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कार्यवृत
Proceedings

अखिल भारतीय समन्वित खरपवार प्रबंधन परियोजना की XXIX वार्षिक समीक्षा बैठक

XXIX Annual Review Meeting of All India Coordinated Research Project on Weed Management

स्थान
तमिलनाडू कृषि विश्वविद्यालय, कोयम्बतूर (तमिलनाडू)

25–27 मई, 2022

Venue

Tamil Nadu Agriclutural University, Coimbotre (Tamil Nadu)

25-27 May, 2022

भा.कृ.अनु.प.–खरपतवार अनुसंधान निदेशालय
जबलपुर–482 004 (म प्र)
ICAR-Directorate of Weed Research
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Proceedings of
XXIX Annual Review Meeting
All India Coordinated Research Project on Weed Management
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Tamil Nadu Agricultural University, Coimbatore

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INAUGURAL SESSION

Dr V Geethalakshmi, Hon'ble Vice Chancellor TNAU graced the inaugural session as the Chief Guest and Dr M Raveendran, Director of Research, TNAU as Guest of Honour. Dr J S Mishra, Director, ICAR-DWR, Jabalpur welcomed the dignitaries and participants, and highlighted the AICRP-WM programmes that need to be linked with national priorities like organic farming, use of bio-herbicide, drone based herbicide application technique, development of herbicide tolerant crop varieties, basic research in terms of weed dynamics, biology and ecophysiology of crop-weed interaction and shift in weed flora under climate change regime, weed risk assessment, weeds of national importance and impact analysis. At the end of his remark he emphasized on the formulation of technical programme on the basis of emerging weed problem.

Dr Raveendran, highlighted the emerging areas of weed management like use of Artificial Intelligence and Robotic in weed management, use of renewable energy and laser radiation for controlling weeds, exploration of weed competitiveness varieties for minimizing crop-weed competition, microbial formulation and plant product to be used as bio-herbicide, and development of herbicide tolerant crop through NON-GM method.

Dr V Geethalakshmi, in her address, mentioned about the impact of climate change on spatial distribution and altitude migration of weed flora apart from its faster rate of life cycle that leads to higher persistence capacity of the weeds in the ecosystems. She informed the audience about the account of losses of natural resources caused by the weeds. She stressed up on the need of weed management in organic agriculture in order to improve the export quality of high value crops like tea. She also highlighted the emerging researchable areas like image analysis of crops and weeds through machine learning technology, robotic technology for weed management, gene editing and mutation breeding for developing herbicide tolerant crop varieties, use of nanotechnology for nano formulation of herbicides. She also mentioned that these researchable areas could be successfully taken up in collaboration with agencies and institutions specialized in particular areas. She further emphasised the need of cross learning approach for better understanding and sharing of knowledge based information.

On the occasion, former Principal Investigators of AICRP Weed Management, TNAU, Dr Mohammud Ali, Dr O S Kandasamy, Dr Kembuchetty, Dr N K Prabhakar, Dr C Chinnusamy were felicitated for their contribution in the field of weed science in general and AICRP-Weed Management in particular.

Following publications were released during the inaugural session:

- Annual Report, AICRP-WM
- Compendium on herbicide residue research – TNAU, Coimbatore
- Effective weed management technology – PJANCOA, Puducherry
- Herbicidal research on weed management through drone - TNAU, Coimbatore
- Integrated weed management in soybean and precaution of using herbicide application - UAS Bengaluru
- Hand book on weed identification - UAS Bengaluru
- Mobile app on weed management (*Kalai Nirvaagi* app) - TNAU, Coimbatore
- Weed manager App – RVSKV, Gwalior

The Best centre award for 2021 was given to GBPUAT, Pantnagar centre. The session ended with words of gratitude expressed by Dr R P Dubey, In-charge, AICRP-WM.

TECHNICAL SESSION - I

Presentation of salient findings of AICRP-WM Centres

Chairman	**:**	Dr. N.T. Yaduraju Ex Director, ICAR-DWR, Jabalpur
Co-Chairman	**:**	Dr. J.S. Mishra, Director, ICAR-DWR, Jabalpur
Resource persons	**:**	Dr. A.N. Rao, Chief Editor, Indian Journal of Weed Science
Rapporteurs	**:**	1. Dr. V.K. Choudhary, Sr. Scientist (Agronomy), ICAR-DWR, Jabalpur 2. Dr. T. Ramprakash, PI, AICRP-WM, PJTSAU, Hyderabad

In the beginning, a brief presentation on the salient achievements and recommendations of AICRP-WM during 2021-22 was made by Dr. R.P. Dubey. Afterwards, the PIs of the coordinating centres presented the major findings:

PAU, Ludhiana

- Evaluated pyroxasulfone in maize and found 102 g/ha is providing broad-spectrum weed control. Under resource conservation, puddled transplanted rice-ZT (HS) +R provided higher yield but DSR-ZT+R along with integrated weed management recorded higher economics, B: C and better soil parameters.
- Studies on monitoring and managing herbicide resistance to different herbicides in *Phalaris minor* biotypes from farmers' fields have shown a high level of resistance to sulfosulfuron and clodinafop, moderate resistance to mesosulfuron + iodosulfuron and fair resistance to pinoxaden. On the other hand, none of the populations had shown any resistance to pendimethalin, pyroxasulfone and metribuzin.
- Among the different herbicide combinations for the control of multiple HR *P. minor*, pyroxasulfone 127.5 g/ha + pendimethalin 1500 g/ha (PE) fb metribuzin + clodinafop (PoE) was the most effective, recording the lowest weed dry matter and weed control efficiency and wheat yield.
- The problematic weeds in Punjab were *P. minor*, in wheat; *Fimbristylis* sp and *Leptochloa chinensis* in transplanted rice; *Dactyloctenium aegyptium*, *Leptochloa chinensis, C. rotundus* and *E.colona* in DSR.
- *Neochetina* weevil has started showing control of water hyacinth.
- Residues of butachlor, pretilachlor, bispyribac-Na, penoxsulam, cyhalofop butyl, fenoxaprop, trifamone, ethoxysulfuron in rice crop; pyroxasulfone, clodinafop and metribuzin residues in wheat; atrazine residues in tube well water were below the detection levels (BDL) in samples collected from farmers filed in several districts across the Punjab state.
- Degradation of pinoxaden was gradually increased with an increase in temperature, likewise, it was faster in light soil than in heavy soil.

Comments

- The traveling seminar conducted on *Tar Wattar* DSR to the farmers of Punjab and Haryana, *P. minor* resistance management, and effective collaboration with the state agricultural department for pushing the technologies to the farmers was much appreciated.

CSKHPKV, Palampur

- Establishment of perennial weeds under conservation agriculture fields in aerobic rice-based cropping system was reported; ZTR coupled with IWM recorded better weed control, higher yield and more economic returns in aerobic rice-wheat cropping system.
- In an organically managed maize-pea cropping system, crop rotation, RSSB+hoeing and intensive cropping increased pea pod yield by 67.5, 22.5 and 23.8%, respectively, over mechanical check, RSSB+ hoeing, SSB+mulch.

- Under natural farming, weed flora composed of 13 species in *Rabi* and 15 species during *Kharif* season *Lolium temulentum* was the most important weed during *Rabi* season, and during *Kharif* season, *Cyperus* sp was the most important weed with high IVI values.
- Clodinafop and MSM residues in both soil and wheat grain and butachlor in soil and rice grains under different tillage and residue management techniques were BDL at harvest time.
- Residues of ethafluralin in soil and soybean seed were BDL at harvest.

Comments:

- Strong collaboration with the Department of Agriculture and other extension organizations is necessary to take forward the success achieved in DSR for its widespread adoption in the state. The success achieved in Punjab and Haryana should be taken as an example.
- Select one or two WM technologies that can significantly impact the farmers' profitability and start intensive extension activities on these technologies. Farmer to farmer extension is essential for the large scale adoption of WM technology.
- An impact assessment survey is to be carried out to assess the follow-up on the adoption of the technologies, viz., the area covered by the technologies.
- AICRP-WM centres located in the different states shall be cognizant of the developments in the form of the appearance of the new weeds, emerging trends in weed-related problems, herbicide related problems, and herbicide resistance in different states and communicate to ICAR-DWR from time to time.

CCSHAU, Hisar

- Application of PE pyroxasulfone *fb* imazethapyr (PoE) and PE application of pendimethalin + imazethapyr *fb* HW provided good control of weeds and higher WCE.
- In rice-wheat CA system, *P. minor* density and biomass were higher with CT than with ZT wheat. The biomass and density of *R. dentatus* and *Medicago denticulata* were higher with ZT than with CT treatments.
- At Karnal, 11 populations of *P. minor* showed less than 70% control at even 2X doses of clodinafop, sulfosulfuron and mesosulfurin+iodosulfuron.
- Pyroxasulfone at 127.5 g/ha + pendimethalin 1500 g/ha and metribuzine followed by mesosufuron+iodosulfuron 14.4 g/ha is considerably controlling resistant biotypes of *P. minor*.
- *Orobanche* in tomato can be controlled using sulfosulfuron.
- In greengram, pendimethalin+imazethapyr is giving good weed control.
- *Leptochloa* in rice and *Ipomoea* in cotton are emerging weeds.

