# ICAR-DWR : A Profile

भाकृअनुप
ICAR

## ICAR - Directorate of Weed Research
## Jabalpur (M.P.)

(ISO 9001 : 2015 Certified)

DWR

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2001

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# Preface

The need for sustainable weed management is becoming increasingly important not only in agriculture, but also in the natural ecosystems. In modern weed management tools, herbicides are becoming increasingly popular among the farmers due to their high efficacy and lower cost. However, evidences show that due to over-reliance and indiscriminate use of herbicides, new problems such as herbicide resistance in weeds, weed flora shifts, non-target damage to crops/organisms, loss of natural vegetation & biodiversity, and adverse effect in food-chain and environment have increased globally. The problem has been further aggravated due to the global climate change, water & energy scarcity, deterioration of soil health, non-availability of new modes of action herbicides and restrictions/banning of some popular herbicides, and promotion of new ways of farming such as conservation agriculture, natural & organic farming systems. However, advancement in biological science (biotechnology & genetic engineering) and trends in computing power, robotics, etc. suggests that multiple paths exist for improving weed management that can be integrated with existing tools and techniques to develop more sustainable weed management systems. Emphasis need to be given on understanding the weed biology & ecology, weed seedbank dynamics, bio-based herbicide products, harvest weed seed control, etc. In addition, large-scale utilization of weeds, and capacity building of the stakeholders using modern information technological tools are also needed. Weed scientists, herbicide industries and machine manufacturers have a combined responsibility to develop and disseminate the weed management technologies for sustainable agriculture.

ICAR-Directorate of Weed Research (ICAR-DWR), an unique Institute under the Indian Council of Agricultural Research (ICAR), was established on April 22, 1989 in Jabalpur, Madhya Pradesh. The Institute's primary mission is to develop and disseminate viable weed management technologies for different agro-ecological regions of the country through cutting-edge scientific research and capacity building of farmers and other stakeholders. The dedicated team of scientists and technical staffs bring a diverse array of expertise to advance the frontier research in the field of weed management.

This document "ICAR-DWR: A Profile" is a revised and updated version of previous document. It is my great pleasure to present this profile, offering a glimpse into the journey of DWR over the past three and half decades since its inception in 1989. In this publication the Institute's major achievements, research facilities, laboratories, and infrastructure have been highlighted.

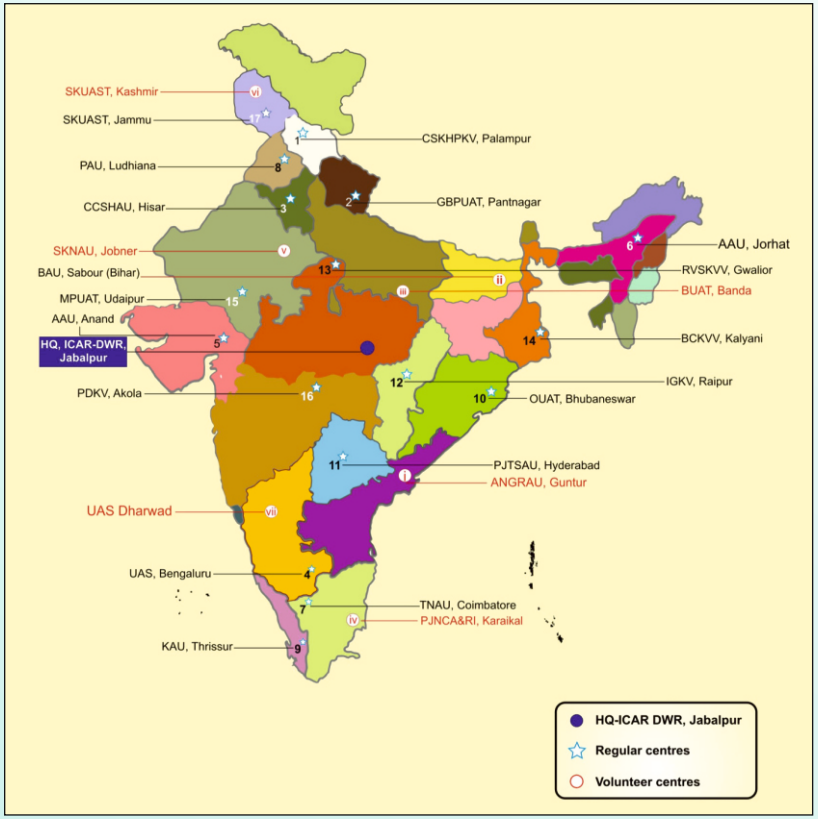
I extend my special thanks to Dr. P.K. Singh and Shri Sandeep Dhagat for taking initiative for bringing out this publication. I also express my thanks to all the scientists for providing timely information for this document.

