009)	12	5161	4831
4.	On Farm Trials (2010-2013)	38	3794	3353
5	Adaptive Research Trials (2011-2013)	47	3179	2775
Total number of trials		131		
Overall Mean of trials			4076	3641
Per cent increase over COW(W)1			12.0	



It produces very nutritious grain, registering a mean test weight of 40.5g with more than 11 per cent protein, and high level of micronutrients viz., Iron (53.1ppm), Zinc (46.3ppm), Copper (5.33ppm) and Manganese (47.5ppm) indicating excellent grain nutritional quality. In addition, this variety has high scores for bread making quality (7.0 out of 10), chapathi quality (7.4 out of 10) with Glu-1 score of 8 out 10 and mean sedimentation value of 45.5, high Hectolitre weight of 78.3 (Table 2).

Table 2: Data on grain quality characters

Parameters	HW 5207	COW(W)1(C)
Protein (%)	11.3	11.94
High Molecular weight Glutinin Sub-units Glu D1 Glu-A1 Glu-B1 Glu-1 Score	 2+12 2 7+8 8	 5+10 1 7+9 9
Hectolitre Weight (Kg/hl)	78.3	78.3
Sedimentation Value	45.5	43
1000 grain weight(gm)	40.5	40.5
Grain Appearance	5.6	5.4
Bread Quality (Max. Score:10)	6.95	7.15
Chapati Quality (Max. Score:10)	7.42	7.33
Biscuit Quality (Speed factor)	6.43	4.93
Iron (ppm)	53.1	49.5
Zinc (ppm)	46.3	39.8
Copper (ppm)	5.33	4.51
Manganese (ppm)	47.5	39.9

It exhibited high degree of resistance to stem, leaf and stripe rusts under both artificial and natural epiphytotic conditions against all the pathotypes occurring in the Nilgiris, which is a hot spot for rust incidence (Table 3). The Seedling Resistance Test (SRT) results showed the response of 'R' for all the leaf rust (*Puccinia triticina*) and stem rust (*P. graminis* f.sp. *tritici*) pathotypes throughout the evaluation period from 2007-09. At the same time it has shown 'R' reaction to yellow rust (*P. striiformis*) pathotypes except for the pathotypes 78S84 (MR-S) and 46S119 (R-S) with varied reaction.

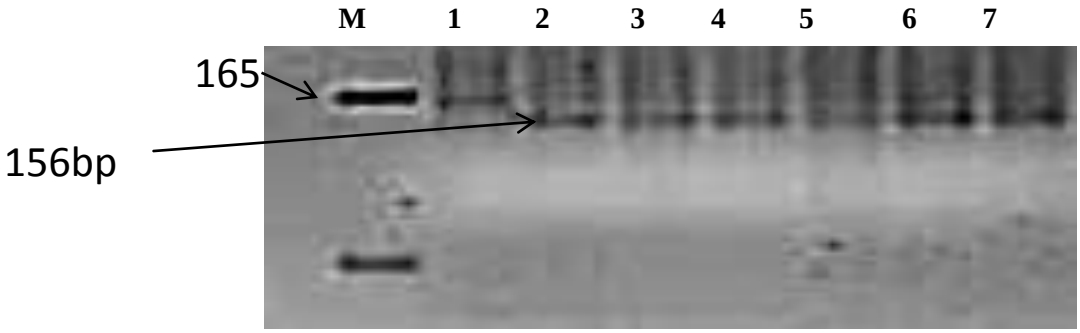
The resistance to rusts and powdery mildew attributed to the presence of the combination of genes *viz*., *Sr*2 and *Sr*24 for stem rust, *Lr*24 for leaf rust and *Yr*15 for yellow rust derived from the parents involved in the cross which has been confirmed using molecular markers (Figure 2 & 3). Due to high and stable yield performance over locations and resistance to leaf and stem rust diseases, the culture, HW 5207 was released as “Bread Wheat COW3” for the benefit of farmers as the best alternative winter cereal crop.