Comments:

- The spread of the *tar-wattar* DSR in terms of area and adoption by the farmers should be quantified in Haryana state to understand the impact of the technology. Reasons for slow/ poor adoption of the *Tar-wattar* technology should be found out and sorted out to facilitate the spread of the technology.
- Data in terms of the district-wise severity of the herbicide resistance problem, especially *P. minor* should be collected through an extensive survey. Further, season-wise dynamics of the intensity of HR, losses caused by this specific weed, and the impact of the weed management technologies in mitigating the losses to the farmers shall also be collected and documented. Such data would be essential in identifying the impactful WM recommendations and making policy recommendations to the government.
- *P. minor* is a serious problem. Therefore, a sample survey is required to study the spatial variability of the intensity of the problem.
- Collaborate with the state government and push DSR technology in Haryana as Govt is giving Rs 4000/acre incentives to DSR adopters.

GBPUAT, Pantnagar,

- Studies on management and *in-situ* utilization of weeds in different cropping systems had shown the highest WCE (74%) and blackgram seed yield (1250 kg/ha) with imazethapyr 100 g/ha. In maize, the highest WCE (77.1%) and maize seed yield (5600 kg/ha) was obtained with topramezone (33.6 g/ha) *fb* one hand weeding.
- The highest WCE (77.1 %) and cane yield (70.5 t/ha) were recorded with sugarcane paired row (120 cm), hoeing *fb* atrazine 1000g/ha (PE) *fb* topramezone 25 g/ha (PoE). This treatment gave 14.6 % higher yield.
- Under CA, TPR+residues incorporation-ZT+R wheat-sesbania along with IWM was effective in rice-wheat cropping system.
- Transplanting rice with Sesbania incorporation and stale seed bed in sweetcorn and two mechanical weeding in pea has proven better than other treatments under organic farming.
- In wheat at farmers field, pinoxaden 40 g +metsulfuron 4 g/ha has given higher yield over farmer's practice.

Comments:

- The Pantnagar centre is among the oldest under AICRP-WM, hence an impact assessment study should be made to showcase the major contributions to the farming community.

SKUAST, Jammu,

- In rice, green manuring of Sesbania coupled with triafamone + ethoxysulfuron 66.5 g/ha at 25 DAS was found suitable for DSR and in wheat 125% RDF with clodinafop+metribuzin (54+120 g/ha) gave better weed control, higher yield and higher returns.
- Conventional tillage FIRB and zero tillage wheat produced statistically similar yields but higher net returns and B:C were observed in zero tillage than in conventional tillage and FIRB. Pendimethalin 1 kg/ha *fb* bispyribac 25 g/ha *fb* HW in rice and sulfosulfuron+metsulfuron 30+2 g/ha *fb* HW in wheat provided better weed control and higher yield. However, under ZT+R *Medicago* was the dominant weeds
- In maize, atrazine 500+topramezone 25.2 and atrazine 500+tembotrione 120 g/ha and in chickpea pendimethalin+imazethapyr 1 kg/ha and in marigold, pendimethalin at 1.5 kg/ha *fb* hand weeding at 30 DAS resulted in better weed control options with higher yields.
- In organic cultivation of rice, the highest WCE, yield, B:C with *Sesbania* green manure *fb* one hand weeding at 30 DAT followed by paddy straw mulch (6 t/ha) in transplanted knolkhol recorded higher WCE, more yield and higher economic returns.
- The fenoxaprop ethyl+ metribuzin or pinoxaden+ metribuzin were found to provide satisfactory control at *P. minor* which was resistant to clodinafop or sulfosulfuron.

Comments:

- Document information on the extent of herbicide use in different crops through impact surveys
- Interaction effects of tillage and weed management experiments, especially in CA should be documented. Only main treatment effects are being presented.
- Identify areas where herbicide resistance is emerging in Jammu state. Survey to identify areas where the HR problem is serious in Jammu state and how HR problem is changing in different years.
- Effective recommendations developed in the centre and recommendations developed in neighbouring states should be identified, and effective extension strategies shall be formulated to nip the problem in the bud. And to prevent the spread of the problem to new areas.
- An extensive survey needs to be conducted to bring out the facts and farmers' perceptions about HR.
- Collaborate with the PAU and CCSHAU in conducting the surveys and gain from their experience.

RVSKVV, Gwalior

- Under CA, for the last two years *Rumex* and *Fumaria* are not being recorded,
- In the pearl millet- mustard-cowpea cropping system under CA, the lowest weed density, weed biomass and highest WCE were recorded with ZT-ZT+R-ZT, whereas the WCE and crop performance were higher with Conventional tillage practices in mustard.
- In organically grown maize-potato-green manure cropping system, highest WCE, net returns, B:C was recorded with soil solarization *fb* one hand weeding at 40 DAS in sweet corn crop. Similar results were recorded with the potato crop also.
- In berseem, *Cuscuta* can be effectively managed by applying imazethapyr 40 g/ha after first and the last cut.

Comments:

- Survey the intensity of *Cuscuta* infestation in berseem in farmer's fields in MP.
- Identify reasons for the complete disappearance of *Portulaca* in long-term experiments.
- Ascertain the facts behind the response of CT showing better results than other tillage practices in mustard. However, in pearl millet and cowpea crops, ZT+R applied during the entire year responded to higher WCE and better yields.
- Discontinue the CA experiments if machinery is not being used in the experiment because the up-scaling is not possible without involving machines.

PJTSAU, Hyderabad

- In CA experiment in cotton-maize-green manure, the dry weed weight was significantly low in CT plots, followed by ZT+R plots over ZT plots at 30 DAS. Application of atrazine + paraquat PE *fb* tembotrione PoE in ZT and ZT+R and atrazine PE *fb* tembotrione PoE in CT (chemical) controlled weeds effectively compared to tembotrione + atrazine 50% WP EPoE *fb* brush cutter at 40 DAS (IWM) in *Rabi* maize. Yield and economics did not vary among the tillage treatments. However, higher yield, gross and net returns and B: C were realized with chemical weed management, which was significantly superior over IWM and control.
- *Leptochloa chinensis, Ischaemum rugosum, Paspalum distichum* are emerging as problem weeds in rice growing areas, especially in wet DSR / dry converted wet rice.
- Significant phytotoxicity of oxyfluorfen, oxadiargyl, and bensulfuron methyl+ pretilachlor was observed on fingermillet and resulted in complete failure of germination.
- There was a significant impact of the weed management practices on soil enzyme activity (Dehydrogenase activity, Urease, Acid and Alkaline Phosphatase activities), soil microbial populations (bacteria, fungi, actinomycetes, *Azotobacter* and *Azospirillim*) at 5 and 30 DAS. At 60 DAS, the effect was non-significant.

Comments:

- Under organic cropping systems involving non-chemical weed management include soil solarization as one of the treatments, as soil solarization is very effective for the control of parasitic weeds.
- Research results on the impact of herbicides on soil micro-flora and soil functional diversity should be published on a priority basis to dispel the misinformation about the damage caused by the herbicides soil microbes.

UAS, Bengaluru,

- Under permanent beds with pendimethalin *fb* hand weeding recorded lesser weeds, higher WCE, more yield and higher economic returns.
- In organically grown *Rabi* blackgram crop, WCE recorded in stale seed bed technique+ intercultivation at 25 and 45 DAS was at par with the WCE recorded in hand weeding at 20 & 40 DAS and inter cultivation (25 DAS) *fb* hand weeding (45 DAS).

- Weed management in organically grown *Kharif* kodo millet has shown that stale seed bed *fb* intercultivation at 25 and 45 DAS resulted in lower weed density, weed biomass, and highest B:C.
- In field bean, diclosulam 22-26 g/ha and pendimethalin 38.7% 750 g/ha in French bean, metsulfuron+chlorimuron 4 g/ha in foxtail millet, fluazifop+fomesafen 250 g/ha and diclosulam 22-26 g/ha in soybean were effective.
- FLDs on post-emergence herbicides in maize with tembotrione + atrazine had shown that the adoption of improved practices resulted in higher seed yields, B:C compare to the farmer's practices of atrazine PE *fb* inter cultivation.

Comments:

- Weed seed bank studies should only be taken up in long-term experiments.

