Celebrating 25 years 1989-2014

DWSR

Marching Ahead

भा.कृ.अनु.प.- खरपतवार विज्ञान अनुसंधान निदेशालय, जबलपुर (म.प्र.)
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Year

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Preamble

Considering the growing infestation of weeds in cropped and non-cropped lands, the Indian Council of Agricultural Research decided to establish the National Research Centre for Weed Science, which came into existence on 22nd April, 1989 with the joining of its first Director, Dr V.M. Bhan. This centre was further upgraded as Directorate of Weed Science Research on 23rd January, 2009. This is a unique institute in the National Agricultural Research System, which is probably the only one of its own kind in the whole world dealing exclusively with weed science research. Besides, training, extension, coordination, consultancy and collaborative programmes on weed management are also undertaken with various stakeholders.

Over the last 25 years, the Directorate has played a significant role in conducting weed survey and surveillance, development of weed management technologies for diversified cropping systems, herbicide resistance in weeds, biology and management of problem weeds in cropped and non-cropped areas, and environmental impact of herbicides. Adoption of these technologies has been promoted on large areas through on-farm research and demonstrations, which has raised agricultural productivity and livelihood security of the farmers. Training and awareness, and consultancy programmes organized by the Directorate have been found highly beneficial and appreciated by various stakeholders. All these activities have been further geared up to address the emerging challenges in weed management including threats posed by climate change, invasive weeds, herbicide resistance, herbicide residue hazards, and safety concerns about herbicide tolerant crops.

Several publications/monographs are being brought out during the Silver Jubilee Year (2014) of the Directorate, highlighting the contributions made in the past and formulating effective strategies for the future. This document 'DWSR Marching Ahead' provides brief information on the activities and significant achievements made over the last five years (2009-2014), and new initiatives and future research programmes. It is hoped that it will be useful to our stakeholders to get a glimpse of the activities of this Directorate. Any suggestions for further improvement and growth of the Directorate will be appreciated.

29 September, 2014

(A.R. Sharma)
Director

..... the recent developments
and future plans ....

DWSR :

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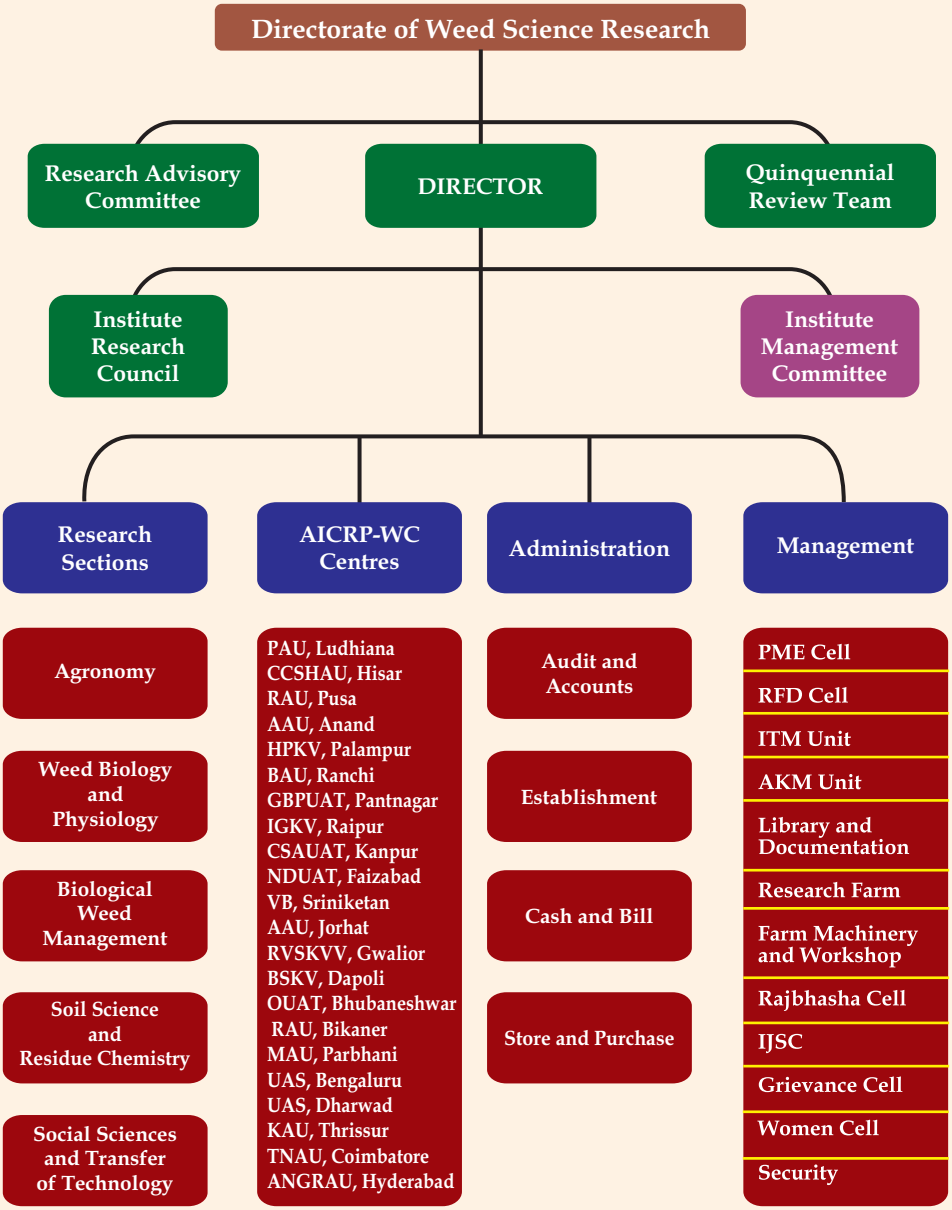
ORGANOGRAM


Directorate of Weed Science Research
Research Advisory Committee
DIRECTOR
Quinquennial Review Team
Institute Research Council
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Research Sections
AICRP-WC Centres
Administration
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Agronomy
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PAU, Ludhiana
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PME Cell
RFD Cell
ITM Unit
AKM Unit
Library and Documentation
Research Farm
Farm Machinery and Workshop
Rajbhasha Cell
IJSC
Grievance Cell
Women Cell
Security

Directorate of Weed Science Research, previously known as National Research Centre for Weed Science, was established in April 1989 as a nodal centre for basic and applied research in weed science. It has 22 centres across India under the umbrella of All India Coordinated Research Project on Weed Control (AICRP-WC). It is the only institution in the world exclusively dealing with weed science research using multi-disciplinary approach. The Directorate is located on the national highway (NH-7) at 23.13^{0}N latitude, 79.58^{0}E longitude and altitude of 412 m above mean sea level. It is well connected by railways (11 km from Jabalpur railway station) and airways (28 km from Dumna airport).

Vision

Developing innovative, economic and eco-friendly weed management technologies to contain challenges ahead for sustainable agriculture and other societal benefits

Mission

To provide scientific research and technology in weed management for maximizing the economic, environmental and societal benefits for the people of India

Mandate

- To undertake basic, strategic and applied research for developing efficient weed management strategies in different agro-ecological zones
- To provide leadership and coordinate the network research with state agricultural universities for generating location-specific technologies for weed management in different crops, cropping and farming systems

- To act as a repository of information in weed science
- To act as a centre for training on research methodologies in the area of weed science and weed management
- To collaborate with national and international agencies in achieving the above mentioned goals
- To provide consultancy on matters related to weed science.

Budget expenditure during 2009-2014 (₹ in lakhs)

Heads	2009-10	2010-11	2011-12	2012-13	2013-14	Total
Plan (DWSR)	299.98	139.38	66.28	121.30	137.29	**764.23**
AICRP-WC	519.23	399.88	1370.16	1039.58	814.58	**4143.43**
Non-plan	487.02	594.08	582.90	568.34	639.29	**2871.63**
Total	**1306.23**	**1133.34**	**2019.34**	**1729.22**	**1591.16**	**7779.29**

Staff position (as on 31.03.2014)

Particulars	Sanctioned	Filled	Vacant
Research management position	01	01	-
Scientist	27	17	10
Technical	23	21	02
Administrative	13	08	05
Supporting	22	21	01

Discipline-wise scientific position (as on 31.03.2014)

Disciplines	Sanctioned			In Position			Vacant		
	PS	SS	S	PS	SS	S	PS	SS	S
Agricultural Biotechnology	-	1	1	-	1	-	-	-	1
Agricultural Chemicals	1	1	1	-	2	-	1	-	-
Agricultural Economics	-	-	1	-	-	-	-	-	1
Agricultural Entomology	-	1	-	1	-	-	-	-	-
Agricultural Extension	-	1	1	1	-	-	-	-	1
Agricultural Microbiology	-	-	1	-	-	1	-	-	-
Agricultural Statistics	-	-	1	-	-	1	-	-	-
Agronomy	2	1	3	2	1	1	-	-	2
Economic Botany & Plant Genetic Resources	-	1	1	-	-	-	-	1	1
Farm Machinery and Power	-	-	2	1	-	-	-	-	1
Plant Pathology	-	1	-	-	1	-	-	-	-
Plant Physiology	1	1	-	1	1	-	-	-	-
Soil Science	-	1	1	1	1	-	-	-	-
Plant Biochemistry	-	-	1	-	-	-			1
Total	**4**	**9**	**14**	**7**	**7**	**3**	**1**	**1**	**8**