Place: Jabalpur
Date: 02 April, 2024

**(JS Mishra)**
Director
ICAR-Directorate of Weed Research

# Introduction

Weeds have always been the major biotic constraint in crop production. Weed management is therefore essential for agricultural production to meet future food requirements. Of the total loss caused by various pests in agriculture, weeds accounts for 37% followed by insects (29%), diseases (22%) and others including nematodes, rodents, mites, birds, etc. (12%). The actual yield loss due to weeds varies from 14% in transplanted rice to as high as 36% in groundnut. The totals actual economic loss due to weeds in 16 major crops has been estimated as Rs 78,591 crores per annum. Besides, invasive weeds have invaded 22% of the natural habitats in the country. In view of the emerging challenges in weed management due to extreme climate events, weed seed dispersal through global trade, weed flora shift and herbicide resistance in weeds, labour shortage, adverse impact of herbicides on the quality of crop produce, environment and human health, etc., development of efficient weed management technologies incorporating the interaction of environmental, economic and societal dimensions of agro-ecosystems is vital for increasing productivity, sustainability and farmer's income.




Historically, weeds are being managed by the farmers adopting repeated tillage, crop rotation, manual/mechanical weeding, puddling and stagnation of water in rice, etc. In India, sodium arsenite was the first chemical used in 1937 as an herbicide to control the *Carthamus oxycantha* (wild safflower) in Punjab. Later 2,4-D was first evaluated in 1946 and introduced in 1948 for broad-leaved weed control. However, the systematic research on weed

management in India was initiated by the Indian Council of Agricultural Research (ICAR) in 1952 with the inception of All India Coordinated Research Scheme in major crops like rice, wheat and sugarcane. To give further impetuous on weed management research, the weed control section was started in the Division of Agronomy, Indian Agricultural Research Institute (IARI), New Delhi in 1952, and Division of Weed Ecology and Control at Indian Grassland and Fodder Research Institute, Jhansi in 1967. The All India Coordinated Research Project on Weed Management (AICRP-WM) was started in 1978 to address the location-specific weed problems. To carry out the basic and strategic research on weed management, the National Research Centre on Weed Science (NRCWS) was established at Jabalpur during 1989, which was later upgraded to the ICAR-Directorate of Weed Science Research (DWSR) in 2009, and renamed as the ICAR-Directorate of Weed Research (DWR) in 2014.

Started with 6 centres, AICRP-WM now has 24 centres (17 regular and 7 voluntary) spread in different agro-ecological regions of the country. The ICAR-DWR has been continuously working to strengthen its research and extension programmes. To meet the future challenges in weed management, major emphasis is being given on weed management in conservation agriculture and direct-seeded rice, crop-weed interaction and herbicide efficacy under changing climate scenario, biological control of invasive weeds, precision weed management, estimation of herbicide residue in food chain and environment, dissemination of improved weed management technologies and strengthening collaboration with herbicide industries and other organization.