KAU, Thrissur

- In organically grown chilli, the lowest weed density, weed biomass and WCE were recorded with black polythene mulch.
- In green gram, the highest WCE was recorded with application of imazethpyr+ imazamox as PE 0-3 DAS *fb* hand weeding and application of diclosulam *fb* hand weeding and oxyfluorfen *fb* hand weeding was also equally effective
- *Leptochloa chinensis* can be managed by applying cyhalofop and fenoxaprop.
- *Syngonium* infestation in rubber, *Pyrrosia* in tea and *Cyperus digitatus* in rice fields are new weeds.
- Weeds in non-crop area can be managed by applying glyphosate and indaziflam.
- *Salvinia* in rice can be managed by applying butachlor+penoxsulam and cyhalofop+penoxsulam.
- *Clerodendron indicum* infestation was recorded in coconut plantations at Pattambi.
- *Paraponyx diminutolis* was identified potential bioagent for control of Hydrilla.

Comments:

- Host specificity of the potential parasite *Paraponyxdim inutolis* on aquatic weed *Hydrilla* should be established before proceeding with further studies. Liming (Three times) is very effective for the control of *Hydrilla*.
- Glyphosate resistance in weeds should be studied systematically in the areas where Indaziflam + glyphosate is recommended in plantation areas. Further, residues of glyphosate shall also be examined.

TNAU, Coimbatore

- Pyrazosulfuron *fb* cyhalofop+penoxsulam recorded higher WCE, higher yield and economic returns in rice-rice system.
- In rice –rice cropping system, herbicide application reduced soil enzyme activities upto 15 days after herbicide application, started increasing from 30 days and reached maximum days after herbicide application
- Residues of pyrazosulfuron ethyl, bispyribac sodium, penoxsulam, bensulfuron methyl, cyhalofop ethyl and pretilachlor in soil, rice grain and straw were below the detection level in both *Kharif* and *Rabi* seasons
- A Higher WCE of 81.7 % was recorded in CT+ZT+ZT in the cotton-baby corn cropping system. Among the weed management practices, PE pendimethalin (CS) 680 g/ha followed by a directed spray of paraquat (0.6 kg/ha) recorded the higher WCE (81.3%) in cotton
- Application of diuron *fb* pyrithiobac sodium significantly reduced the soil enzyme activities and microbial population.
- EPoE of topramezone + 2,4D at 20-25 DAS in maize recorded significantly higher WCE (81.3%), and grain yield of 7223 kg/ha

- Pendimetalin+imazethapyr 900 g/ha and fluazifop+fomesafen 250 g/ha or propaquizafop + imazethapyr 135 g/ha was identified as the best management practice for control of *Cuscuta* in onion
- *Striga* in sorghum is new reported weed.
- At recommended dose, the herbicides residues at the station and also from farmers' fields were found below detectable limit.
- In turmeric, oxyfluorfen 250 g/ha fb HW provided better weed control and higher yield.

Comments:

- Technology for management of *Cuscuta* in onion by the centre should be popularized for large-scale adoption after testing its efficacy in farmers filed through OFTs /FLDs.
- Safety/Phyto-toxicity of imazethapyr+propaquizafop on onion should be studied completely before recommending it to the farmers.
- Use of drone for herbicide application: Finalize the SOPs for herbicide application (PE and PoE) and focus on capacity building /training of the young entrepreneurs for dissemination of the technology.

PDKV, Akola

- Tillage practices, ploughing+ two harrowing by tyne harrow and a blade harrow in soybean and subsequent wheat was found optimum. Sequential application of diclosulam (PE) *fb* propaquizafop + imazethapyr (PoE) in soybean; PoE of clodinafop + metsulfuron as PoE at 30 DAS in wheat was found promising with high WCE and yield.
- In the maize-chickpea fertigation experiment, fertigation with 125%RDNK (5 splits) to maize and 100 % RDNK (3 splits) to chickpea were found to be optimum. Atrazine 0.75 kg/ha PE *fb* topramezone 25.2 .ha PoE to maize and PE of pendimethalin 1.0 kg/ha *fb* topramezone 17 g/ha to chickpea was found very effective
- Application of pendimethalin + oxyfluorfen (0.54 +0.102kg/ha) PE application has resulted in highest WCE (75.41%),bulb yield in onion crop.
- In organic cotton-chickpea system, plastic mulch is good on weed control
- Some of the weeds like, *Cryzophora* in chickpea, *Salvinia* in Gadhchiroli, *Pistia* in Akola and *Alternanthera triandra* in non-crop area are new weeds recorded.

Comments:

- A survey on the prevalence of weed flora should be carried out by the centre to find out the predominant aquatic weeds infesting different kinds of water bodies and to identify potential bio-agents for their control.
- Suggested to ascertain the demand for organic cotton and include such crop which fetches a premium price for organic produce.

MPUAT, Udaipur

- Application of imazethapyr + propaquizafop (TM) at 15-20 DAS recorded significantly lower weed density on monocots and highest WCE of 90.74 % in blackgram crop at 60 DAS. Application of imazethapyr +quizalofop resulted in significantly higher seed and haulm yield.
- In groundnut, maximum yield was recorded by controlling weeds through IC *fb* HW at 20 and 40 DAS followed by application of fluazifop butyl + fomesafen (PoE) *fb* hand weeding at 40 DAS.
- In groundnut- wheat cropping system, minimum total weed density was recorded with pinoxaden + carfentrazone tank mix followed clodinafop + carfentrazone (TM) application. The highest WCE was recorded with pinoxaden+ carfentrazone TM application.
- In maize-wheat CA system, among different weed management practices, maximum grain yield, stover yield of maize were recorded with application of atrazine 500 g/ha+ tembotrione

120g/ha PoE at 20 DAS. Under ZTR system better soil nutrient status, microbial flora and enzymes were recorded. *Cynodon* and *Malva parviflora* were dominant weeds.

- Maximum seed yield (1836 kg/ha) and haulm yield (5151 kg/ha) of fenugreek was recorded with crop sown with the treatment of stale seedbed technique with plastic mulch with soil solarisation.
- In dill crop, oxadiargyl *fb* propaquizafop and pendimethalin are working well.
- *Ipomoea* and *Commelina diffusa* are problematic weeds not being controlled by herbicides recommended in soybean.

Comments:

- Herbicide residue analysis should be carried out by the University, especially in CA experiments. The centre should explore the possibilities for residue analysis through out-sourcing
- Suggested to map the *Malva parviflora* infestation.

AAU, Jorhat

- Adoption of CT (*Sesbania*)-CT (transplanted rice –*Kharif*)- MT (mustard) along with IWM (PE of recommended herbicides along with one mechanical weeding) has resulted significantly lower weed density, biomass, and higher WCE.
- Pyrazosuluron 25 g/ha *fb* bispyribac 25 g/ha with (75% inorganic and 25% organic source of nutrients are better in rice-rice system. The infestation of BLWs is more wherever organic manures are being used.
- In weed survey conducted in different districts of Assam state, it was revealed that, *Parthenium* is almost absent in Goalpara, Nagoan, Majuli, Charideu districts in Brahmaputra valley, Karimgunj and Hilakadi in Barak valley agro-climatic zones
- The major weed flora in *Kharif* rice included *Leersia hexandra, Sacciolepsis interrupta, Oryza rufipogon and Paspalum distichum* among grasses; *Eleocharia dulcis* and *Scirpus maritimus* among sedges; *Alternathera sessilis, Cuphea balsomona, Hydroea zeylanica, Monochoria vainalus* among BLWs.
- Mulching with rice straw 6 t/ha in potato + pre-emergence application of atrazine 0.5 kg/ha in maize resulted in very low weed density, biomass and WCE in potato in potato-maize cropping system.
- *Orobanche* in mustard has been noticed.

Comments:

- Intensify dissemination of the "Competitive replacement of *Parthenium* with *Cassia"* in the state to prevent the spread of *Parthenium* to new areas in the state.
- Documentation of the indigenous weed management technology in deep water rice (ITK) by the Assam farmers should be documented, and scientific validation should be done.
- As the morphological markers are already developed for the identification of weed seeds by the AAU centre, efforts should be made to collaborate with the computer/AI experts to build barcode/QR code for AI-based rapid identification.

TECHNICAL SESSION - II

Presentation of salient findings of AICRP-WM Centres

Chairman	**:**	Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Co-Chairman		Dr. R. P. Dubey, In-charge, AICRP-WM
Resource persons	**:**	Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
Rapporteurs	**:**	1. Dr. Yogita Gharde, Sr. Scientist, ICAR-DWR, Jabalpur 2. Dr. B.R. Bazaya, Sr. Scientist, Principal Investigator, SKUAST, Jammu

OUAT, Bhubaneshwar

- Bensulfuron methyl + pretilachlor 660 g/ha at 2 DAT *fb* 2,4-D EE 500 g/ha at 30 DAT was found suitable for weed management in transplanted finger millet.
- In CA experiment, 20% increase in grassy weed density in ZT-ZT-ZT system and 15% in CT-ZT-ZT system in comparison to base year in rice-maize-cowpea cropping system was observed.