Table 3. Reaction to rust diseases

Disease	Condition	Year	Proposed Variety HW 5207*	COW(W)1 (C)
Stem Rust	Natural	2005-06	F	F
		2006-07	F	F
		2007-08	F	F
		2008-09	F	F
	Artificial (South)	2005-06	5MR(0.5)	20MR(2.4)
		2006-07	20MR(2.3)	10S(2.1)
		2007-08	20MR(2.0)	5S(2.2)
		2008-09	10S(2.5)	20S(5.4)
Leaf Rust	Natural	2005-06	F	F
		2006-07	F	F
		2007-08	F	F
		2008-09	F	F
	Artificial (South)	2005-06	5MS (0.6)	20MS(4.2)
		2006-07	5S (1.0)	5S(1.1)
		2007-08	20MR(1.7)	5S(1.0)
		2008-09	10MS(1.1)	40S(7.7)
Stripe Rust	Natural*	2005-06	F	F
		2006-07	F	F
		2007-08	F	F
		2008-09	F	F
	Artificial (North only)	2005-06	40S(14.0)	80S(62.0)
		2006-07	5S (1.0)	100S(83.3)
		2007-08	15S(4.4)	80S(60.0)
		2008-09	25S(5.0)	80S(47.1)

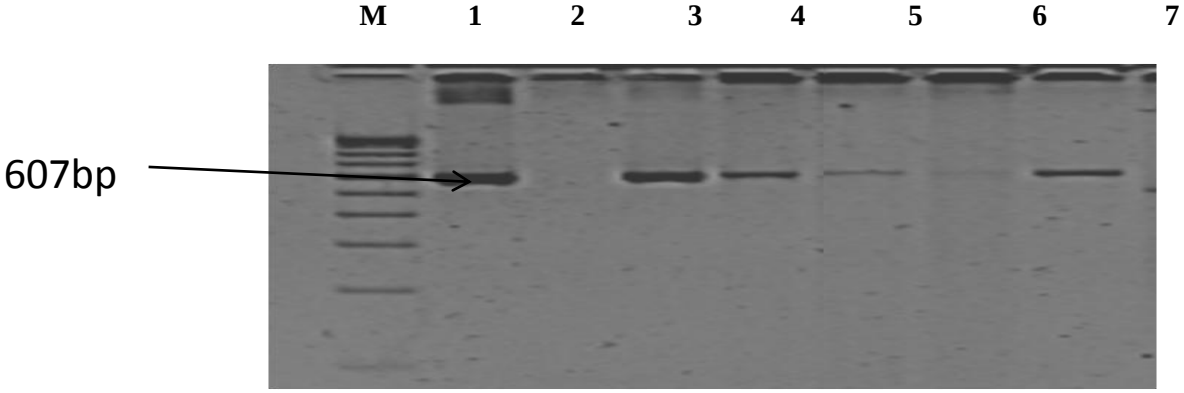
* 'I' *race of P.striformis*

(a) Marker linked to *Yr*15- Xgwm 273



M: 100 bp ladder, 1: Negative control (HD 2687); 2: Positive Control (Avocet^{6}/Yr15); 3-7: HW 5207

(b) Marker linked to *Lr*24- SCS1302



M: 100 bp ladder; 1- Positive Control (HD 2687+*Lr*24); 2- Negative Control (HD2687) and 3-7: HW 5207

Fig.2. Validation of presence of genes *Lr*24 and *Yr* 15 in HW 5207

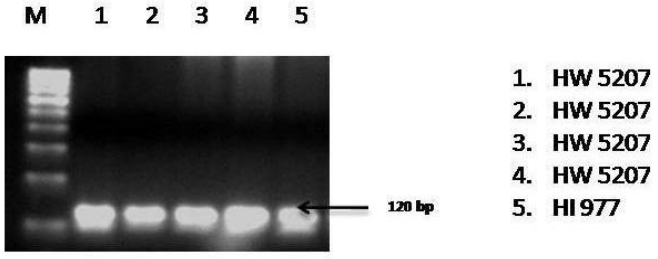


Fig. 3. Confirmation *Sr*2 in HW 5207 using gwm 533 marker

Varietal description of bread wheat culture HW 5207 (COW3)