## 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

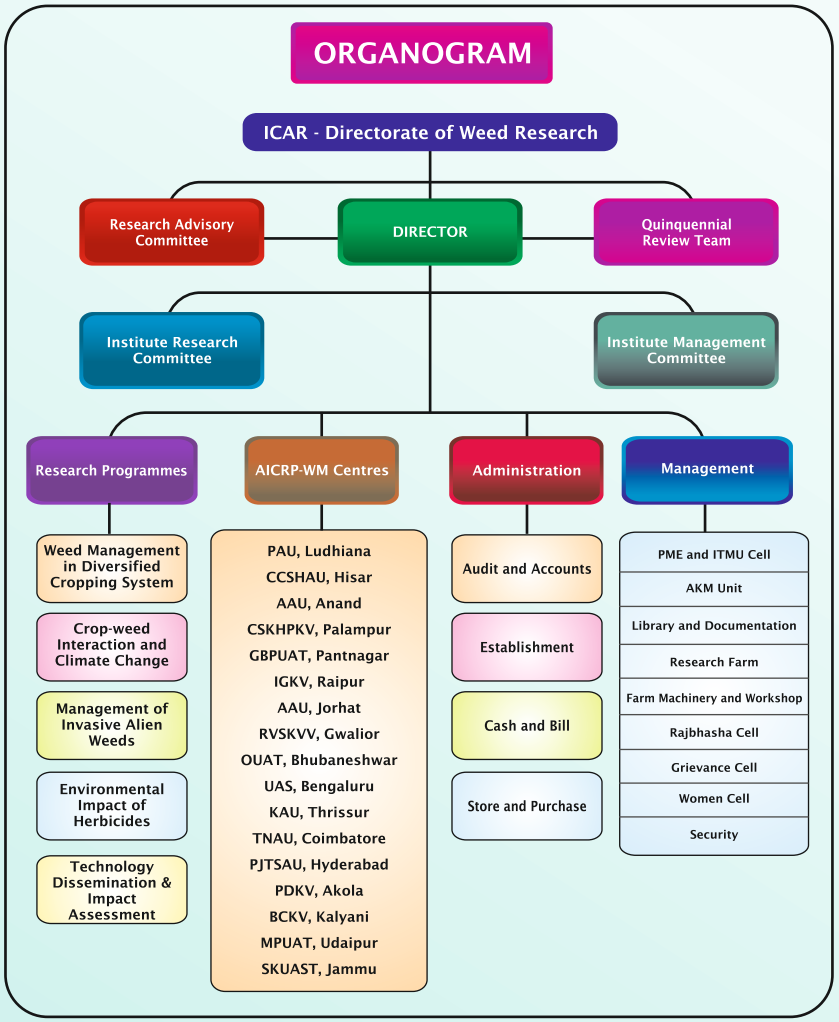
- Conducts weed management research for developing viable technologies for different agro-ecological regions.
- Coordinate the network research and to provide training in weed management in agricultural systems.
- Repository of information in weed science and act as a centre for training in weed management.

# Organization

ICAR-DWR is organized with an inter-disciplinary structure, and has strong focus on developing and disseminating sustainable weed management technologies. The Director has the administrative control over the Directorate. Quinquennial Review Team (QRT), Research Advisory Committee (RAC), Institute Management Committee (IMC) and Institute Research Committee (IRC) are other advisory bodies for research, teaching/training and extension activities. There are 5 major research sections, 4 administrative sections and 9 other units & cells for smooth functioning and effective coordination.

## Location

The Directorate is located at Maharajpur in the historic city of Jabalpur (22.5-24.8°N latitude, 78.2-80.6°E longitude with an altitude of 412 m above mean sea level), about 11 km from Jabalpur railway station and 28 km from Dumna airport.