BCKV, Kalyani

- Under rice-wheat-green manure cropping system, pretilachlor PE 0.7 kg/ha *fb* cono-weeder performed well and gave excellent control of weeds in rice whereas, in wheat, pendimethalin PE 1.0 kg/ha *fb* metribuzin PoE 0.2 kg/ha found most effective in controlling weeds.
- Under rice-rapeseed-greengram cropping system under CA, CT transplanted and pretilachlor 0.7 kg/ha PRE *fb* bispyribac sodium 25 g/ha at 25 DAT + mechanical weeding at 50 DAT performed well in rice.
- In weed management in *Olitorious* jute, nail weeder at 12 DAS *fb* thinning + HW at 25 DAS and 40 DAS was effective in controlling weeds.

AAU, Anand

- EPoE application of penoxsulam + cyhalofop-butyl 120 g/ha (PM) *fb* HW at 30 DAS and EPoE triafamone 20% + ethoxysulfuron 10% WG (44.0 + 22.5 g/ha) (PM) *fb* mechanical weeding at 30 DAS found effective in dry DSR.
- Application of pendimethalin 38.7% CS 680 g/ha at 10 DAS was found effective against *Cuscuta* in Lucerne without any phytotoxicity.
- Early post emergence application of oxyfluorfen 23.5% EC 80 g/ha and propaquizafop 5%+ oxyfluorfen 12% w/w EC (PM) 43.75 + 105 g/ha were found effective in onion nursery.
- In onion, pendimethalin 38.7% CS 580.5 g/ha PPI (2-3 DBTP) *fb* oxyfluorfen 23.5% EC 120 g/ha PoE, pendimethalin 38.7% CS 580.5 g/ha PPI (2-3 DBTP) *fb* oxadiargyl 6% EC 75 g/ha PoE and propaquizafop 5% + oxyfluorfen 12% w/w EC (PM) 43.75 + 105 g/ha PoE were found effective.
- *Rumex dentatus* was reported in wheat and tomato crops in Tarapur village of Anand district.

IGKV, Raipur

- Application of oxyfluorfen 0.25 kg/ha PE found to be effective in controlling *Cuscuta* in berseem.
- In organically grown aromatic rice, motorized weeder twice at 20 & 40 DAT + one intra row HW was found best over other treatments.

SKUAST, Srinagar

- Highlighted findings of 2 research experiments on weed management in maize and rice crop under temperate conditions. In maize, atrazine alone or tank mix with pendimethalin *fb* 1 hand weeding recorded lower weed count and biomass.

BAU, Sabour

- In chickpea, topramezone 25 g/ha as PoE at 25 DAS significantly lowered weed count and biomass and improved yield and economics.
- In lentil, application of metolachlor 1.0 kg/ha as PE *fb* one hand weeding at 25 DAS was equally effective as the treatment hand weeding at 20 DAS and metolachlor 1.0 kg/ha as PE *fb* quizalofop-ethyl 0.05 kg/ha as PoE in controlling different weeds, improving yield and found as economically viable option in lentil.

PAJANCOA & RI, Puducherry

- In finger millet, hand weeding twice (20 & 40 DAP) significantly reduced the weed density, improved weed control efficiency and finger millet yield. However, it was found to be on par with the application of bensulfuron-methyl + pretilachlor 660 g/ha when it was integrated with stale seed bed or inter cultivation or 1 hand weeding at 40 DAP.

- *Cassia* sp. was found to reduce the plant height of *Parthenium* over the period of time. Likewise, effect of *Parthenium* competition on *Cassia* was observed between 15 and 45 days after emergence.

UAS, Dharwad

- In maize the lowest weed density and weed dry matter, along with enhanced soil microbiological activities and yield was recorded with topramezone + atrazine (25.2 + 500 g/ha) EPoE *fb* IC + HW.
- In soybean, yield was significantly superior with the treatment received diclosulam 30 g/ha PE imazethapyr 750-1000 g/ha POE *fb* 1 hoeing + 1 HW 20 DAS.
- Effect of arbuscular mycorrhizal fungi in the management of *Orobanche* in tomato and tobacco, highest numbers of *Orobanche* was observed in UIC plots (32.00/plot), while lowest were recorded with the plots received STD AMF consortium (1.22/plot).
- In another experiment, application of mycorrhizal consortium suppressed the *Striga* emergence, while enhancing the growth parameters of the sugarcane.

ANGRAU, Guntur

- Centre conducted 2 experiments during the year. In the experiments conducted for development of sustainable WM strategies in diversified cropping system, pendimethalin 750 g/ha PE *fb* imazethapyr 50 g/ha PoE performed well as compared to others.
- For *Cuscuta* on blackgram in the rice fallows of Krishna zone, pendimethalin 750 g/ha + imazethapyr 50 g/ha was effective.
- In Proso millet, oxadiargyl 80% 0.1 kg/ha, atrazine 50% 0.75 kg/ha & metolachlor 50% performed better. In case of kodo millet, topramezone 33.6% found to be effective with highest WCE.

SKNAU, Jobner

- Sulfentrazone + clomazone 725g/ha (RM) and diclosulam 24 g/ha showed phytotoxicity both on groundnut and clusterbean.
- In groundnut and clusterbean crop, pendimethalin 30% + imazethapyr 2% (RM) showed best results among PE herbicides.
- In groundnut crop, sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC 245g/ha controlled weeds among PoE herbicides, whereas, in clusterbean, fluazifop-butyl 13.4 % + fomesafen 11 % (RM) reported best treatment among PoE herbicides.

Overall comments:

- In Conservation Agriculture experiments, all three principles should be followed.
- Proper terminology should be used while presenting the weeds data such as weed density and biomass.
- Weed flora should be critically observed in station as well as in farmers' fields for any shift or changes.
- Duplicity should be avoided in herbicide residue analysis.
- Studies should be conducted to minimize the residual effect of herbicides on succeeding crops.
- Number of demonstrations under SCSP should be increased to ultimately enhance the income of the SC farmers.
- Before recommendation of any technology, it should be tested in the farmers' fields.

- Presentations should be more effective. More colours and data should be avoided in the slides. Black/blue and white colours may preferably be used for presentation.

26 May, 2022

Before start of the technical sessions, a demonstration of herbicide spray technology through drones was made at the experimental field of Agronomy Farm.

TECHNICAL SESSION - III

Formulation of Network technical programme for 2022-23 & 2023-24

Chairman	**:**	Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
Co-Chairman	**:**	Dr. C. Chinnusawmy, Ex. Principal Investigator, AICRP-WM
Resource persons	**:**	Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Rapporteurs	**:**	1. Dr. Arvind Verma, Principal Investigator, MPUAT, Udaipur 2. Dr. Jamaludheen A. Scientist, ICAR-DWR, Jabalpur

(WP-1 Development of location-specific sustainable weed management practices)

The technical programme for weed management in major crops and cropping systems and station trials specific to the states was presented by Dr. P.K. Mukherjee, PS, ICAR-DWR, Jabalpur.

WP-1.1.1 Weed management in *tar-vattar* direct-seeded rice (DSR)

Experiment: Effect of weed control and timing of first irrigation on weed dynamics and productivity of *tar-vattar* direct-seeded rice (DSR)

Centres: PAU, Ludhiana; CCSHAU, Hisar; GBPUAT, Pantnagar; SKUAST, Jammu

- PAU, Ludhiana has been dropped since the trial has been already conducted with different times of first irrigation and standardized.
- HAU, Hisar agreed with the treatments they proposed in this trial.
- GBPUAT Pantnagar and SKAUST Jammu agreed to take up only two irrigations in main plots i.e., 14 & 21 DAS
- For the effective implementation *tar-vattar* direct seeded rice (DSR) technology Dr. M.S. Bhullar, PAU Ludhiana is requested to communicate the guidelines to all the centres.
- ICAR-DWR, Jabalpur should also conduct DSR experiment as per guideline
- Centres advised to take varieties specifically recommended for their region/state.
- With regard to the weed management, pendimethalin 38.7% CS formulation should be replaced by 30% EC formulation
- In weedy check, weeds should be removed after 60 DAS after taking all necessary weed observations.
- The ready mix of penoxsulam+cyhalofop butyl in treatment 5 needs to be replaced with tank mix of fenoxaprop ethyl 67g/ha + ethoxysulfuron 18g/ha.

WP-1.1.2 Weed management in dry direct-seeded rice (DSR)

Experiment: Management of diverse weed flora in dry direct-seeded rice (DSR)

Centres: IGKV, Raipur; BCKV, Kalyani; OUAT, Bhubaneshwar; CSKHPKV, Palampur; BAU, Sabour; PAJANCOA & RI, Puducherry

- All the above centres agreed with the proposed treatments

WP-1.1.3 Weed management in cotton

Experiment: Integrated weed management in cotton-based intercropping system

Centres: PDKV, Akola; PAJNCOA & RI, Puducherry; PJTSAU, Hyderabad

- This experiment has been approved to take up as a station trial at PJTSAU, Hyderabad and not in network mode
- All the intercrops should be raised in a 1:2 ratio of Cotton-legume/non-legume

WP-1.1.4 Weed management in transplanted onion

Experiment: Evaluation of different herbicide combinations for weed management in transplanted onion

Centres: OUAT, Bhubaneswar; BCKV, Kalyani

- Experiment is approved to be taken up as station trial at OUAT, Bhubaneswar, and BCKV, Kalyani.