PS – Principal Scientist, SS – Senior Scientist, S – Scientist

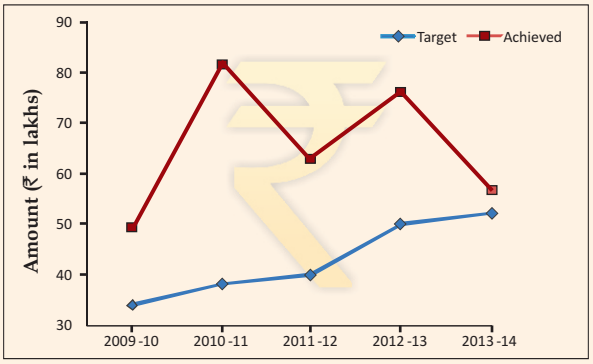
Staff position at AICRP on Weed Control centres (as on 31.03.2014)

Centre	Scientific		Technical		Administrative		Supporting	
	Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled
PAU, Ludhiana	4	4	3	3	1	1	2	2
UAS, Bengaluru	4	4	3	2	1	-	2	2
RVSKVV, Gwalior	4	3	2	2	1	1	2	2
GBPUAT, Pantnagar	4	4	3	3	1	1	2	2
CSKHPKV, Palampur	4	4	3	3	1	1	2	2
AAU, Jorhat	4	4	3	3	1	1	2	1
VNMKV, Parbhani	4	3	3	3	1	1	2	1
AAU, Anand	4	3	3	3	1	-	2	2
TNAU, Coimbatore	4	4	3	3	1	1	2	2
NDUAT, Faizabad	4	4	2	2	1	-	2	2
VB, Sriniketan	3	3	2	2	1	1	1	1
BAU, Ranchi	3	2	2	2	1	1	1	1
CSAUAT, Kanpur	3	3	1	1	1	1	1	1
KAU, Thrissur	3	3	2	1	1	1	1	-
OUAT, Bhubaneshwar	3	3	2	2	1	1	1	1
ANGRAU, Hyderabad	3	3	1	1	1	1	1	1
CCSHAU, Hisar	3	3	2	2	1	-	1	-
RAU, Pusa	3	3	2	-	1	-	1	1
DBSKKV, Dapoli	2	2	1	1	1	1	1	1
IGKV, Raipur	2	2	1	1	1	1	1	1
UAS, Dharwad	2	2	1	1	1	1	1	1
SKRAU, Bikaner	2	2	1	1	1	-	1	1
Total	**72**	**68**	**46**	**42**	**22**	**16**	**32**	**28**

Details of revenue generated under different heads (₹ in lakhs)

Heads	2009-10	2010-11	2011-12	2012-13	2013-14
Farm produce	13.68	24.70	24.18	42.37	6.67
Contract research	19.37	15.50	18.02	9.63	10.50
Consultancy project	14.98	42.33	22.50	27.00	34.25
Others	1.35	0.00	0.00	0.90	4.97
Total	**49.38**	**82.53**	**64.70**	**79.90**	**56.39**

Resource generation during last five years (₹ in lakhs)

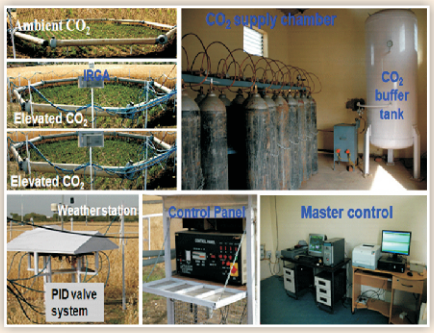


2. INFRASTRUCTURE FACILITIES

Research facilities

- Well laid out laser-levelled fully-irrigated experimental farm (60 ha)
- Containment facility for conducting experiments under varied environmental conditions
- Open Top Chambers (OTCs) to assess the impact of climate change on crops and weeds
- Free Air CO_2 Enrichment (FACE) facility to study the effect of elevated CO_2 on crop-weed interaction
- Lysimeters to assess ground water contamination potential of herbicides
- Phytoremediation unit to study the bioremediation potential of weed species
- Setup to evaluate management practices for aquatic weeds
- Runoff tanks for studies on herbicides toxicity to non-target organisms
- Well equipped research laboratories
- Agrowaste and weed biomass composting unit
- Weed cafeteria for demonstration and conservation of weed germplasm
- Weed seed herbarium containing germplasm of 100 species
- Technology park on weed management technologies
- Information centre displaying the world of weed science
- Net/poly-houses for quarantine weeds and multiplication of bio-agents

Technology park



Free Air CO_2 Enrichment (FACE) facility

Lysimeters

Aquatic ponds

Runoff tanks

Phytoremediation unit

Central laboratory

Containment facility

Weed cafetaria

Open Top Chambers (OTCs)

Equipments

- LC-MS/MS system
- High performance liquid chromatography (HPLC) unit
- Gas chromatography (GC) unit
- Portable photosynthesis system (IRGA)
- Soil CO_2 flux analyser
- Spectro-radiometer
- SPAD chlorophyll meter
- Osmometer

- Stereo zoom research microscope with photographic attachment
- Thermal cycler (PCR)
- Gel documentation unit
- Atomic absorption spectrometer (AAS)
- High speed centrifuge
- Ultra water purification unit
- Root scanner
- Multi-probe soil moisture meter
- Leaf area meter
- Vacuum evaporator
- Lyophilizer
- UV-visible double beam spectrophotometer
- Kjel-tec unit for nitrogen analysis

LC-MS/MS System

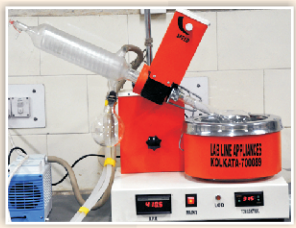
Gel Documentation Unit

Portable Photosynthesis System

Thermal cycler

Lyophilizer

High Performance Liquid Chromatography

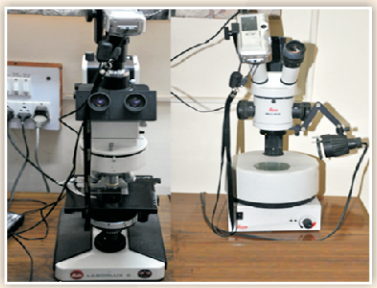


Vacuum Evaporator

Atomic Absorption Spectrometer

UV-visible Spectrophotometer

Gas Chromatography Unit



Stereo Zoom Microscope

Spectro-radiometer

AKMU

Agriculture Knowledge Management Unit (AKMU) is well equipped with computers, LAN facilities, colour xerox-cum-printer and A-0 plotter. Specialized software like ARCInfo for GIS analysis and ERDAS Imagine for satellite image analysis are available. All the scientists are provided with internet connection through Lease Line. The main building of the Directorate is Wi-Fi enabled.

Agriculture Knowledge Management Unit

Library

Library has a total collection of 5059 books pertaining to weed science. It has modern facilities such as CAB-PEST and CAB-SAC CD-ROMs and Current Contents on Diskette (CCOD) on biological sciences, software for library automation and information retrieval. It has 60 Indian and 20 foreign journals in its subscription. Library is also a member of Consortium for e-Resources in Agriculture

Library

(CeRA). All the scientists have online access to more than 2000 e-journals in various fields of science. Reprographic and documentation facilities have also been created for the preparation of documents and reports.

Information centre

Well developed Information Centre has been created with the aim of briefly informing farmers, dignitaries and other stakeholders about its mandate and thrust areas; history, importance, methodologies and tools of weed management; problematic and alien invasive weeds; weed utilization and environmental concerns in respect to chemical weed management using sophisticated display systems. Directorate's publications, prototypes of weed management tools and live specimen of weed seeds are also displayed.

Information Centre

Kisan mobile advisory service

Knowledge management service through SMS has been launched for disseminating weed management technologies to the farming community. The Kisan mobile advisory service delivers real time agricultural information and customized knowledge to improve farmers' decision making ability in developing strategies to manage weeds for enhancing farm productivity. The advisory services on weed management are provided to more than 1000 of registered farmers/stakeholders. Any farmer may avail the service by getting registered free of cost.

SMS to farmer's on weed control

Farm and other civic amenities

- Well developed farm with roads, street lights and boundary wall
- Water harvesting ponds for efficient drainage and ground water recharge
- Threshing yard
- Plantations of teak, white oak and other ornamental trees along roadside and boundary

- Agri-horticulture based system (Mango, guava, *aonla* (Indian gooseberry), citrus and pomegranate)
- Watch towers to strengthen farm security
- Farm godowns for storage of farm produce
- Staff welfare club for recreational activities
- Well developed sports ground
- Conference hall, committee hall and visitors' room
- Guest house


Farm roads


Water harvesting pond


Lawn


Guest house


Visitors room


Godown


Composting unit


Mass multiplication unit for Mexican beetle


Committee hall


Watch tower


ICAR central zone sports meet in the playground

Farm mechanization

Research farm is equipped with modern farm machines like high power tractors, mini tractor, power weeders, tractor-driven sprayers, laser land-leveler, happy seeder, zero-till seed-cum-fertilizer drill, multi-crop seed-cum-fertilizer drill, disc bund former, dozer blade, front loader, bed maker, multi-crop thrashers, reaper, tube wells, underground irrigation pipelines and sprinkler system.