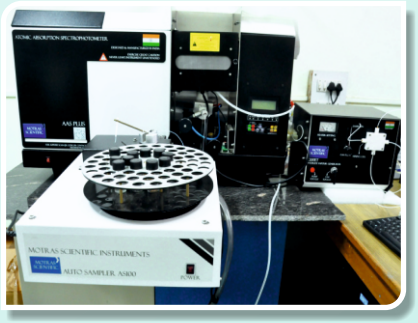
## Research Farm and Workshop

The Institute has a well-developed research farm of 61.5 hectares to undertake field experiments on different aspects of weed management to meet the international standards. It includes well established threshing floor, vermi-compost unit, implement shed, storage godown, water harvesting structure, solar panel, micro-irrigation systems, modern farm machineries, etc. In addition, there is a well-developed agricultural engineering Workshop with facilities for fabrication, designing and development of weeding tools and spraying systems.

## Laboratories and Equipments

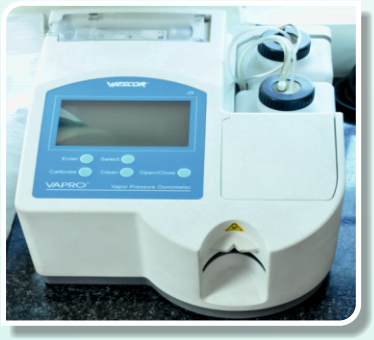
ICAR-DWR has dedicated laboratories for research work on soil science, agronomy, plant physiology, plant biotechnology, residue analysis, biocontrol, microbiology and pathology. Apart from these, one central laboratory is also in place housing all common equipments like ice maker machine, leaf area meter, root scanner, UV spectrophotometers, pH meters, conductivity meters and BOD incubators etc. Laboratories are well-furnished and equipped with modern and sophisticated scientific instruments like LC-MS/MS, GC, HPLC, IRGA, lyophilizer, atomic absorption spectrometer, UV-visible double beam spectrophotometer, spectroradiometer, N-auto-analyzer, osmometer, thermal cycler, solid phase extraction unit, gel documentation unit, vacuum evaporator, high-speed refrigerated centrifuge, water purification system, flame

LC-MS-MS instrumentation



Atomic absorption spectrometer

IRGA Photosynthetic System




Osmometer

Gel Doc System


PCR machine

photometer, and nano spectrophotometer. Sample storage facilities include liquid nitrogen containers, ultra-freezer (-80°C) and deep freezers (-20°C). It has a containment facility and two controlled environmental chambers to facilitate research under controlled environmental conditions. Directorate has specialized facilities like Free Air $CO_2$ Enrichment (FACE) facility and Open Top Chambers (OTC) to study possible impact of futuristic climate change on crop-weed interaction and herbicide efficacy, beside an automatic weather station, phytoremediation unit and biocontrol insects rearing units.

## Agriculture Knowledge Management Unit, Library and Information Center

Agriculture Knowledge Management Unit (AKMU) is well equipped with computers, video conferencing facility, LAN facilities, color xerox-cum-printer and plotter. All the scientists and coordination units have been provided with internet connection and Wi-Fi connectivity. Library has a total collection of 3370 books related to weed science, 14 Indian journals in its subscription, newspapers section and sufficient reading area for students and employees. Reprographic and documentation facilities have also been created for the preparation of documents and reports. One information center has been developed to display the updated information regarding weed science and management technologies. Directorate's publications, prototypes of weed management tools and live specimens of weed seeds are also on display for visitors.

## Conference Rooms

The Directorate has two conference rooms equipped with modern audio-visual systems for conducting parallel sessions of conferences, trainings, meetings, etc.


## Guest House

The Directorate has a well-furnished 'Training Hostel-cum-Guest House' which has 12 double bed rooms and 2 dormitories, and can accommodate about 32 guests at a time. The guest house has a well-equipped kitchen and well-furnished dining hall.



## Weed Cafeteria

A weed cafeteria including 120 number of weeds of rainy, winter and summer seasons has been developed at the Directorate to show the live specimen of different weeds to the farmers, students and other stakeholders.