WP-1.1.5 Weed management in sorghum

Experiment: Bio-efficacy and phytotoxicity evaluation of herbicides in sorghum

Centres: MPUAT, Udaipur; RVSKVV, Gwalior; PJTSAU, Hyderabad; SKNAU, Jobner

ANGRAU, Guntur centre proposed to conduct this experiment as a station trial. The treatments may be revisited on the basis of feedback from AICRP Sorghum, Hyderabad.

WP-1.1.6 Weed Management in Direct seeded/Drill sown *Ragi*

Experiment: Evaluation of herbicides for controlling weeds in Direct-seeded/Drill sown *Ragi*

Centres: UAS, Bengaluru; IGKV, Raipur; PAJNCOA & RI, Puducherry

- TNAU, Coimbatore, UAS, Dharwad, OUAT, Bhubaneswar have dropped this experiment
- Treatments No. 1, 5, and 9 that have Isoproturon should be dropped due to the concern of the non-availability of herbicide
- Similarly, treatments No. 2,6 and 10 that are having Oxyfluorfen should be dropped due to the issue of phytotoxicity
- Hence, 8 treatments are retained in the experiment finally.

WP-1.1.7 Weed management in soybean

Experiment: Evaluation of herbicides for controlling weeds in soybean

Centres: UAS, Bengaluru; BCKV, Kalyani; PDKV, Akola; CSKHPKV, Palampur; MPUAT, Udaipur

- AAU (Anand), IGKV (Raipur) and RVSKVV (Gwalior) were dropped from this experiment
- MPUAT, Udaipur is also included.
- Two additional treatments viz. Diclosulam+ Pendimethalin as PE (25.2+750 g/ha tank mix) and Imazethapyr+ Propaquizafop125 g/ha as PoE herbicides were added as suggested by the house.

WP-1.1.8 Weed management in maize-based cropping system

Experiment: Weed management in maize-chickpea cropping system

Centres: MPUAT, Udaipur; RVSKVV, Gwalior; PJTSAU, Hyderabad; IGKV, Raipur; GBPUAT, Pantnagar; BCKV, Kalyani; UAS, Dharwad

- IGKV Raipur and GBPAUT, Pantnagar were dropped from this experiment and UAS Dharwad was added
- Revisit the treatment and come up with a new set of treatments

WP-1.1.9 Long-term herbicide trial in transplanted lowland rice- green gram/black gram cropping system

Centre: TNAU, Coimbatore

- Black gram is finalised as the second crop in the cropping system

- Hand weeding timing in treatment No. 6 finalised as 20&40 DAT in rice and black gram one hand weeding at 25 DAS
- It has been suggested to go for a split-plot design with 5-7 treatments in rice and 3 treatments in black gram

WP-1.1.10 Long-term herbicidal trial in a rice-rice cropping sequence

Centre: AAU, Jorhat

- Continue for this year only and should be dropped in next year

WP-1.1.11 Weed management in rice-pea-rice cropping sequence

Centre: AAU, Jorhat

- Suggested to report and conclude this experiment after this year

ST-1.2 Station trials specific to the state

ST-1.2.1 Management of blood grass (*Isachne miliacea*) in transplanted rice

Centre: KAU, Thrissur

- Keep at least 15 days interval between application of glyphosate and transplanting of rice

ST-1.2.2 Weed Management in plantation crop (Rubber)

Experiment: Management of alien weed *Syngonium podophyllum* in rubber plantation

Centre: KAU, Thrissur

- Specify the number of hand weeding and time of implementation in treatments
- Mention the age of rubber plantation in the experiment in detail
- Explore the possibility to establish cover crops after brush cutting
- Keep farmer's practice as weedy check

ST-1.2.3 Weed management in direct-seeded rice (DSR)

Experiment: Weed management in direct-seeded rice through a synergistic module of green manure crops with herbicides

Centre: CCSHAU, Hisar

- This experiment has been dropped

ST-1.2.4 Weed management in rajmash

Experiment: Evaluation of different herbicides for controlling weeds in rajmash

Centre: CSHPKV, Palampur

- Fluchloralin should be removed from the treatments
- Timing of hand weeding should be specified

ST-1.2.5 Weed management in pea

Experiment: Bio-efficacy of different herbicides for controlling weeds in pea

Centre: CSHPKV, Palampur

- Conduct experiment as per the resource availability at CSHPKV, Palampur centre.

ST-1.2.6 Weed management in lavender

Experiment: Evaluation of weed management practices for controlling weeds in lavender

Centre: CSHPKV, Palampur

- It has been suggested to drop as the crop is cultivated in a very limited area in the state

ST-1.2.7 Weed management in cluster bean

Experiment: Evaluation of different herbicides against complex weed flora in cluster bean

Centres: MPUAT, Udaipur; SKNAU, Jobner

- SKNAU, Jobner has been dropped and MPUAT would continue the experiment after taking treatment suggestions from Jobner

ST-1.2.8 Weed management in sesame

Experiment: Bio-efficacy of different herbicides for controlling weeds in sesame

Centre: UAS, Bengaluru

- It has been suggested to take a non-replicated filler trial and come up with some basic data and then propose a station or network trial

ST-1.2.9 Weed management in groundnut

Experiment: Integrated weed management in *Kharif* groundnut

Centres: PDKV, Akola; GBPUAT, Pantnagar; AAU, Anand

- GBPAUT Pantnagar has been dropped as they do not have a significant groundnut sowing area in the state.
- PDKV(Akola), and AAU(Anand) should take this experiment as a station trial with the flexibility in treatments as per their requirements.

WP-1.2 Weed Management under conservation tillage-based cropping systems

The technical programme for Weed Management under conservation tillage-based cropping systems was presented by Dr. V.K. Choudhary, Sr. Scientist, ICAR-DWR, Jabalpur.

WP 1.2.1: Weed management in conservation tillage on rice-based cropping systems

Experiment 1: Weed management in rice-wheat -legume cropping system under conservation tillage

Centres: GBPUAT, Pantnagar; SKAUST, Jammu; CCSHAU, Hisar; PAU, Ludhiana

- PAU Ludhiana has been dropped from this experiment
- One more treatment CT+R needs to be added for all the three crops of the system
- It has been suggested to conduct a bioassay after 3 years to know the herbicide resistance and weed flora shifts

Experiment 2: Weed management in rice- maize-legume cropping system under conservation tillage

Centres: IGKV, Raipur; OUAT, Bhubaneshwar; BCKV, Kalyani; AAU, Jorhat

- BCKV Kalyani has to decide whether to join in this network programme after proper consultation with PI.
- AAU, Jorhat has been dropped
- In maize, atrazine should be replaced by pyroxasulfone in the second year

WP1.2.2: Weed management under conservation tillage system on maize-based cropping system

- UAS Bengaluru should take up an experiment on maize- green gram-green manure system with the same set of treatments
- PAU Ludhiana centre proposed to take this trial by reframing the second crop as mustard and green gram as a summer crop

WP 1.2.3: Weed management under conservation tillage system on soybean-based cropping system

Centre: CSKHPKV, Palampur; MPUAT, Udaipur; PDKV, Akola

- CSKHPKV, Palampur; MPUAT, Udaipur should take up an experiment on soybean-wheat-greengram/green manure green manure
- PDKV, Akola may revisit the experiment and communicate to ICAR-DWR about the possibility of taking up chickpea as a second crop

WP 1.2.4: Weed management under conservation tillage system on cotton-based cropping system

Centre: AAU, Anand; PJTSAU, Hyderabad; TNAU, Coimbatore

- The experiment has been kept in abeyance for one year since PJTSAU, Hyderabad and TNAU, Coimbatore already running similar system of experiments and these centers need to complete one more cycle of the experiment to conclude.

WP 1.2.5: Weed management under conservation tillage system on pearl millet based cropping system

Centre: RVSKVV, Gwalior

- Suggested either to drop this trial or take up after discussion with PI if they have all required facilities to conduct this trial

WP-1.3 Weed management strategies in organic agriculture/natural farming

The technical programme for Weed management strategies in organic agriculture/natural farming was presented by Dr. R.P. Dubey, PS, ICAR-DWR, Jabalpur.

It was suggested, in general, to choose high-value crops specific to the area and frame the treatments by making suitable permutations and combination of major organic practices such as soil solarization, stale seedbed, intercropping, smothering crops, plastic mulch, mechanical weeding, straw mulch etc.