Name of the variety	:	**HW 5207**
Pedigree	:	**HW 3029// V763-2312 (*Yr*15*)***
Area of adaptation	:	Southern hill zone
Production condition	:	Restricted irrigated, Medium fertility, Timely sown conditions
1. Growth habit	:	Erect
2. Anthocyanin pigmentation on		
(i) Coleoptile	:	Absent
(ii) Leaf sheath	:	Absent
(iii) Auricle (at flag leaf stage)	:	Absent
(iv) Stem	:	Occasional presence of pigmentation (Pseudo black chaff-*Pbc*) in the form of streaks of pink/black colour on stem, near the nodal region prominent
3. Foliage colour (boot stage)	:	Light bottle green to dark green with waxyness
4. Leaf width (boot stage)	:	Medium
5. Average days to heading	:	58 days
6. Days to maturity	:	95- 100 days
7. Waxyness at ear emergence	:	
(a) Flag leaf	:	Present
(b) Leaf sheath	:	Present
(c) Ear	:	Present
(d) Peduncle	:	Present
8. Average plant height (cm)	:	90cm
9. Ear colour at maturity	:	White but presence of Pseudo black chaff (tightly linked to *Sr*2) on glume and glume border, at dough stage (*Sr*2) is prominant
10. Ear shape	:	Tapering with prominent crooked neck mostly on main tillers
11. Ear density	:	Dense
12. Awn length	:	Normal
13. Awn colour (at maturity)		White
14. Glume shoulder	:	Oblique
15. Glume beak	:	Medium
16. Glume pubescence	:	Absent
17. Grains		
i) Colour		Amber
ii) Texture	:	Hard
iii) Cheeks	:	Round
iv) Crease width	:	Narrow
v) Brush and hair	:	Not prominent
vi) Shape	:	Oblong
v) Average 1000 grain weight	:	40.5 g
18. Mean Yield (kg/ha)	:	4070

Identification of newer rust resistance gene(s) from emmer wheat

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Emmer wheat germplasm 'Mexican dwarf' observed to confer moderate resistance against most of the yellow rust races and particularly against the occurring race 'I' at Wellington. As per our studies it is confirmed to carry the recessive gene for yellow rust resistance. An effort was made to transfer this resistance gene to hexaploid wheat. The highly susceptible bread wheat line NI 5439 was used as female parent and all the F_1 pentaploid plants showed high susceptible reaction to yellow rust but conferring high degree of resistance to stem and leaf rust. Lines carrying the recessive yellow rust resistance gene and possibly linked to leaf and stem rust was selected at BC_2F_2 stage. Further work is being carried out to constitute a stable mapping population to tag the new rust resistance gene(s).

Table 1: Adult plant response to rust diseases against the occurring races at Wellington

Parents and derivatives	Leaf rust	Stem rust	Yellow rust	Powdery mildew(0-9 scale)	Blight
NI 5439	60S	80S	60S	2	20
Mexican Dwarf	F	F	5MR	1	10
F1	60s	F	F	2	10
Constituted line	F	F	5MR	1	10

First report of aecial and pycnial stages of rust(s) on Barberry species from Kodai hills

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Systematic surveys were conducted in Southern hills particularly in Kodaikanal hills of Tamil Nadu during the month of November and January. Different species of Barberry bushes were identified in forests located in an elevation of 2421 m (AMSL). Appearance of aecial and pycnial stages of rust was noticed in the month of January, 2015. Numbers of aecial cups were ranging from 5 to 85 in each leaf and the size of cup was also larger and prominent than the aecia observed in Nilgiri hills earlier. Release of orange, single cell spores from aecium was maximum in early hours than late evening. This is the first observation of aecial stages on Barberry leaves from Kodaikanal hills. Types of pycnial and aecial colonies on upper and lower surface of Barberry leaves respectively and release of aeciospores from aecia are depicted below. Further works are under progress to elucidate pathogenesis on other hosts including wheat and allied species.