Laser land leveller

Happy seeder

Multi-crop seed-cum-fertilizer drill

Zero-till seed-cum-fertilizer drill

Raised-bed seed-cum-fertilizer drill

Mini tractor

Tractor-driven multi-boom sprayer

Power weeder

Reaper

Sprinkler system

Disc bund former

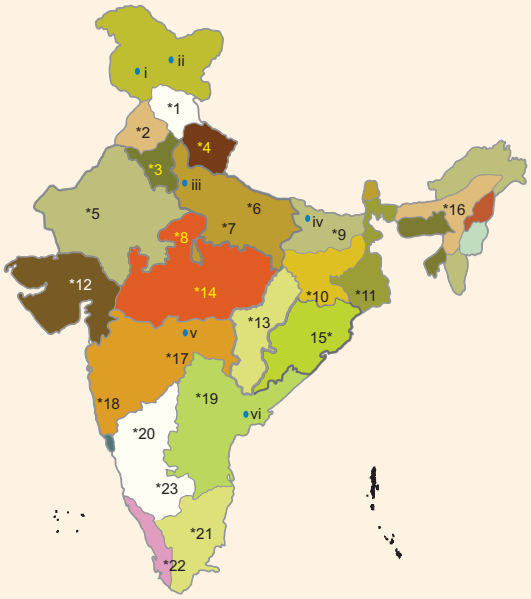
3. RESEARCH PROGRAMMES

In house Research Programmes

1. **Development of sustainable weed management practices in diversified cropping systems**
   - 1.1 Weed management under long-term conservation agriculture systems
   - 1.2 System-based approach to weed management
   - 1.3 Improving input-use efficiency through efficient weed management
   - 1.4 Standardization of spraying techniques and mechanical tools for weed management
2. **Weed dynamics and management under the regime of climate change and herbicide resistance**
   - 2.1 Effect of climate change on crop-weed interactions, herbicide efficacy and bioagents
   - 2.2 Physiological and molecular basis of herbicide resistance development in weeds and evaluation of herbicide-tolerant crops
   - 2.3 Development of weed seed identification tools and weed-risk analysis
3. **Biology and management of problematic weeds in cropped and non-cropped areas**
   - 3.1 Biology and management of problematic weeds in cropped lands
   - 3.2 Biology and management of problematic weeds in non-cropped lands
   - 3.3 Biology and management of aquatic weeds
4. **Monitoring, degradation and mitigation of herbicide residues and other pollutants in the environment**
   - 4.1 Impact of herbicides in soil, water, plants and non-targeted organisms and mitigation measures
   - 4.2 Degradation of herbicides in soil and water
   - 4.3 Bioremediation of pollutants using terrestrial / aquatic weeds
5. **On-farm research and demonstration of weed management technologies and impact assessment**
   - 5.1 On-farm research and demonstration of weed management technologies for enhanced productivity and income
   - 5.2 Impact assessment of adoption of weed management technologies on socio-economic upliftment and livelihood security

Network Research Programmes (2012-14)

The Directorate carries out network research through its 22 regular centres and many voluntary centres located at different SAUs across different agro-ecological regions of the country.



AICRP-Weed Control

Regular Centres

1 CSKHPKV, Palampur
2 PAU, Ludhiana
3 CCSHAU, Hisar
4 GBPUAT, Pantnagar
5 SKRAU, Bikaner
6 NDUAT, Faizabad
7 CSAUAT, Kanpur
8 RVSKVV, Gwalior
9 RAU, Pusa
10 BAU, Ranchi
11 VB, Sriniketan
12 AAU, Anand
13 IGKV, Raipur
14 **HQ, DWSR, Jabalpur**
15 OUAT, Bhubaneswar
16 AAU, Jorhat
17 VNMKV, Parbhani
18 DBSKKV, Dapoli
19 ANGRAU, Hyderabad
20 UAS, Dharwad
21 TNAU, Coimbatore
22 KAU, Thrissur
23 UAS, Bengaluru

Volunteer Centres

i SKUAST, Jammu
ii SKUAST, Kashmir
iii SVBPUAT, Meerut
iv RAU, Sabour
v PDKV, Akola
vi PAJANCOA & RI, Puducherry

WS 1. Weed surveillance and monitoring

1.1 Monitoring of appearance of new weed species

1.2 Monitoring of weed shift due to weed management practices, changes in cropping systems and climatic parameters

1.3 Monitoring of herbicide resistance/escapes in weeds of the dominant cropping system

WS 2. Weed biology and physiology

2.1 Biology of important problem weeds

2.2 Development of key identification and other taxonomic criteria in recognizing seed and seedlings of weed flora

2.3 Station trials based on location-specific problems

WS 3. Weed management in crops and cropping systems

3.1 Herbicides combinations for control of complex weed flora in rice

3.2 Herbicides combinations for control of complex weed flora in wheat

3.3 Weed management in turmeric and other vegetables

3.4 Weed management in pulses and oilseed crops

3.5 Integrated weed management in cotton

3.6 Weed management in conservation agriculture systems

3.7 Long-term herbicide trials in different cropping systems

3.8 Station trials based on location-specific problems

WS 4. Management of problematic weeds

4.1 Management of parasitics weeds (*Orobanche, Striga, Cuscuta* and *Loranthus*)

4.2 Management of *Parthenium*

4.3 Biological control of water hyacinth by *Neochetina bruchi*

WS 5. Herbicide residues and environmental quality

5.1 Herbicide residues in long-term herbicide trials

5.2 Studies on herbicide persistence in water

5.3 Testing of persistence of herbicides in the farmers' field

5.4 Studies on metabolites of herbicides

5.5 Herbicide residues in conservation agriculture systems

5.6 Herbicide residues in crops and cropping system

WS 6. On-farm research and impact assessment

6.1 On-farm research and frontline demonstration

6.2 Impact assessment of weed management technologies

Inter-Institutional / Externally-Funded Projects

The Directorate collaborates with various universities, sister institutions under ICAR, and other scientific organizations of the country in the field of research, teaching and extension activities. It also works in association with agro-industries and other public concerns through consultancy/contract research projects.

Ongoing externally-funded projects

Projects	PI	Funding Agency	Collaborating Institutes	Period	Budget (₹ in lakhs)
1. Development and formulation of microbial metabolites for the management of root parasite weed *Orobanche* in mustard	C. Kannan	MPBT Council, Bhopal	None	2012-15	15.05
2. Study of domestication traits of two weed species	Bhumesh Kumar	NFBSFARA, ICAR	AAU, Jorhat; UAS, Bengaluru; GBPUAT, Pantnagar	2013-16	119.50
3. Bioremediation of contaminants in polluted sites: use of weedy plants	P.J. Khankhane	NFBSFARA , ICAR	IARI, New Delhi; DU, New Delhi	2013-17	206.31
4. Phenotypic studies and genetic characterization of weedy rice biotypes from Madhya Pradesh based on SSR markers	Meenal Rathore	MPBT Council, Bhopal	None	2014-16	12.97

Externally-funded projects completed in the last 5 years (2009-2014)

Projects	PI	Funding Agency	Period	Budget (₹ in lakhs)
1. National Invasive Weed Surveillance (NIWS) programme (In collaboration with different universities of 10 states)	J.G. Varshney	DPPQS	2008-11	716.00
2. Compost production from weed biomass for the socio-economic development of rural people	Sushil Kumar	DST	2009-11	5.55
3. Precision farming technologies based on microprocessor and decision support systems for enhancing input application efficiency in production agriculture	V.P. Singh	NAIP, ICAR	2009-14	65.41

Consultancy / Contract research projects (2009-2014)

Projects	PI	Funding Agency	Period	Budget (₹ in lakhs)
Consultancy projects				
1. Survey, training, release and monitoring of bioagent *Zygogramma bicolorata* for biological control of *Parthenium* in Nagpur region	Sushil Kumar	Govt. of Maharashtra	2008-12	102.51
2. Analysis of wheat grains for *Striga* seed infestation	D.K. Pandey/ Bhumesh Kumar	FCI	2012-13	4.30

Projects	PI	Funding Agency	Period	Budget (₹ in lakhs)
Contract research projects				
1. Evaluation of fenoxaprop (rice star) 6.9% EC in rice	Anil Dixit	Bayer Crop Science	2007-09	3.60
2. Evaluation of quizalofop-ethyl 5 EC in onion and blackgram	Anil Dixit	Dhanuka Agritech Ltd.	2008-09	5.65
3. Bioefficacy and phytoxicity study of ready mixture herbicides AEF130060+MKH 6561-11.25 WG and AEF 46360+DIC 1468-22% for weed control in wheat	Anil Dixit	Bayer Crop Science	2008-10	5.77
4. Evaluation of premix of carfentrazon + metsulfuron against broad-leaved weeds in wheat	Anil Dixit	DuPont India Ltd.	2008-10	2.80
5. Bio-safety Research Trials Level-1 (BRL-1) for transgenic stacked corn hybrids (MON 89034 X NK603)	Anil Dixit	Monsanto India Ltd.	2009-11	6.68
6. Evaluation of carfentrazon + glyphosate for total weed control in non-cropped area	Anil Dixit	FMC Agril Solutions	2009-11	3.60
7. Evaluation of fluroxypyr-methyl w/v (45.5% w/w) EC for efficacy on weeds in onion	Anil Dixit	Dow Agro Sciences	2012-13	1.79
8. Evaluation of penoxsulum 2.5% OD w/v (2.67% w/w) for the control of weeds in transplanted rice	Anil Dixit	Dow Agro Sciences	2012-13	2.46
9. Evaluation of biological studies of alachlor 50% EC (Lasso) in soybean	Anil Dixit	Sinochem	2012-13	2.87
10. Evaluation of fluazifop-p-butyl 12.5% + fomesafen 12.5% (Fusilex 25% SL) for weed control in soybean	Anil Dixit	Syngenta India Ltd.	2012-13	2.69
11. Evaluation of bioefficacy and phytoxicity of AE1887196 -20% + AEF 095404 -10%-30% WG against broad-spectrum weeds in transplanted and direct-seeded upland rice, and their residues on succeeding crop	Anil Dixit	Bayer Crop Science	2012-13	5.39
12. Weed control efficacy of K-salt glyphosate formulation against weeds of cotton and corn	Anil Dixit	Monsanto India Ltd.	2012-13	15.00

4. SALIENT ACHIEVEMENTS

Weed survey and surveillance

The Directorate conducted survey and surveillance for collecting information on the spread and occurrence of weeds, and identified those causing serious problem.