WP 1.3.1: Weed management in organically grown direct-seeded finger millet-pulse cropping system

Centre: DWR, Jabalpur; UAS, Bengaluru; TNAU, Coimbatore; PJTSAU, Hyderabad; OUAT, Bhubaneswar; IGKV, Raipur; UAS, Dharwad; PJANCOA&RI, Puducherry

- TNAU, PJTSAU, IGKV, UASD has been dropped from this experiment
- Centers should specify the pulse crop in the cropping system
- Treatment numbers 4 and 7 should be dropped
- One more treatment is added as normal spacing fb one HW at 20 DAS
- Centres should take all the crop cultivation practices as per the guidelines of organic farming

WP 1.3.2: Weed management in organically grown fennel-sweet corn cropping system

Centre: AAU, Anand

- Use only previous crop straw as mulch for the next crop
- Suitable treatments could be adopted from MPAUT, Udaipur

WP 1.3.3: Weed management in the organically grown maize-wheat cropping system

Centre: CSKHPKV, Palampur

- It has been dropped

WP 1.3.4: (i) Weed management in organically grown rice-based cropping system (Rice – vegetable pea – sweet corn) (Collaboration with Network project on organic farming)

ii. Comparison of weed management in Rice-vegetable pea- sweet corn cropping system under natural farming, organic farming, and chemical farming.

Centre: GBPUAT, Pantnagar

- It has been suggested to continue and weed management aspects may be recorded in the natural farming production system available at the university

WP 1.3.5: Weed management in organically grown aromatic rice in transplanted rice –tomato cropping system

Centre: IGKV, Raipur

- It should not be in system mode. Revisit the treatments and bring out a new set of treatments for proposed crops separately

WP 1.3.6: Organic weed management practices for coconut plantations (years old)

Centre: KAU, Thrissur

- Suggested to increase the number of treatments and try to include intercropping and mechanical weeding in the treatment schedule

WP 1.3.7 Weed management in rice-tomato-okra system under organic farming

Centre: OUAT, Bhubaneswar

- Compile the five years result and conclude the experiment and propose a new experiment

WP 1.3.8: Weed management in Cotton-Mid-late duration under organic farming

Centre: PDKV, Akola

- Use the term medium duration cotton instead of mid-late duration cotton

WP 1.3.9: Weed management in the organically grown sweetcorn-potato-green manure cropping system

Centre: RVSKVV, Gwalior

- It has been suggested to drop as it has already been conducted and no need to continue

WP 1.3.10: Non-chemical weed management in brinjal or chilli

Centre: TNAU, Coimbatore

- Finalized Brinjal as a test crop for the proposed experiment
- Consider soil solarization as one of the treatments in organically grown vegetables
- Suggested to elaborate on the proposed multi varietal techniques and growth stage of weeds to be used as mulch in the treatments

WP 1.3.11: (i) Non-chemical weed management in Baby corn – Fenugreek cropping system

Centre: MPUAT, Udaipur

- Suggested to continue the experiment for two more years
- Treatment numbers 4 and 5 (Soil solarization *fb* intercultural practices) should be revisited.

WP 1.3.12 (i) Weed Management in organically grown *Kharif*- Barnyard millet (*Echinochloa frumantacea*)- *Rabi*- Black gram (*Vigna mungo*)

Centre: UAS, Bengaluru

- It has been dropped.

WP 1.3.13: Weed management in organically grown aromatic rice

Centre: AAU, Jorhat

- Revisit the proposed experiment and communicate with ICAR-DWR, Jabalpur.

WP 1.3.14: Weed management in organically grown basmati rice- vegetable pea-sweet corn cropping system

Centre: SKUAST, Jammu

- Revise the treatments according to the suggestions made for other centres.

Centre: CCSHAU, Hisar

- Weed management in organic onion, may delete it.
- Revisit and reframe the experiment considering all the suggestions made for previously discussed experiments.

Indigenous Technical Knowledge (ITK) in weed management

- Develop a proforma to collect comprehensive information on ITK in weed management and circulate it among experts in the subject to collect more inputs
- Proforma may be circulated via tools like google forms to collect data

WP-1.4 Management of parasitic weeds

Management of *Orobanche* in brinjal and tomato

Centres: OUAT, Bhubaneswar; PJTSAU, Hyderabad; MPUAT, Udaipur UAS, Dharwad

- Neem cake @ 200kg/ha should be applied at the root zone using the plant hole application technique
- The consortium developed by UAS-D has to be distributed to all the centres.
- If *Orobanche* is not a problem at the research farm of the centre, they should take it in OFR mode with four treatments viz. one suitable chemical control, neem cake @ 200kg/ha using plant hole technique, UAS-D AMF consortium, and weedy check.

Management of *Striga* in sugarcane

Centres: UAS, Dharwad; TNAU, Coimbatore; PJTSAU, Hyderabad

- Reframe the experiment and restrict the trials with three treatments viz. Atrazine *fb* HW, TNAU package of practices for management of *Striga*, and UAS-D AMF consortium.

Management of herbicide resistance in weeds

Technical programme for the management of herbicide resistance in weed was presented by Dr. M.S. Bhullar, PAU, Ludhiana.

- All centres need to be more vigilant regarding the development of herbicide resistance in their respective areas.
- Conduct a systematic survey and collect a sufficient population of reported resistance and then go for further study on herbicide resistance.
- Collect samples/seeds from the area where the herbicide is not yet applied so as to establish the resistance.

WP-1.5.1 Management of resistant *Phalaris minor* and other weeds with a new herbicide combination

WP-1.5.2 Management of resistance developed in *Cyperus difformis* against Bispyribac Sodium

- Treatment number 4 should be removed

WP-1.5.3 Assessment of glyphosate resistance in *Eleusine indica*

- Collect samples/seeds from the area where the glyphosate is not yet applied to establish the resistance.
- Treatments need to be revisited.

WP-1.5.4 Monitoring and management of herbicide resistance to different herbicides in *P. minor* biotypes from farmers' field

- Experiments should be reframed with new chemicals

WP-1.5.5 Management of multiple herbicide resistance populations of *P. minor* in Wheat

- Take only new molecules as treatments

TECHNICAL SESSION - IV

Formulation of technical programme

Chairman : Dr. A. N. Rao, Chief Editor Indian Journal of Weed Science

Co-Chairman Dr. C. R. Chinnamuthu, Ex Head, Dept of Agronomy, TNAU

Resource persons : Dr. N. T. Yaduraju, Ex Director, ICAR- DWR, Jabalpur

Rapporteurs : 1. Dr. K. N. Geetha, Principal Investigator, UAS, Bengaluru
2. Dr. P. Prameela, Principal Investigator, KAU, Thrissur

WP -2: Management of weeds in non-cropped and aquatic areas

Dr. Sushilkumar, PS, ICAR-DWR presented the various experiments proposed under "Management of weeds in non-cropped and aquatic areas.

- *Parthenium* awareness and related observations may be continued by all centres.
- All centres should continue their works related to biocontrol of *Eichhornia* using the weevil except Jorhat, Thrissur and Bengaluru where this technology is not very promising. Many centres are not seriously undertaking this and they have to select suitable water bodies for release and monitor the population and weed growth with minimum four observations per year.
- Dr. Rao opined that information on status of water hyacinth infestation in different states to be collected from centres and should be compiled.
- Trial on bio control of *Salvinia* has to be done by 6 centers. (Raipur, Akola, Bhubaneshwar, Coimbatore, Kalyani, Bangalore & Hisar. The survival /multiplication rate of *Cyrtobagous* is a problem in Kerala in some locations and water quality parameters in different waterbodies infested with *Salvinia* has to be monitored.
- AAU, Jorhat centre has proposed studies on biology of *Arundo*, *Panicum*, *Chromolena* and *Pistia* but details are not furnished. However many scientists opined that biology has already been studied in detail elsewhere and this has to be discussed and finalized.
- Palampur centre proposed a study on *Lantana* management, (Cutting date and herbicide spray). But it was not approved due to the fact that recommendations developed by the centre in this regard has not been practically used, and hence no further studies are required.
- The study on *Alternanthera philoxeroides* extracts proposed by UAS, Bengaluru centre and Pond liming to control submerged aquatic weed Hydrilla proposed by KAU centre were approved.
- All centres should monitor and record new weeds appearing in the area and have to refer past data generated by the centre.
- The experiment on *Parthenium* proposed by Hisar Centre was not approved as Director, DWR and Dr. C. R. Chinnamuthu were of the opinion that no new information can be generated through this and already studies have been undertaken by TNAU centre earlier.

WP- 3: Fate of herbicide residues in different agro ecosystems.