Barberry plant in Kodaikanal hills

Early stage of aecia

Pucinnial colonies

Aecia with aeciospores

Release of aeciospores

Dilution/suppression of stripe rust resistance in wheat hexaploids derived from *Triticum aestivum* and *T. carthalicum*

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Stripe rust (caused by *Puccinia striiformis* Westend.) continues to be a threat for wheat cultivation worldwide. Breeding resistant cultivars are the cheapest, most reliable and environmentally safest way to control the disease. Genes for resistance when introgressed from alien species or lower ploidy level often have the problem of diluted effectiveness in the hexaploid wheat background or else suppressed. Crosses were made between cultivars of *Triticum aestivum* (AABBDD; hexaploid), and *T. dicoccum* (AABB; tetraploid) as female and *T. carthalicum* (AABB; tetraploid) as male parent. Seedlings of the parents and F_5 progenies (only the hexaploid progenies in case of *T.aestivum* x *T. carthalicum*) were evaluated against 10 pathotypes of stripe rust. Seedlings of the interspecific lines displayed high phenotypic diversity for resistance. Among the hexaploid progenies of *T.*

aestivum x *T. carthalicum* cross, all derived lines expressed resistance/ susceptible reaction similar to one of the parents except for pathotypes 14A(66S64), 38A(66S64-1) and I (38S102) wherein the seedlings showed susceptible reaction in contrast to the resistant reaction of both the parents. However, all seedlings of the progenies of *T.dicoccum* with *T.carthalicum* showed resistance/susceptible reactions similar to one of the parents for the same pathotypes. Resistance of one/both of the parents were not expressed or partially expressed in a hexaploid background which suggests the possibility of presence of suppressor genes in A or B genome of *T. carthalicum* or its interaction with the A, B or D genome of *T. aestivum.* In-spite of the fact that the D genome being the native genome of *T.aestivum*, possibility of suppressor gene in D genome cannot be ruled out since there could be the activation of suppressor gene in D genome due to the presence of A and B genome of *T. carthalicum.* Suppressor gene(s) is/are expressed only in the hexaploid background and not in the tetraploid background.

National Off season/Summer nursery at Indian Agricultural Research Institute, Regional Station, Wellington - 643 231, The Nilgiris

V. K. Vikas, M. Sivasamy, P. Jayaprakash, P. Nallathambi, C. Umamaheswari, Arun Kumar, R.K. Meena, M.L.Meena, K.Sivan, E. Punniakotti and B. Naveen Kumar

Off- season/Summer nursery for crops such as Wheat, barley, oats, mustard, linseed, soya bean, flax, linseed etc. were successfully conducted from the month of May, 2014 and the crops were harvested during the month of October to November. Nearly 22,000 lines of above mentioned crops belonging to various ICAR institutes (8) and SAUs(12), seed certification agencies, private participants were sown for generation advancement, corrective crossing, rust disease scoring, MAS etc.

Summer nursery participants at I.AR.I., Regional Station, Wellington, 2014.

Sl. No.	Crops	Research Institutes			Total
		ICAR	SAUs	Others (including Private participants)	
1	Wheat	10546	6039	4170	20755
2	Barley	100	270	150	520
3	Oats	-	96	-	96
4	Mustard	855	50	-	905
5	Linseed	-	-	200	200
Total		11501	6455	4520	22476

News

Dr. M.Sivasamy, presented a lead paper (Oral) on "Deployment of rust resistance genes in wheat varieties increased wheat production in India" at National seminar on Challenges and Innovative Approaches in Crop Improvement, A.C. & R.I., TNAU Madurai, Dec.16-17, 2014

Dr.Vikas V.K., presented a paper (Oral) on "Functional food: Role of gamma irradiation in the improvement of *Triticum dicoccum* (Schrank) Schulb." at International Conference on Radiation Biology, NASC Complex, New Delhi, Nov. 11-13, 2014.

Dr.Vikas V.K., presented a paper (Oral) on "Marker assisted pyramiding of stem and leaf rust resistance genes (*Sr*2, *Sr*24/*Lr*24, *Sr*36 and *Lr*19/*Sr*25) in Wheat (*Triticum aestivum* L.)" at National seminar on Challenges and Innovative Approaches in Crop Improvement, A.C. & R.I., TNAU Madurai, Dec.16-17, 2014.