# Salient Achievements

**Major achievements of the Directorate during the last 35 years are**

- Developed integrated weed management technologies in different crops and conservation agriculture-based cropping systems.

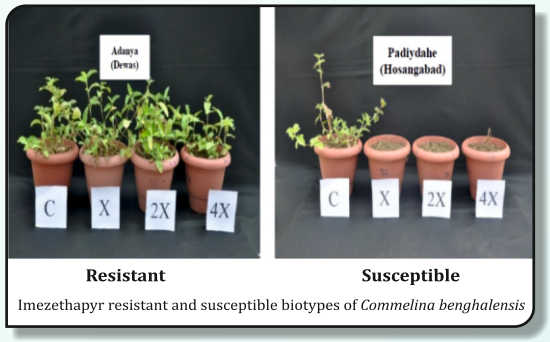


- Biological control of invasive weeds *Parthenium hysterophorus* using bio-agent *Zygogramma bicolorata* and replacement of *Parthenium* using *Cassia* spp.; water hyacinth by *Neochetina* spp. and *Salvinia molesta* using *Cyrtobagous salviniae*.

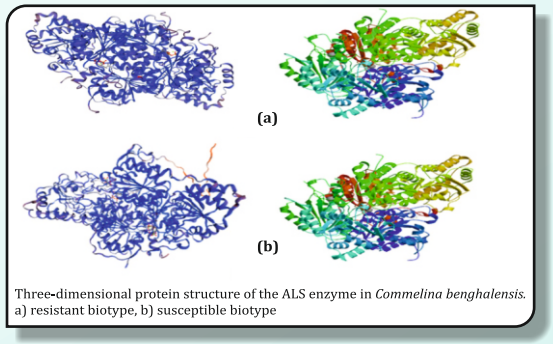


- Agro-techniques for management of herbicide resistant biotypes of *Phalaris minor* in wheat.


- Identification of herbicide resistant weed biotypes and molecular mechanisms of herbicide resistance.




Imezethapyr resistant and susceptible biotypes of *Commelina benghalensis*




Three-dimensional protein structure of the ALS enzyme in *Commelina benghalensis*. a) resistant biotype, b) susceptible biotype

- Management of parasitic weeds *Orobanche* in mustard, *Cuscuta* in pulses & oilseeds, *Striga* in sugarcane and *Loranthus* in tree crops.

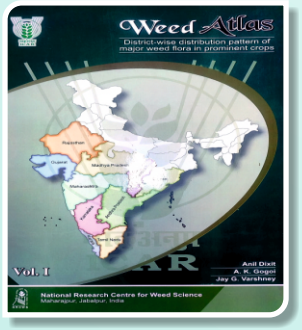
- Developed sensor-based ergo-refined weeding tools and spraying systems.

- Impact of climate change on crop-weed interactions and herbicide efficacy.

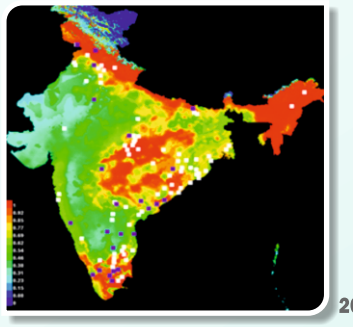
- Technology for phytoremediation of polluted water using aquatic weeds.

- Impact of herbicide residues in soil, water, food and non-target organisms, and developed multi-herbicide residue analysis method.

- Developed Weed Atlas of the country.