Dr. Shobha Sondhia, PS, ICAR- DWR presented the trials proposed

1. The residues of herbicides shall be estimated as included under Weed management in major crops and cropping systems) , Long term tillage studies, WP 3.1, WP 3.2 WP 3.3 and WP 4. For WP 1.1 soil collection is to be done at 0 (2h), 10, 20, 30, 60, 90 and at harvest. Samples of grain, straw can be collected at harvest. Detailed methodology will be sent to the centres. Anand, Hisar, Bengaluru centres will collaborate with AINP on Pesticide Residues in the respective SAUs. The chromatographs has to be sent along with the data.
2. Dr. Yaduraju remarked that soil and ground water samples from farmer's fields which were under continuous use of herbicides (at least with a history of 10 years) to be collected at least 10 samples from each centre and analysed and information compiled. A protocol for this has to be sent to all centres, to ensure uniformity. Also possibility of studying the microbial load and changes in soil has to be done, so that general public are aware of the truth and not mislead by unscientific information. Even third party analysis can be resorted to.
3. Dr. A. N. Rao suggested that all centres while formulating the experiments should consider the farmers as the target to ensure practical utility. Close collaboration with other disciplines is required to ensure good and quality output and avoid repetitions.

27 May, 2022

A lecture by Dr. B. Muthukumar, Associate Professor, Weed Science, Texas University was arranged on digital tools for weed mapping, artificial intelligence and machine learning in weed management.

TECHNICAL SESSION - V

Formulation of technical programme

Chairman	**:**	Dr J.S. Mishra, Director, ICAR-DWR, Jabalpur
Co- Chairman		Dr S. Panneerselvam, Head, Agronomy, TNAU, Coimbatore
Resource persons	**:**	1. Dr. N.T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
		2. Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Rapporteurs	**:**	1. Dr Sushil Kumar, Principal Scientist, ICAR-DWR, Jabalpur
		2. Dr Shrikant Chitale, Sr. Scientist, AICRP-WM, IGKV, Raipur

Weeds of National Importance (WoNI)

At the outset, Dr. Yaduraju gave a brief presentation on the topic and highlighted the earnest need to identify the WoNI so that policy makers could be informed about the dire need to manage such weeds at national level. He expressed that identification of WoNI will be of immense use to chalk out the strategies in advance to manage such weeds.

Dr. Sushil Kumar proposed the methodology of the survey to be carried out through a systematic study with the criteria of the national importance of a weed i.e. (i) Impacts of the weeds, (ii) Potential for spread, (iii) socio-economic and environmental values. Dr. Kumar outlined how to identify the weeds of importance and stated that the proposed study has to be done by all the AICRP-WM centers and active participation of all PIs is necessary in this regard. He proposed a questionnaire for the data collection. Dr Kumar also elaborated the guidelines for filling the data. During discussion, Dr. N.T. Yaduraju, suggested that the data may be recorded from the persons having some knowledge on weeds, he may be an agriculture department officer/KVK scientist or local progressive farmer. Stating the practical problems during collecting the data from other government officer, Dr Murali Arthanari, PI AICRP-WM, Coimbatore requested the Directorate to issue directives in this regard from the DWR. Dr J.S. Mishra, Director, DWR assured the house that he will write a letter to the ATARI and ATARI will pass it on to the concerned KVKs and DDAs of agricultural department. Dr Mishra also emphasized that the dominant weed shall be district wise, state wise and then the national level. Dr Mishra informed the house that the proposed survey is not meant for 50 or 100 weed species, identify only 10 to 15 weeds of importance. Dr Mishra also suggested that looking to the importance of this survey, the PIs may drop a few experiments of less importance for giving more time for this study. After a long discussion, all the centres agreed to start this study at their level.

Impact Assessment of weed management technologies

The topic was presented by Dr Jamaludheen, Scientist, DWR. He pointed out the importance of the impact assessment of the technology given to the farmers and what is the view of the beneficiaries on it towards the production potential and sustainability of following a technology/intervention during a certain time duration. Dr Jamaludheen emphasized the importance of conducting impact assessment. He proposed a proforma for assessment and elaborated the guidelines for the data collection. Dr. T Ramprakash, PI AICRP-WM, PJTSAU, Hyderabad pointed out the difficulties to collect the herbicide

consumption in the district. Dr Jamaludheen clarified that collecting the herbicide consumption data is not of much importance and it is only supportive but dissemination of the WM technology and cost involved is more important.

Preparation of digitized map of extent of infestation of aquatic weeds and *Parthenium*

Dr Yogita Gharde, Sr. Scientist, DWR, proposed the protocol for collecting data on aquatic weeds and *Parthenium* infestation in India. Dr Gharde described the proforma step wise and explained how to fill it. The data on aquatic weeds should be with coordinates and secondary data can also be taken for support. The house discussed in length how to fill the data. Dr Gharde also proposed another proforma for collecting the data on how much cropped and non-cropped area has been infested by the *Parthenium* in the state.

Online data reporting

Dr Yogita Gharde also presented an online data submission and analysis programme for network experiments through information system for AICRP- WM. She informed to house that there will be sufficient time for data submission during both the seasons and stressed on timely data submission.

Demonstration through FLDs, OFR and SCSP

A separate presentation was also given by Dr Yogita Gharde. She presented the treatment details of proposed FLD and OFR demonstrations to be taken by each centres. Describing the guidelines for conducting all the three demonstrations, Dr Yogita informed that the activities should be taken under SCSP programme only after funds availability and emphasized that data on farmers mobile number and field coordinates must be taken. Director Dr Mishra stressed that each center should clearly mention the recommended and farmers' practice in their programme. It was observed that some centres did not mention the time of application of herbicide and particular dose, which must be included in the revised programme. Dr Yaduraju suggested that if any herbicide is not available in local market, it should not be included in the demonstration.

Concluding/Plenary session

The session was chaired by Dr S. Bhaskar, ADG (A, AF & CC), ICAR in online mode. Dr. Somasundaran, Director, Agribusiness Management, TNAU, Dr Paneerselvam, HoD, Agronomy, TNAU, Dr. JS Mishra, Director, ICAR-DWR were also present. The rapporteurs of various sessions presented the recommendations of the discussions held. Dr Bhaskar outlined the geo-political scenario of the world and stressed to show our visibility at national level. He asked to strengthen the research on non-crop weeds, integration of weed research at DWR and other ICAR institutes. The session ended by felicitating the two superannuating scientists viz. Dr. VP Singh of Pantnagar and Dr. MM Mishra of Bhubaneshwar.

Dr M. Arthanari, PI, AICRP-WM. TNAU centre proposed the vote of thanks.

General recommendations:

1. The technical programme should be formulated keeping in view the farmer's practical needs on weed management.
2. Close collaboration with other disciplines is required to ensure good and quality output and avoid repetitions.
3. All the centres should carry out studies on weed management under organic farming/natural farming in high value crops.
4. The impact assessment of weed management technologies should be conducted by all the centres, starting with few districts of the state.

5. Greater emphasis needs to be given by all the coordinating centres on studying the weeds of national importance (WoNI) following the proforma developed. Information should be collected from persons in the SAU, KVK, state department having basic knowledge of weeds.
6. The regular activity of organizing Parthenium Awareness Week shall continue at all the centres.
7. Training and awareness on safe use of herbicide and adoption of advanced techniques for application of herbicide like drone-based application technique need to be strengthened at each centre.
8. All the centres shall submit success stories of the promising weed management technologies developed at their place.
9. The centres should submit the AUC in the format provided to them. The next release of funds will be made only after getting the AUC.

30/06/2022

Dr. RP Dubey
Pr. Scientist & In-charge, AICRP-WM

Dr. JS Mishra 30/06/2022
Director, ICAR-DWR

XXIX ANNUAL REVIEW MEETING OF
ALL INDIA COORDINATED RESEARCH PROJECT ON WEED MANAGEMENT

ICAR - DIRECTORATE OF WEED RESEARCH, JABALPUR

25-27 MAY, 2022
PROGRAMME

25th May, 2022 (Wednesday)
Registration : 9:00 AM

10:00-11:00 hrs	**INAUGURAL SESSION**
Tamil Thai song	
ICAR Theme song	
Lighting of lamp	By the honorable dignitaries
Welcome address	Dr. J.S. Mishra, Director, ICAR - DWR, Jabalpur
Felicitation address	Dr. M. K. Kalarani, Director, Directorate of Crop Management, TNAU, Coimbatore
Remarks by Guest of Honour	Dr. M. Raveendran, Director of Research, TNAU, Coimbatore
AICRP-WM Best Centre Award & Release of publications	By the honorable dignitaries
Address by Chief Guest	Dr. V. Geethalakshmi, Vice-chancellor, TNAU, Coimbatore
Vote of thanks	Dr. R.P. Dubey, Pr. Scientist and In-charge, AICRP-WM
Rapporteurs	1. Dr. P. K. Mukherjee, Pr. Scientist, ICAR-DWR, Jabalpur 2. Dr. V. K. Gaud, Principal Investigator, PDKV, Akola
11:00-11:20 hrs	High Tea
TECHNICAL SESSION – I	
Chairman	Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
Co-Chairman	Dr. J.S. Mishra, Director, ICAR – DWR, Jabalpur
Resource Person	Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Rapporteurs	1. Dr. V. K. Choudhary, Sr. Scientist, ICAR-DWR, Jabalpur 2. Dr. T. Ramprakash, Pr. Scientist, Principal Investigator, PJTSAU, Hyderabad
11:20-13:30 hrs	**Presentation on salient achievements and recommendations of AICRP on Weed Management by Dr. R.P. Dubey, Pr. Scientist and In-charge, AICRP-WM**
	Presentation of salient findings by Principal Investigators of AICRP-WM centres (10 min. for each centre)
	PAU, Ludhiana: Dr. M.S. Bhullar
	CSKHPKV, Palampur: Dr. S.S. Rana
	CCSHAU, Hisar: Dr. Todar Mal Poonia
	GBPUAT, Pantnagar: Dr. V. Pratap Singh
	SKUAST, Jammu: Dr. B.R. Bazaya
	RVSKVV, Gwalior: Dr. Deep Singh Sasode
	PJTSAU, Hyderabad: Dr. T. Ramprakash