- *Mikania micrantha* Kunth (Mile-a-Minute or Bitter vine), a problematic weed in north-east India, is rapidly spreading in Odisha and hilly terrain of Karnataka.
- Infestation of *Malwa parviflora, Rumex retroflexus, Poa annua, Coronopus didymus* and *Polypogon monspliensis* is increasing in rice-wheat cropping zone.
- *Ipomoea*, a serious weed of sugarcane in Haryana and Uttar Pradesh, is getting established in southern parts of the country.
- *Phragmites karka,* a submerged and emergent weed, is spreading across Chilka lagoon and posing serious problem.
- *Parthenium* is spreading beyond the non-cropped areas, and gradually entering into cropped and plantation areas.
- Several species of weedy rice are spreading very fast and becoming nuisance in cultivated rice fields across the country.

***Mikania micrantha* infestation in plantations**

Weedy rice infestation in rice

***Ipomoea lacunose* infestation in sugarcane**

***Phragmites karka* infestation in Chilka lake**

- *Phalaris minor*, a major problem of wheat, is also showing tolerance to clodinafop and sulfosulfuron, the major herbicides introduced to tackle its resistance to isoproturon in Punjab and Haryana.
- *Loranthus* (*Dendrophthoe* spp.), a parasitic weed, is infesting tea, fruit trees, viz. mango, sapota, guava, elephant-fruit, *jamun* (Blackberry), citrus, *ber* (Indian plum), etc., and other plantations like *sheesham* (Indian Rosewood), *mahua* (Indian Butter tree), *peepal* (Sacred Fig), *neem* (Indian Lilac), etc.

- A new problematic weed *Ambrosia psilostachya* has been observed in Muniyuru Bevinahally, Turuvekere Taluk, Tumkur District of Karnataka in waste lands, road sides, plantations, cultivated crops and forest shrubs.

***Ambrosia psilostachya* infestation**

***Loranthus* infestation in plantation crops**

- A new alien invasive weed, *Solanum carolinense,* has been detected in few locations of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala.

Robust plant

Flower and fruit
Solanum carolinense

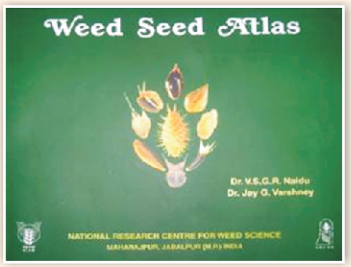
Cross-section of fruit

National database on weeds

- Developed 2 volumes of Weed Atlas covering the dominant crop-field weeds of 435 districts and 19 states of the country.
- Developed a Weed Seed Atlas.
- Developed a weed seed repository of 100 species.

Weed Atlas (Vol-1)

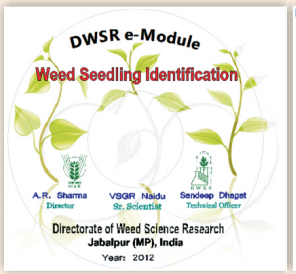
Weed Atlas (Vol-2)



Weed Seed Atlas

DWSR e-modules

Developed e-modules on identification of weed seeds, weed seedling and weed plants. These modules are very useful for effective and economic management of weeds. All these modules are uploaded on the Directorate website for end users.

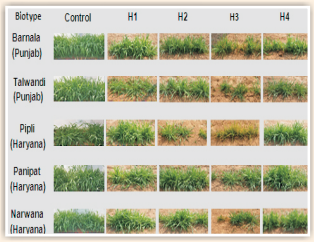


Online databases for identification of weed seeds, seedlings and matured plants

Weed biology and physiology

- Conclusively proved the presence of high morphological diversity amongst the *Echinochloa* germplasm of the country, and so far identified 15 taxa of species and intra-specific ranks under 11 species.
- Characterized about 100 weedy rice accessions for diversity with respect to morphological, physiological, biochemical and reproductive characteristics, dormancy and shattering pattern.
- Recorded weed suppressing ability of a quick-growing and spreading type pea cultivar `JP 885'.
- Elucidated biology of *Parthenium hysterophorus, Alternanthera sessilis, Cassia tora, Celosia argentea* and *Bracharia eruciformis*.
- Developed technology to break the seed dormancy of wild oat, *Ageratum houstonianum, Bidens pilosa, Mimosa pudica* and *Cyperus iria* using Ga_3.
- Observed multiple herbicide resistance in *Phalaris minor* biotypes from Haryana and Punjab.

Diversity in weedy rice accessions



Multiple herbicide resistance in *Phalaris minor* biotypes

H1: IPU
H2: Pinoxaden
H3: Mesosulfuron-methyl + iodosulfuron-methyl-sodium
H4: Sulfosulfuron + metsulfuron-methyl

Global climate change

- Studied the possible effect of climate change on crop-weed competition and herbicide efficacy. Predicted increasing competitive ability of *Phalaris minor* compared to wheat and wild oat due to global warming.
- Observed reduced efficacy of sulfosulfuron against *Phalaris minor* under elevated temperature and CO_2, making management of this weed more difficult.

Wheat Wild oat *Phalaris* minor

Effect of elevated CO_2 and temperature

Ambient CO_2 & temp. Elevated CO_2 & temp.

Efficacy of sulfosulfuron on *Phalaris minor*

Weed management in crops and cropping systems

- Made herbicide recommendations for various crops and cropping systems based on the multi-disciplinary and multi-location trials conducted in different agro-climatic zones.
- Recommended alternative chemical weed control methods to counter weed flora shift caused by continuous use of some herbicides.
- Developed weed management technologies for conservation agriculture systems.

Zero-till rice

Zero-till maize

Zero-till wheat

Zero-till mustard

Zero-till chickpea

Zero-till greengram

Weed management in different crops under conservation agriculture systems

- Monitored herbicide residues in soil, water and food chain under several crops and cropping systems across the country. When used at recommended rates, the herbicide residues were within the safety limit in soil and edible plant parts.
- Studied the impact of herbicides on soil micro-flora. In general, recorded short-term and reversible adverse effects of herbicides on soil microbial population.
- Noticed reduction in *Phalaris minor* but increase in wild oat population in ZT-wheat under rice-wheat system.
- Recorded weed shift from grassy to broadleaved species, especially *Euphorbia geniculata,* under continuous use of fenoxaprop in soybean.

Untreated

Fenoxaprop-treated

Soybean

- Developed IWM technologies using cowpea, *Sesbania* and berseem as intercrops in maize, rice and wheat, respectively.
- Developed IWM technologies for new orchards using cover crops.
- Developed non-chemical methods of controlling annual weeds in sesame-tomato system by integrating soil solarisation technique and FYM application.
- Developed technique for weed management in vegetable crops using black polythene mulch.

Managing weeds in rice through *Sesbania* brown manuring

Berseem as intercrop in wheat

Cowpea as cover crop in citrus orchard

Soil solarization for vegetable nursery

Black polythene mulch in okra

Mechanical tools

- Improved several weeding tools from different parts of the country for more efficient weeding.
- Developed a wick applicator for application of non-selective herbicides in standing crops like mustard and soybean.

Wick applicator in soybean

Directed spray in mustard

Management of problem weeds

- Summer ploughing *fb* glyphosate application (2.0 kg/ha) at 4-6 leaf stage during April-May was found effective in controlling *Saccharum spontaneum* (Kans).
- Quizalofop at 125-150 g/ha was also found effective in managing *Saccharum spontaneum* in mustard, chickpea and pea.
- Metsulfuron-methyl was found effective in controlling alligator weed (*Alternanthera philoxeroides*) in aquatic bodies and lowland areas.

***Saccharum* in untreated and glyphosate-treated fields**

Alligator weed infested pond

- Managed *Asphodelus tenuifolius* in chickpea using oxadiazon (0.5 kg/ha) and pendimethalin (1.0 kg/ha) as pre-emergence.
- Managed the problem of *Cuscuta* in niger and blackgram using pendimethalin (1.0 kg/ha) as pre-emergence.
- Soil solarisation and application of neem cake were found promising for managing *Orobanche* in tobacco, potato, tomato, mustard etc.
- Post-emergence spraying of 2,4-D (0.6%) + urea (2%) was found effective in managing the root parasite *Striga asiatica* in sugarcane.

***Orobanche* in tomato and tobacco**

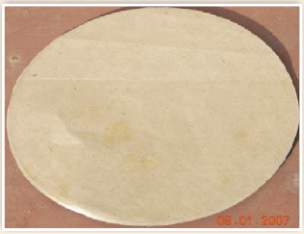
***Cuscuta* in onion**

***Striga asiatica* in sugarcane**

Weed utilization

- Utilized *Parthenium* and water hyacinth biomass for making compost/vermi-compost with nutrient contents equivalent to FYM.
- Utilized *Parthenium* biomass for making paper and particle boards.

Particle board made of *Parthenium*



Paper made of *Parthenium*

Vermi-composting unit

- Evaluated the biomass of several weed species like *Lantana, Mikania, Chromolaena, Ipomoea carnea, Salvinia,* water hyacinth etc. as effective mulch materials.
- Evaluated *Arundo donax* for phytoremediation of nickel, copper, nitrate and phosphate contaminated waste water.