- Future projection maps of major invasive weeds such as *Alternanthera sessilis*, *Phalaris minor* and *Physalis minima*.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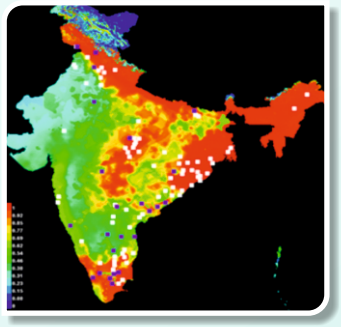
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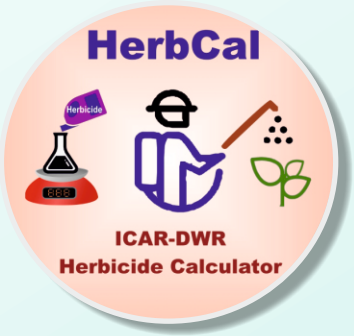
- Mobile Apps "HerbCal, Weed Manager, Weedseed GURU.

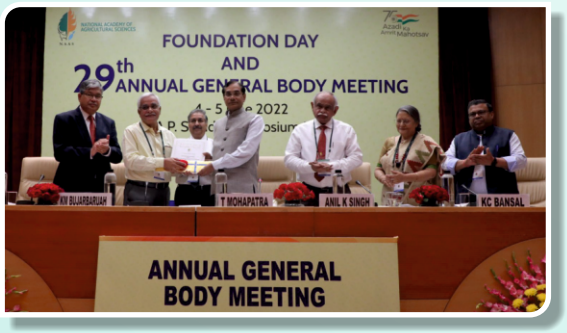





- Developed Weed Seed identification kit

# Awards and Recognitions

The Directorate received several prestigious ICAR awards namely *Rajarshi Tandon Rajbhasha* Award, *Ganesh Shankar Vidyarthi* Hindi Magzine Award, Dr. Rajendra Prasad Puraskar for Hindi book "*Oushadhiya Kharpatwar*; Swami Sahajanand Saraswati Outstanding Extension Scientist Award, FAI Award, NAAS Fellowship; Rajbhasha shield and Appreciation certificates from NARAKAS, Jabalpur, and ranked 37$^{th}$ position among all the ICAR institutes. In addition, several awards and recognitions have been received by the individual scientists.



## Quality Seed Production

The Directorate has signed MoU with Madhya Pradesh State Seed and Farm Development Corporation and producing certified seeds of improved varieties of rice, wheat, mustard, chickpea, field pea, blackgram and greengram.


## Linkage and Collaboration

To widen the scope of weed management research, ICAR-DWR signed MoUs with most of the State Agricultural Universities, Private Universities, Herbicide industries, NGOs and other national and international organizations. Large number of post-graduate and Ph.D. students are doing their research work at the DWR.


## Training, Consultancy and Contract Research Services

Based on rich expertise and multi-disciplinary team of the scientists the Directorate offers regular training to farmers, State Government Officers, Scientists from KVKs and other organizations, Industry personals and other

stakeholders on various aspects of weed management. The DWR also provides consultancy services to State/ Central government organizations on management of invasive weeds. In addition, the Directorate conducts evaluation trials of new herbicide molecules received from herbicide industries on regular basis under contract research programme.


## Road Map for Future Research

- Continue to address emerging challenges in weed management in crops and cropping systems.
- Development of low-cost ergo-refined spraying systems and weeding tools
- Sensor-based precision weed management
- Development of herbicide tolerant varieties in major crops
- Crop-weed interaction and herbicide efficacy under climate change
- Development of bio-herbicides
- Development of multi-herbicide residue methods
- Identification and management of herbicide resistant weeds
- Bioprospecting, nutritional and biochemical profiling of potential weeds
- Development of insect quarantine lab and import of biocontrol agents (insects)
- Impact assessment of weed management technologies
- Digitization and mapping of weeds of different cropping systems
- NABL accreditation of laboratories
- Development of ICT tools