Water hyacinth mulch in potato

***Arundo donax* grown in hydrophonics**

Biological control of weeds

- Developed technique for mass multiplication of Mexican beetle (*Zygogramma bicolorata*), an effective bioagent against *Parthenium hysterophorus.*
- Identified environmentally beneficial competitive plants, *viz. Cassia* and marigold to suppress *Parthenium* growth.

Mexican beetle feeding on *Parthenium*

Parthenium infested non-crop land

Cassia tora* and marigold suppress *Parthenium

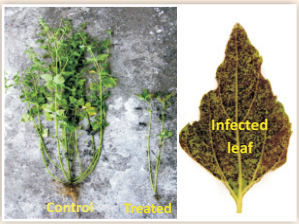
- Successfully suppressed water hyacinth in three ponds of Jabalpur using *Neochetina* sp., an exotic bioagent.

A pond full of water hyacinth

Adult *Neochetina* feeding on leaves

Browning of water hyacinth due to *Neochetina* attack

- Isolated a new rust bioagent, *Puccinia* sp. (isolate NRCWSR-3), to manage *Lagascea mollis*, an exotic weed.
- Isolated and evaluated the promising strains of *Alternaria alternata* and *A. eichhorniae* as bioagents to manage water hyacinth.



Reduced growth of *Lagascea mollis* due to *Puccinia* sp.

***Alternaria alternata* infected water hyacinth**

***Alternaria eichhorniae* infected water hyacinth**

5. TRANSFER OF TECHNOLOGY

DWSR carried out a large number of field trials to demonstrate the effectiveness of improved weed management technologies. On an average, the farmers made an additional net income of approximately ₹ 10000/ha due to adoption of demonstrated technologies in various crops.



Field demonstrations on improved weed management

- Adopted 6 localities, about 50-100 km from Jabalpur, under On-Farm Research programme during 2012-14. A multi-disciplinary team of 2-3 scientists visited these localities regularly to demonstrate and refine the improved weed management technologies on farmers' field.

Kundam locality

Shahpura locality

Majholi locality

Bankhedi locality

Panagar locality

Gosalpur locality

- Distributed about 8.0 lakhs Mexican beetle throughout the country free of cost to SAUs, ICAR institutes, KVKs, etc.
- Provided advisory services on weed management technologies to farmers through mobile telephony.

Awareness programmes

- Regularly conducted *Kisan Melas/Gosthis,* and participated in TV shows, radio talks etc. to make the people aware about the effectiveness of improved weed management technologies for cropped and non-crop areas.
- Since 2004, carried out '*Parthenium* Awareness Week' throughout the country during August-September every year.
- Since 2012, celebrated 'Agriculture Education Day' to promote the spirit of agricultural science among the school children.
- Regularly organized 'Scientist – Industry Interface Meet' to exchange views relating to weed management technologies.

Kisan Mela, 19 February, 2013

National Science Day, 28 February, 2014

Parthenium Awareness Week, 16-22 August, 2013

Agriculture Education Day, 10 December, 2013

DWSR-Industry Day, 19 December, 2013

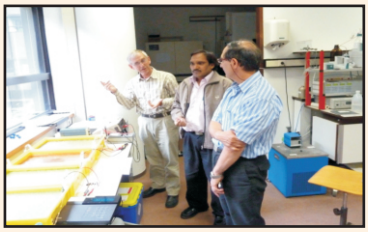
Field Day, 26 March, 2014

Farmer - Scientist Interface Meet, 29 April, 2014

6. HUMAN RESOURCE DEVELOPMENT

International trainings received

- Dr. P.J. Khankhane, Sr. Scientist (Soil Science) visited Faculty of Geo-science, Environmental Hydrology Group, Utrecht Universeit, The Netherlands during 01 July - 26 September, 2010 for training on bioremediation.
- Dr. Shobha Sondhia, Sr. Scientist (Organic Chemistry) visited Natural Product Chemistry Research Unit, USDA, Mississippi (USA) during 18 November, 2010 – 18 February, 2011 for training on biomolecules.
- Dr. V.S.G.R. Naidu, Sr. Scientist (Economic Botany) visited Natural Resource Ecology Laboratory, Dept. of Soil and Crop Science, Colorado State University, Fort Collins, Colorado, USA during 01 February – 30 April, 2011 for training on carbon sequestration, carbon trading and climate change.
- Dr. C. Kannan, Sr. Scientist (Plant Pathology) visited Institute of Molecules and Materials, Radboud University, Nijmegan, The Netherlands during 01 September – 30 November, 2013 for training on biomolecules.
- Dr. A.R. Sharma, Director, visited Cornell University, Ithaca, New York during 22 February – 08 March, 2014 for training on agricultural research management and leadership.



Post Graduate research

The Directorate extended its facilities for the M.Sc. and Ph.D. thesis research work on the issues related to weed science by students from several universities.

Year	Number of students	Name of universities
2009	3	RDVV, Jabalpur; APS University, Rewa
2010	11	RDVV, Jabalpur; Home Science College, Jabalpur
2011	8	RDVV, Jabalpur; Home Science College, Jabalpur; St. Aloysius College, Jabalpur; Bharathiar University, Coimbatore
2012	11	RDVV, Jabalpur; Mata Gujri College, Jabalpur; St. Aloysius College, Jabalpur; JNKVV, Jabalpur; APS University, Rewa
2013	6	JNKVV, Jabalpur; Bundelkhand University, Jhansi

Training programmes organized

Particulars	Period	Participants
Model training course on recent advances in weed management	29 December, 2008 – 05 January, 2009	Officers of state departments of UP, MP, MH, HR, GJ, CG and UK
Advance training for the analysis of herbicide residues in soil, water and food chain	16-22 November, 2009	Scientists and researchers from various universities
Weed management in field crops	04-11 January, 2010	Officials of SAUs and KVKs of AP, JK, UP, MP, CG and MH
Model training course on recent advances in weed management	11-18 October, 2010	Officials from various state departments of agriculture and horticulture
Advancement in weed management techniques	16-20 October, 2012	Officers of state departments of UP and progressive farmers
1st National training on advances in weed management	31 October – 09 November, 2012	Scientists of ICAR institutes and SAUs
Model training course on weed management for sustainable oilseeds and pulse production	13-20 December, 2012	Subject matter specialists of different states

Table Contd...

Particulars	Period	Participants
Weed management and chemical weed control	12-14 March, 2013	Progressive farmers under PD ATMA, Parbhani
Weed management techniques	13-15 June, 2013	Progressive farmers under PD ATMA, Parbhani
Microbes and their biotechnological interventions for sustainable agriculture with special reference to biological weed management	22 July - 5 August, 2013	PG students of colleges and universities
2nd National training on advances in weed management	14-23 January, 2014	ICAR/SAU scientists
National training on weed management	11-15 March, 2014	Officers of state departments of UP
Training-cum-workshop on weed management for KVKs scientists	19-21 May, 2014	KVKs scientists

Group meetings and workshops of AICRP on Weed Control

Particulars	Date	Venue
Annual group meeting	27-28 February, 2009	RAU, Bikaner
Biennial workshop	23-24 February, 2010	IGKV, Raipur
Annual group meeting	29 February - 01 March, 2011	AAU, Anand
Biennial workshop	17-18 April, 2012	KAU, Thrissur
Annual group meeting	26-27 April, 2013	CSKHPKV, Palampur
Annual group meeting	12-14 February, 2014	DWSR, Jabalpur

Review meetings

Year	QRT	RAC	IRC	IMC
2009	-	25-26 June	19-20 June	15 April, 15 September
2010	-	24-25 May	28-31 May	-
2011	5-6 September	7-8 April	29 June -12 July	-
2012	1-3 May, 16-17 May	-	14-16 June	30 June
2013	-	22-23 February	6-7 May, 17-18 June	12 July
2014	-	18-19 April	2-3 May	-

Organization of national events

Particulars	Date	Venue
National conference on 'Weed threat to environment, biodiversity and agricultural productivity' in collaboration with ISWS, Jabalpur, and TNAU, Coimbatore	2-3 August, 2009	TNAU, Coimbatore
National consultation on 'Weed utilization'	20-21 October, 2009	DWSR, Jabalpur
Interface meet of ICAR institutes of central zone with Planning Commission	22 January, 2010	DWSR, Jabalpur
Conference on 'Recent advances in weed science research – 2010' in collaboration with ISWS , Jabalpur, and IGKV, Raipur	25-26 February, 2010	IGKV, Raipur
National consultation on 'Biological control of weeds'	17-18 March, 2010	DWSR, Jabalpur
Interface meeting of Directors and Project Coordinators of Crop Science and Horticulture divisions with DWSR	17-18 May, 2010	DWSR, Jabalpur
Conference on 'Weed threat to agriculture, biodiversity and environment' in collaboration with ISWS, Jabalpur, and KAU, Thrissur	19-20 April, 2012	KAU, Thrissur
Conference on 'Emerging challenges in weed management' in collaboration with ISWS	15-17 February, 2014	DWSR, Jabalpur


7. NEW INITIATIVES

Initiatives since 2012-13

1. More than 20 research projects running at this Directorate were reorganized into five major research programmes. Focussed programmes on conservation agriculture, climate change, problematic weeds, herbicide residues and on-farm research were launched in a multi-disciplinary mode.
2. Six Nodal Officers were identified from HQ for effective collaboration with ICAR Institutes of Crops, Horticulture and NRM Divisions in different regions of the country. They are interacting with the identified weed scientist and also visiting these institutes for refinement of weed management programme.
3. Network programmes of AICRP-Weed Control were strengthened in the Biennial Workshops held during April, 2012 and February, 2014. Effective system of monitoring research and extension work at 22 regular and 6 voluntary centres was developed.
4. A major initiative was taken to show visibility of our research efforts on the farmers' fields. Six teams, each with three scientists, were constituted and assigned a cluster of 2-3 villages located about 50-100 km from Jabalpur. Each member of the team is visiting the locality on a specific day every week; thus sparing about 15-20% of his time for 'On-Farm Research'.
5. A major programme on weed management in conservation agriculture systems was undertaken at HQ and AICRP-WC centres. The entire farm of the Directorate was covered under zero-till sown winter crops, and burning of residues including weeds was completely stopped. A composting unit was established for converting available biomass into nutrient-rich manure.
6. Initiatives for modernization and reducing file/paper work in the office were undertaken. Biometric system for marking attendance and Online Leave Management System were introduced.
7. Website of the Directorate was updated and improved. All information of weed database including weed seed and seedling identification was uploaded on the website.
8. Steps were taken for modernization and mechanization of the experimental farm, i.e. for improving drainage, laser land leveling, reorganization/ renaming of farm/blocks, crop diversification etc. Joint visits with all scientists were organized regularly to examine the field/lab experiments.

9. An Agreement of Understanding was signed with JNKVV and National Seeds Corporation for seed production on non-experimental area of the research farm. More than 100 t seed of rice, wheat, maize and chickpea was produced annually.
10. Four training programmes on "Advances in Weed Management" were organized for Uttar Pradesh State Officers, Agriculture Development Officers from different states, scientists from ICAR Institutes and SAUs and agricultural Offices / progressive farmers from Maharashtra.
11. '*Parthenium* Awareness Week' was organized on a much larger scale during 16-22 August, 2013, which was widely covered by the national and local print and electronic media. A scientist of the Directorate received ICAR award for this work.
12. Monthly meetings with scientists including technical seminars by the scientists of the Directorate as well as outside experts were started.
13. External experts on various subjects were invited in the IRC meeting to review the work done by the scientists.
14. PME cell was made functional and strengthened further. All records of RPFs were updated, and contract research/consultancy projects were implemented through the PME Cell as per ICAR guidelines. Irrational distribution of honorarium was stopped.
15. Two projects were approved under NFBSFARA. More such proposals for external funding were submitted to different agencies. Collaboration with JNKVV, RDVV and other universities/colleges for PG students research / guidance was started.
16. Mandated programmes of the Directorate such as Agricultural Education Day, National Science Day, Industry Day, Foundation Day and Farm Innovators Day were organized for the first time.
17. Technology park displaying the weed management technologies in different crops has been developed.
18. Eight silver jubilee lectures by eminent scientists of the country were organized during 2013, besides 12 technical seminars by the scientists of the Directorate.
19. Certification for ISO 9001 : 2008 has been obtained during December, 2013 for a period for 3 years through the Global Certification Agency.

8. CHALLENGES AHEAD

Weed dynamics in high-input intensive production systems

The weed scenario has undergone a sea change with the discontinuation of some of the traditional practices like crop rotations, intercropping, mulching, organic manuring, etc. Adoption of more intensive cultivation practices with high doses of fertilizers, irrigation and other inputs to fulfil the increased future requirements is likely to shift the weed problems in unpredictable ways, and may become far more complex and challenging.

Crop-weed interaction under changing climate

Majority of crops belong to C3 whereas large number of weeds belong to C4 category. Hence climate change may have significant implications for crop-weed interaction, besides affecting herbicide bio-efficacy, herbicide resistance development, behaviour of bio-agents, and herbicide persistence. As weeds are highly dynamic and adapt quickly to new conditions, the management solutions have to address an ever-changing scenario.

Weeds in conservation agriculture systems

Globally CA systems have been adopted on 125 M ha, and the area is further expanding rapidly due to their potential benefits on crop productivity and farm profitability. However, several studies have projected weeds as the major constraint in adoption of CA technologies. There is a need for developing effective and economic integrated weed management practices to make CA practices popular among resource-poor farmers.

Development of herbicide resistant weeds

A large number of weeds have developed resistance against the popularly used herbicides. Isoproturon resistance in *Phalaris minor* in some parts of the country was a costly lesson learnt. This kind of phenomenon may occur more frequently in the foreseeable future due to rapid increase in herbicide use in view of increasing labour shortage.

Evolution of super weeds

The worldwide area under herbicide-tolerant crops (HTCs) is increasing rapidly, as they make management of problem weeds easy. However, there is possibility of development of 'super weeds' due to introduction of these crops. Glyphosate resistant weeds have already appeared in areas grown with HTCs for many years.

Growing infestation of parasitic weeds

Parasitic weeds are posing serious problems in some parts of the country, viz. *Cuscuta* in niger, lucerne, blackgram, greengram, berseem, lentil, linseed and chickpea; *Orobanche* in tobacco, tomato, potato and mustard; *Striga* in sugarcane, maize, sorghum and pearlmillet; *Loranthus* on economically useful tree crops such as

mango, neem, teak, *Dalbergia, Ficus*, etc. These weeds are spreading to newer areas and parasitizing many other host plants.

Environmental impact of herbicides

Indiscriminate use of herbicides affects the environment, and also influences the weed biology. Herbicides use in India is little at present, as compared to the global scenario, but is expected to increase by 15-20% per annum in the future. Hence, greater emphasis is needed for monitoring herbicide residues in environment and food chain.

Weeds in organic farming systems

Growing concern for human health is giving way for organic farming in some parts of the world, which needs non-chemical weed control measures, viz. tillage, crop rotation, residue management, soil solarization, intercropping, cover cropping etc. However, it is a big challenge to make these methods effective and economical.

Obnoxious weeds in terrestrial and aquatic environment

Obnoxious weeds such as *Lantana, Parthenium, Ageratum, Chromolaena, Mikania* and *Mimosa* have invaded vast areas of forest, grasslands, wastelands, orchards and plantation crops. Weedy rice is an emerging problem in direct-seeded rice in many states; and its control is difficult as they cannot be recognized at early growth stages and selective herbicides are not effective. Widespread infestation of these weeds is threatening agricultural production systems, biodiversity, and human and animal health.

Globalization and introduction of alien invasive weeds

The sanitary and phyto-sanitary agreement of WTO suggests that the countries should update their quarantine laws and incorporate the elements of pest-risk analysis for making regulatory decisions for both import and export. Therefore, there is an urgent need to analyze the risk factor associated with different exotic weeds to design safeguards and to lower the risk of their entry.

Development and updating of databases

A national database on weeds has been developed which provides information on the occurrence and diversity of major weeds in different crops, cropping systems and non-cropped areas. There is need to continuously upgrade this database to include weed shift, introduction of new alien weeds etc. Such up-to-date information would be of immense use for policy planners, researchers and local administrations.

Dissemination of weed management technologies

The societal impact of improved weed management technologies are to be assessed more systematically. Information about safe use of herbicides, herbicide application technology for higher efficacy and integration of chemicals with other methods of weed management are also to be disseminated.

9. HONOURS AND AWARDS

Name of Scientist	Award/Recognition	Year	Organization
Dr. J.G. Varshney	Late Shri P.P. Singhal Memorial Award	2010	Society of Plant Protection Sciences, New Delhi
Dr. J.G. Varshney	ISWS Gold Medal	2010	Indian Society of Weed Science, Jabalpur
Dr. J.G. Varshney Dr. Shobha Sondhia	Best English Book Award	2010	Indian Society of Weed Science, Jabalpur
Dr. J.G. Varshney	Best Hindi Book Award	2010	Indian Society of Weed Science, Jabalpur
Dr. V.P. Singh	ISWS Fellow	2010	Indian Society of Weed Science, Jabalpur
Dr Shobha Sondhia	ISWS Fellow	2010	Indian Society of Weed Science, Jabalpur
Dr. Sushil Kumar	Swami Sahajanand Saraswati Outstanding Extension Scientist Award	2011	Indian Council of Agricultural Research, New Delhi
Dr. R.P. Dubey	ISWS Fellow	2011	Indian Society of Weed Science, Jabalpur
Dr. A.R. Sharma	Fellow (2009)	2012	Indian Society of Agronomy, New Delhi
Dr. A.R. Sharma	Fellow (2010)	2012	Indian Association of Soil & Water Conservationists, Dehradun
Dr. A.R. Sharma	Award of Honour	2012	Golden Jubilee Alumni Meet of the PAU, Ludhiana
Dr. Sushil Kumar	Late Shri P.P. Singhal Memorial Award	2013	Society of Plant Protection Sciences, New Delhi
Dr. Chandra Bhanu Dr. V.S.G.R. Naidu	Dr. Rajendra Prasad Puraskar for Hindi book	2013	Indian Council of Agricultural Research, New Delhi
Dr Anil Dixit	ISWS Fellow	2014	Indian Society of Weed Science, Jabalpur
Dr. Sushil Kumar	Dr. Anand Prakash Award	2014	Applied Zoologists Research Association, Cuttack



10. PUBLICATIONS

Research papers

2009

Barman, K.K., Shrivastava, E. and Varshney, J.G. 2009. Effect of butachlor on total microbial activity, azotobacter and phosphate solubilizing fungal population. *Indian Journal of Weed Science* **41**: 27–31.

Bora, R., Barua, I.C., Das, N.J. and Naidu V.S.G.R. 2009. Seed mimicry study on *Argemone-Brassica-Cleome* and *Vicia-Lathyrus* species. *Journal of Economic and Taxonomic Botany* **33**: 903–909.