# Staff of ICAR-DWR

## DIRECTOR

Dr J.S. Mishra

## SCIENTIFIC STAFF

| | |
|---|---|
| Dr. P.K. Singh | Principal Scientist |
| Dr. R.P.Dubey | Principal Scientist |
| Dr. K.K. Barman | Principal Scientist |
| Dr. Pijush Kanti Mukherjee | Principal Scientist |
| Dr. Shobha Sondhia | Principal Scientist |
| Dr. V. K. Choudhary | Principal Scientist |
| Dr. Yogita Gharde | Senior Scientist |
| Dr. Chethan C.R. | Scientist |
| Dr. Deepak V. Pawar | Scientist |
| Dr. Surabhi Hota | Scientist |
| Dr. Jitendra Kumar Soni | Scientist |
| Dr Archana Anokhe | Scientist |
| Dr. Himanshu Mahawar | Scientist |
| Dr. Sreekanth Dasari | Scientist |
| Er. Vaibhav Choudhary | Scientist |
| Mr. Jamaludheen A. | Scientist |
| Dr. Sahadeo I. Kuwardadra | Scientist |
| Dr. Deekhsa M.G. | Scientist |

## TECHNICAL STAFF

| | |
|---|---|
| Mr. R.S. Upadhyay | CTO |
| Mr. Sandeep Dhagat | CTO |
| Mr. G.R. Dongre | ACTO |
| Mr. Pankaj Shukla | ACTO |
| Mr. S.K. Parey | ACTO |
| Mr. J.N. Sen | ACTO |
| Mr. K.K. Tiwari | STO |
| Mr. G. Vishwakarma | STO |
| Mr. M.K. Meena | STO |
| Mr. S.K. Tiwari | TO |
| Mr. S.K. Bose | TO |
| Mr. A.P. Singh | TO |
| Mrs. Iti Rathi | TA |
| Mr. D.K. Sahu | TO (Driver) |
| Mr. Bhagunte Prasad | TO (Driver) |
| Mr. Sebastin Das | TO (Driver) |
| Mr. Veer Singh | T-1 |

## ADMINISTRATIVE STAFF

| | |
|---|---|
| Mr. R. Hadge | AO |
| Mr. Rajeev Kulshrestha | F & AO |
| Mr. T. Lakhera | AAO |
| Mrs. Nidhi Sharma | PS |
| Mr. M.K. Gupta | PA |
| Mr. Francis Xavier | UDC |