Chandra Bhanu. 2009. *Puccinia jabalpurensis* sp. Nov. on exotic weed *Lagascea mollis* from India. *Indian Phytopathology* **62**: 365-368.

Choudhury, P.P., Barman, K.K. and Varshney, J.G. 2009. Photolysis of pretilachlor on soil surface. *Indian Journal of Weed Science* **41**: 87–89.

Khankhane, P.J., Barman, K.K. and Varshney, J.G. 2009. Effect of rice residue management practices on weed density, wheat productivity and soil fertility in a swell shrink soil. *Indian Journal of Weed Science* **41**: 41–45.

Mishra, J.S. and Singh V.P. 2009. Weed dynamics and productivity of soybean *(Glycine max)* – based cropping systems as influenced by tillage and weed management. *Indian Journal of Agronomy* **54**: 29–35.

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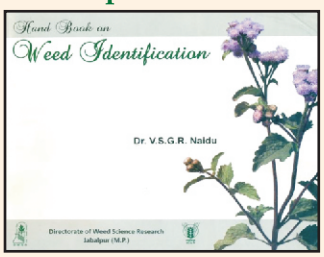
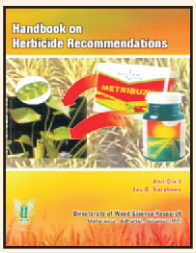
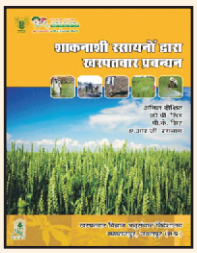
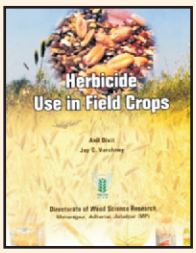
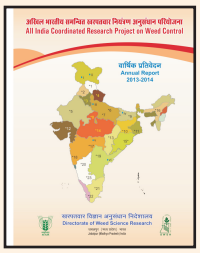
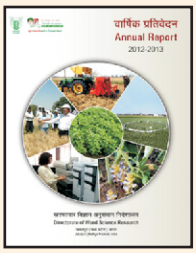


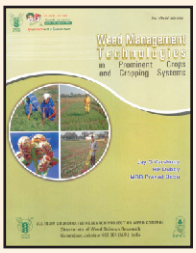


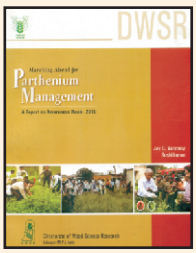


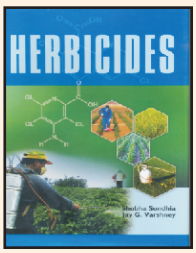


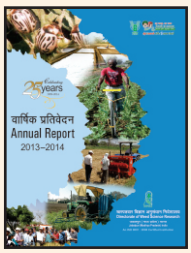


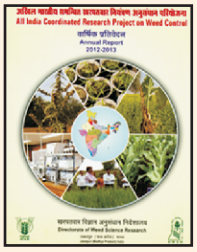


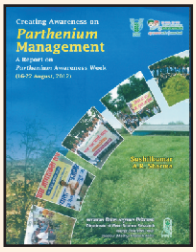


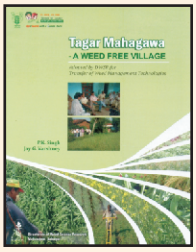


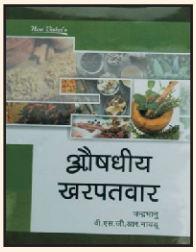


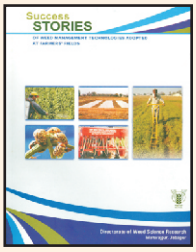


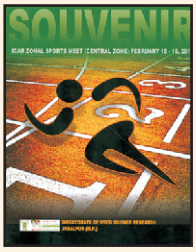












11. PROMINENT VISITORS

Prominent visitors and their comments

Dr Raghuveer Raj Prasad, Adjunct Professor, Pacific Forestry Centre, Canada (13/02/2009)

Extremely delighted to visit this Centre to interact with the scientists/staff and thoroughly enjoyed my stay here. They are doing very useful/ relevant research. My dream of a National Weed Centre for India that I proposed and initiated with Dr. M.S. Swaminathan in 1970 seems to fulfilled.

Dr M.M. Pandey, Director, CIAE, Bhopal (08/03/2009)

The campus, particularly the entrance lawn is excellently built and maintained. The R&D thrust in the important area of weed science is very relevant and the national level coordinated programmes are being pursued with vigour, objectivity and with a view to not only enhance agricultural production and productivity but also to safeguards bio security. Feeling privileged to have visited the Directorate.

Dr T.P. Trivedi, Project Director, DIPA, ICAR, New Delhi (20/06/2009)

I find it very interesting to visit DWSR and very effective, impressive activities, presence of young scientists. The upkeep and maintenance of facilities is exemplary. Keep it up.

Dr D.P. Singh, Ex-VC, JNKVV & Member, State Farmers Commission, Bhopal (26/06/2009)

I am very much delighted to see the impact of the present Director in bringing overall development and execution of multifarious activities of the institute in an excellent way. The dedicated team of young scientists under the dynamic leadership of the present Director are doing excellent work in the key areas of weed science research and their efforts will go a long way in improving the production of different crops and welfare of the farmers of the country.

Dr B.S. Bisht, VC, GBPUA&T, Pantnagar (06/10/2009)

The institute is engaged in one of the most important aspects of agricultural sector i.e. weed science and weed control. A delicate balance between agricultural productivity and ecological considerations is being promoted. The institute is well known as leader in its area of work. Congratulations to the Director, scientists, technicians and staff as well as ICAR Hq.

Sh. Hari Ranjan Rao, District Collector, Jabalpur (28/08/2009)

I am impressed by the work done by the Centre and its impact on agricultural productivity of the Nation.

Dr Mangala Rai, Secretary (DARE) and Director General (ICAR, New Delhi) (20/10/2009)

Good progress in farm development and its management.

Dr K. Kasturirangan, Member, Planning Commission (Science) (23/01/2010)

Very memorable visit to an extraordinary institution, unique in many ways. A promising direction to deal with the issues of improving the overall food production for the country.

Dr S. Ayyappan, Secretary, DARE & DG, ICAR, New Delhi (18/05/2010)

It was a good visit to DWSR, with enthusiastic researchers and good facilities. Compliments to the Director and colleagues of the directorate. Best wishes in all endeavors.

Dr H.P. Singh, DDG (Hort), ICAR New Delhi (18/05/2010)

Excellent! Impressive! Look for better integration to have maximum output.

Dr S.K. Datta, DDG (CS), ICAR, New Delhi (18/05/2010)

It is an important area, DWSR is working and the country is waiting for some break through in management of weed control. Some good work is going on, staff are energetic and interested and I do hope, the institute will come up with the present leadership for the future science and management of weeds. I was happy to be here with my colleagues and interacting with all of them.

Dr H.S. Gupta, Director, IARI, New Delhi (18/05/2010)

I am deeply impressed with the infrastructure and research programmes of the directorate.

Dr S.C. Modgal, Chairman QRT, DWSR (02/05/2012)

I am very pleased that DWSR and co-ordinated project scientists are working successfully on weed science problems and trying to make best out of the changing climate and environmental patterns and their effect on emerging technological and socio-economic trends.

Dr Nicholas Davis, BISA (19/10/2012)

Thank you for the tour. I was impressed with your facilities & quality of your research operations. I hope for a prosperous parternership with BISA.

Dr Bhagirath Singh Chauhan, Weed Scientist, IRRI, Los Banos, Philipines (24/11/2012)

I am very much impressed with the work done by DWSR for Indian farming community and research Institutes. I think this is the only institute

in the world which is focusing on weed-related (all) aspects at one place. Further interlinked collaboration among scientists will provide very fruitful information for not only in India but also in other parts of world. I would like to thank Dr. Sharma (Director) and other staff for hosting my visit and providing friendly environment during the visit.

Dr R.C. Gautam, Former Head, Agronomy & Dean, PG School, IARI, New Delhi (04/01/2014)

Lot of improvement was seen at DWSR in this visit. I am sure that DWSR will bring a name in solving weeds problems in our country. My good wishes to the scientists of this institute.

Dr M.S. Basu, Former Director, NRCG, Junagadh (20/01/2014)

It was really a great pleasure for me to see the present establishment of DWSR and the facilities created, kind of research projects being operated which really a exposure on recent trends and educative too. I wish all the success.

Dr A.K. Sikka, Deputy Director General (NRM), ICAR, New Delhi (22/04/2014)

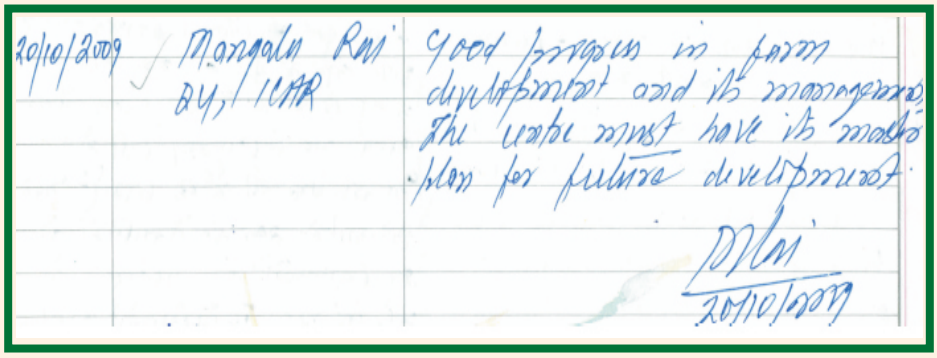
It was impressive to see that the research farm has been well laid out and excellently managed with conservation agriculture concept and the basic premise facilities are maintained properly. Scientists were quite enthusiastic and range of weed management experiments are being conducted including on-farm weed management. On completion of 25 years of the Directorate, the Director, Scientists and Administrative, Technical and Supporting staff deserve appreciation. I wish them all the best for their endeavors for taking the Directorate to the newer heights.