# Major Activities





# Conferences/ Seminars/ Meetings





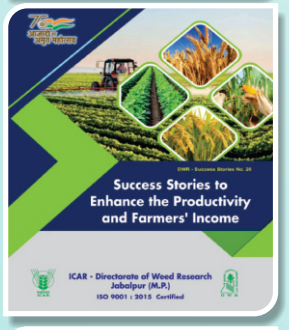

# Extension Activities

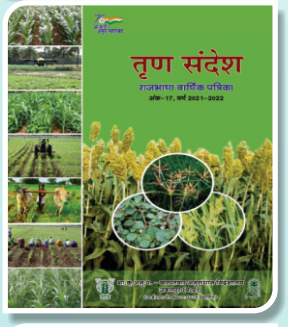
# Other Activities




# Publications



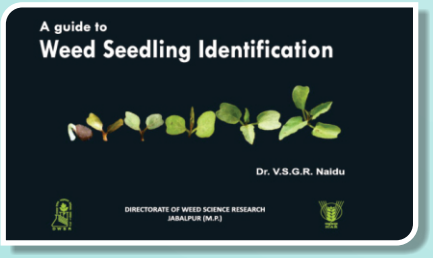



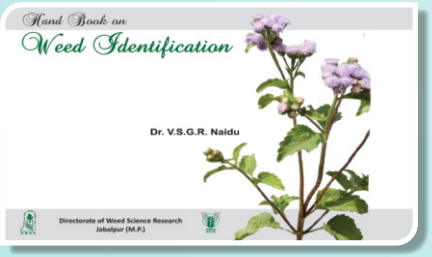





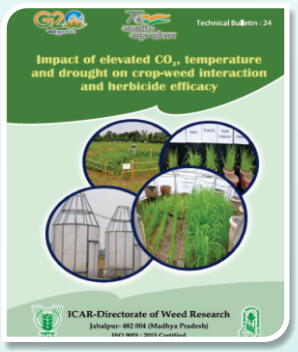


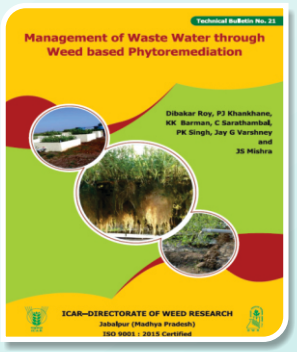


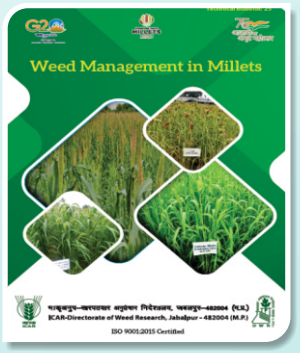


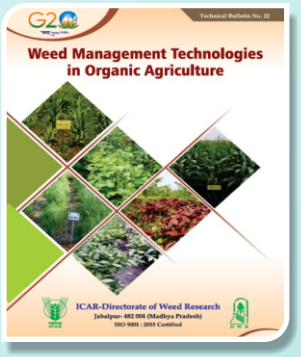



# Publications

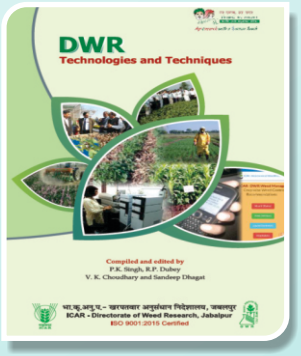


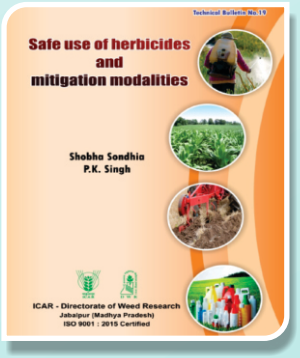



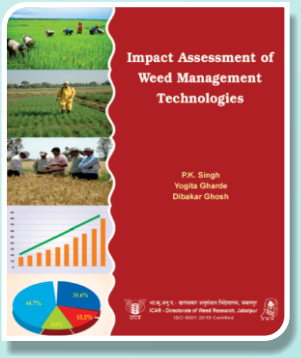



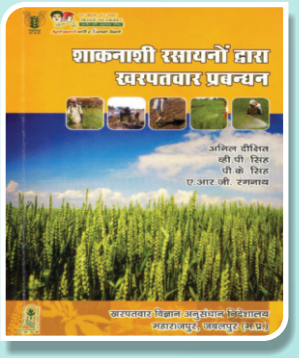





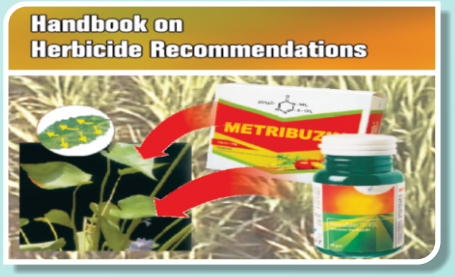


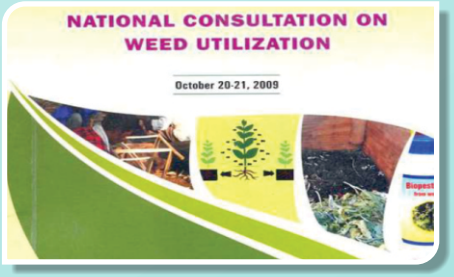








हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

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Facebook Link: https://www.facebook.com/ICAR-Directorate-of-Weed-Research-101266561775694

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