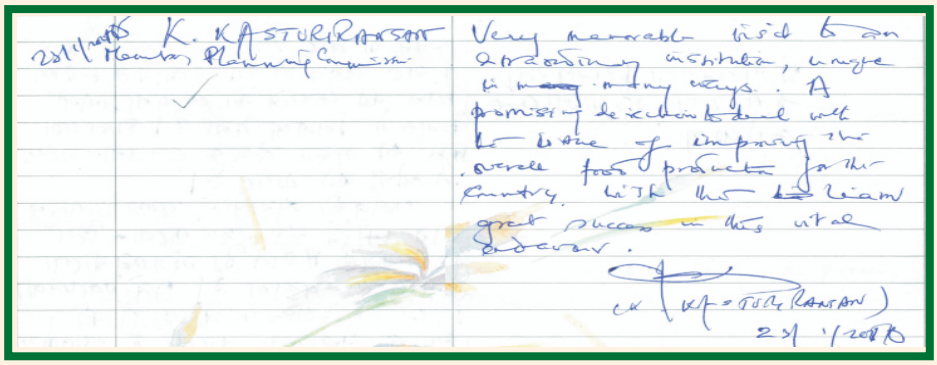
Dr. O.P. Singh, President, Dhanuka Agricutech Ltd. New Delhi and RAC Member, DWSR (17/08/2014)

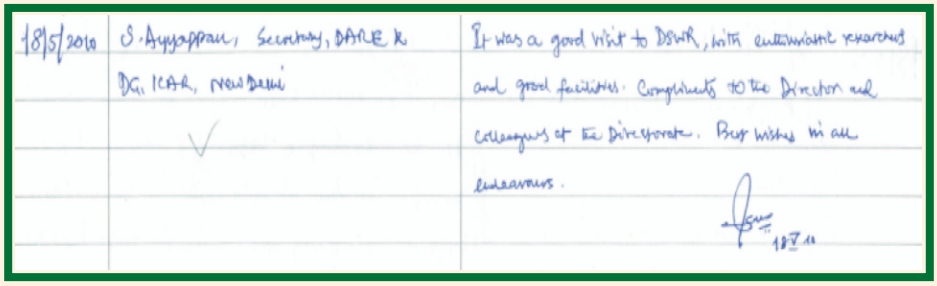
Today, 17/08/2014, Sunday, I along with Dr. Sharma, Director spent 70-80 minutes on the institute farm and Dr. Sharma showed me different innovative technologies, specially DSR, DSR + crop residue etc. As a Plant Protection Scientist and Industry executive this was 1st exposure to see the good results of DWSR technologies in rice, soybean etc. crops. The layout maintenance of experiments, and vision for future sustainable agriculture were quite impressive.

Dr. Samresh Dwivedi, Principal Scientist, ITC LSTC, ITC ABD, Secunderabad (23/08/2014)

Today along with Mr C Sashidhar & Basant Dixit visited this institute, probably only one of its kind in the world engaged in research on weeds. The atmosphere is very good with hard working & talented scientist. The research is very useful in making agriculture profitable to the farmers. Dr. Sharma & his team need to be complimented for their hard work and to continue this sustained enthusiasm for effective dissemination of information.







2 May 2012	S. C. MODGAL Chairman, QRT, DWSR & AICRIP on Weed Control.	I am very pleased that DWSR and the coordinated Project scientists are working successfully on weed science problems and trying to make best out of the changing climatic and environmental patterns and their effect on emerging technological and socio-economic trends. Suresh C. Modgal

19/6/12	Nicholas DAVIS	Thank you for the tour - I was impressed with your facilities & the quality of your research operations. I hope for a prosperous partnership with BISA!

22.04.14	Dr. A. K. Sikka DDG(NRM), ICAR, ft. Delhi	It was impressive to see that the Kaduna farm has been well laid out & efficiently managed, with Conservation Agriculture Concept as the basic premise. Facilities are adequate & properly located. Scientists were found enthusiastic & range of weed management experiments are kept & conducted including on-farm weed management. On completion of visit to the Directorate, the Director, Scientific & Admin, technical & support staff deserve appreciation. I wish them All the best for their future endeavours for taking the Directorate to greater heights. 22/04/14

12. PERSONALIA

Name	Specialization
 **Dr. A.R. Sharma** Director Email: sharma.ar@rediffmail.com Mobile: 09425807290	Weed science, conservation agriculture and nutrient management
 **Er. H.S. Bisen** Pr. Scientist (Agril Engineering) Email: bisenhs@gmail.com Mobile: 09425388101	Mechanical weeding tools, spraying techniques and machinery
 **Dr. P.K. Singh** Pr. Scientist (Agril. Extension) Email: drsinghpk@gmail.com Mobile: 09425388721	Transfer of technology, demonstrations, adoption and impact assessment
 **Dr. Ved Prakash Singh** Pr. Scientist (Agronomy) Email: vpsinghnrcws@gmail.com Mobile: 09424306051	Weed management in cropping systems, orchards and conservation agriculture
 **Dr. Sushil Kumar** Pr. Scientist (Entomology) Email: sknrcws@gmail.com Mobile: 09425388721	Biological control of weeds, aquatic weed management, weed and agro-waste utilization
 **Dr. K.K. Barman** Pr. Scientist (Soil Science) Email: barmankk@gmail.com Mobile: 09826811536	Integrated weed management and environmental quality

Name	Specialization
 **Dr. R.P. Dubey** Pr. Scientist (Agronomy) Email: dubeyrp@gmail.com Mobile: 09425412041	Integrated weed management and organic agriculture
 **Dr. D.K. Pandey** Pr. Scientist (Plant Physiology) Email: dayapandey@hotmail.com Mobile: 09893659994	Allelopathy, seed biology, natural herbicidal molecule isolation and aquatic weeds
 **Dr. P.J. Khankhane** Sr. Scientist (Soil Science) Email: pjkhankhane@yahoo.com.ph Mobile: 09926715757	Bioremediation, weed utilization, crop residue management and wetland management
 **Dr. Shobha Sondhia** Sr. Scientist (Organic Chemistry) Email: shobhasondia@yahoo.com Mobile: 09425464997	Environmental impact of herbicides, mode of degradation, biomolecules, method development for herbicide residues and herbicide mitigation measures
 **Dr. Partha Pritam Choudhury** Sr. Scientist (Organic Chemistry) Email: parthatinku@yahoo.com Mobile: 09179457045	Fate of herbicides in the environment, decontamination techniques and impact of solar UV-fraction on small organic molecules
 **Dr. C. Kannan** Sr. Scientist (Plant Pathology) Email: agrikannan@gmail.com Mobile: 09425865057	Biological management of water hyacinth and parasitic weeds, systemic induced resistance in host, microbial composting and bioethanol

Name	Specialization
 **Dr. Bhumesh Kumar** Sr. Scientist (Plalnt Physiology) Email: kumarbhumesh@yahoo.com Mobile: 09806622307	Weed dynamics and management under the regime of climate change, herbicide resistance and bioprospection of weed species
 **Dr. Raghwendra Singh** Sr. Scientist (Agronomy) Email: singhraghu75@gmail.com Mobile: 09806637031	Weed ecology, integrated weed management and conservation agriculture
 **Dr. Meenal Rathore** Sr. Scientist (Biotechnology) Email: mnl.rthr@gmail.com	Molecular tools to assess diversity and study biology of weeds, characterization of weed rice biosimilars
 **Dr. Yogita Gharde** Scientist (Statistics) Email: yogita_iasri@rediffmail.com Mobile: 09425412748	Modelling crop-weed associations
 **Dr. C. Sarthambal** Scientist (Microbiology) Email: csaratha@yahoo.co.in Phone : 0761-2353934, Ext. 327	Soil microbiology
 **Mr. Dibakar Ghosh** Scientist (Agronomy) Email: dghoshagro@gmail.com Mobile: 08989190213	Weed ecology and management in conservation agriculture

Directors

Dr. V.M. Bhan
(22.04.1989 - 31.12.1998)

Dr. L.P. Kauraw (Acting)
(01.01.1999 - 12.07.1999 & 01.08.2000 - 04.09.2000)

Dr. V.N. Saraswat
(13.07.1999 - 31.07.2000)

Dr. N.T. Yaduraju
(05.09.2000 - 04.09.2005)

Dr. A.K. Gogoi (Acting)
(05.09.2005 - 09.05.2006)

Dr. J.G. Varshney
(10.05.2006 - 21.06.2011)

Dr. A.R.G. Ranganatha (Acting)
(22.06.2011 - 11.03.2012)

Dr. A.R. Sharma
(12.03.2012 - till date)

Project Coordinators, AICRP on Weed Control

Dr. V.N. Saraswat
(19.08.1989-15.04.1993)

Dr. Kailash C. Gautam
(03.02.1994 - 07.04.1995)

After April 1995, the post of Project Coordinator was abolished and the responsibility of AICRP on Weed Control was given to the Director, DWSR.