	UAS, Bengaluru: Dr. K.N. Geetha
	KAU, Thrissur: Dr. P. Prameela
	TNAU, Coimbatore: Dr. P. Murali Arthanari
	PDKV, Akola: Dr. V.V. Gaud
	MPUAT, Udaipur: Dr. Arvind Verma
	AAU, Jorhat: Dr. Khagen Kurmi
	Remarks by Chairman, Co-Chairman and resource person
13:30- 14:30 hrs	**LUNCH BREAK**
TECHNICAL SESSION – II	
Chairman	Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Co-Chairman	Dr. R. P. Dubey, Pr. Scientist, I/c AICRP-WM
Resource Person	Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
Rapporteurs	1. Dr. Yogita Gharde, Sr. Scientist , ICAR-DWR, Jabalpur 2. Dr. B. R. Bazaya, Sr. Scientist, Principal Investigator, SKUAST, Jammu
14:30-16:20 hrs	OUAT, Bhubaneswar: Dr. M.M. Mishra
	BCKV, Kalyani: Dr. Bikash Mandal
	AAU, Anand: Dr. D.D. Chaudhari
	IGKV, Raipur: Dr. Shrikant Chitale
	SKUAST, Srinagar : Dr. M. Anwar Bhat
	BAU, Sabour :Dr. Birendra Kumar
	PAJNCOA&RI, Puducherry: Dr. P. Saravanane
	UAS, Dharwad: Dr. P. Jones Nirmalnath
	BUAT, Banda (U.P.): Dr. Dinesh Sah
	ANGRAU, Guntur: Dr. B. Prameela Rani
	SKNAU, Jobner: Dr. Shweta Gupta
16:20-17:00 hrs	Remarks by Chairman, Co-Chairman and resource person

26th May, 2022 (Thursday)

9:00-10:00 hrs	Demonstration of herbicide application by drone followed by a presentation
10:00-13:30 hrs	**TECHNICAL SESSION – III** **Formulation of Network Technical Programme for 2022-23 & 2023-24** (WP-1 Development of location-specific sustainable weed management practices)
Chairman	Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
Co-Chairman	Dr. C. Chinnusamy, Ex. Principal Investigator, AICRP-WM
Resource Person	Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Rapporteurs	1. Dr. Arvind Verma, Principal Investigator, MPUAT, Udaipur 2. Dr. Jamaludheen A., Scientist, ICAR-DWR, Jabalpur
Dr. P.K. Mukherjee	Weed management in major crops and cropping systems and Station trails specific to the state
Dr. V. K. Choudhary	Weed Management under conservation tillage-based cropping system
Dr. R. P. Dubey	Weed management strategies in organic agriculture/natural farming
Dr. M. S. Bhullar	Management of herbicide resistance in weeds

Dr. P. Jones Nirmalnath	Management of parasitic weeds
	Remarks by Chairman, Co-Chairman and resource person
13:30- 14:30 hrs	**LUNCH BREAK**

14:30-17:00 hrs	**TECHNICAL SESSION – IV** **Formulation of Network Technical Programme for 2022-23 & 2023-24** (WP-2/WP-3 Management of weeds in non-cropped and aquatic areas & Fate of herbicide residues in different agroecosystems)
Chairman	Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Co-Chairman	Dr. C. R. Chinnamuthu, Ex. Head, Department of Agronomy, TNAU
Resource Person	Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur
Rapporteurs	1. Dr. K. N. Geetha, Principal Investigator, UAS, Bengaluru 2. Dr. P. Prameela, Principal Investigator, KAU, Thrissur
Dr. S. Kumar	Management of weeds in non-cropped and aquatic areas
Dr. Shobha Sondhia	Fate of herbicide residues in different agroecosystems
	Remarks by Chairman, Co-Chairman and resource person

27th May, 2022 (Friday)

09:30-13:30 hrs	**TECHNICAL SESSION – V** **Formulation of Network Technical Programme for 2022-23 & 2023-24** (WP-4 Demonstration and impact assessment of weed management technologies & SCSP)
Chairman	Dr. J.S. Mishra, Director, ICAR-DWR, Jabalpur
Co-Chairman	Head, Department of Agronomy, TNAU, Coimbatore
Resource Persons	1. Dr. N. T. Yaduraju, Ex. Director, ICAR-DWR, Jabalpur 2. Dr. A. N. Rao, Chief Editor, Indian Journal of Weed Science
Rapporteurs	1. Dr. Sushil Kumar, Pr. Scientist, ICAR-DWR, Jabalpur 2. Dr. Shrikant Chitale, Principal Investigator, IGKV, Raipur
Dr. Y. Gharde/ Dr. Jamaludheen A.	1. OFR, FLD and SCSP 2. Impact assessment of weed management technologies 3. Digitization of weed map (aquatic) 4. Online data reporting
	Remarks by Chairman, Co-Chairman and resource person
13:30- 14:30 hrs	**LUNCH BREAK**
	TECHNICAL SESSION – VI **(General discussion, financial issues, interaction with industry etc.)**
14:30-15:30 hrs	Lecture by Dr. B. Muthukumar, Associate Professor, Weed Science, Texas
Chairman	Dr. R. P. Dubey, Pr. Scientist, In-charge, AICRP-WM
Co-Chairman	Dr. P. Murali Arthanari, Principal Investigator, TNAU, Coimbatore
Rapporteurs	1. Dr. C. Bharathi, Scientist, TNAU, Coimbatore

	2. Dr. P. Saravanane, Principal Investigator, PAJNCOA&RI, Puducherry
	Remarks by Chairman and Co-Chairman
15:30-17:00 hrs	**CONCLUDING / PLENARY SESSION**
	Rapporteur's reports
	Remarks by Special invitees/resource persons
	Remarks by Director, Crop Management, TNAU, Coimbatore
	Remarks by Director, ICAR-DWR, Jabalpur
	Remarks by DDG (NRM)/ADG (Agro., AF & CC), ICAR, New Delhi
	Vote of thanks by Dr. P. Murali Arthanari, Principal Investigator, TNAU, Coimbatore

XXIX Annual Review Meeting
All India Coordinated Research Project on Weed Management
ICAR-Directorate of Weed research, Jabalpur-482004

Venue : Tamil Nadu Agricultural University Coimbatore- (Tamil Nadu)
Date : 25-27 May, 2022

LIST OF INVITEES

INDIAN COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI

1.	Dr. Trilochan Mohapatra	Secretary (DARE) & Director General Indian Council of Agricultural Research Krishi Bhavan, New Delhi 110 001
2.	Dr. S.K. Chaudhari	Deputy Director General (NRM) Indian Council of Agricultural Research Krishi Anusandhan Bhawan-II, Pusa New Delhi – 110 012
3.	Dr. S. Bhaskar	Asstt. Director General (Agronomy, AF & CC) Indian Council of Agricultural Research Krishi Anusandhan Bhawan-II, Pusa New Delhi – 110 012

EXTERNAL EXPERTS

4.	Dr. N.T. Yaduraju	Ex. Director, ICAR-DWR, Jabalpur Mysore
5.	Dr. A. N. Rao	Chief Editor, Indian Journal of Weed Science Hyderabad

ICAR-DIRECTORATE OF WEED RESEARCH, JABALPUR

6.	Dr. J. S. Mishra	Director
7.	Dr. R.P. Dubey	Pr. Scientist (Agronomy) & I/C AICRP-WM
8.	Dr. SushilKumar	Pr. Scientist (Entomology)
9.	Dr. P. K. Mukherjee	Pr. Scientist (Agronomy)
10.	Dr. Shobha Sondhia	Pr. Scientist (Organic Chemistry)
11.	Dr. V.K. Choudhary	Sr. Scientist (Agronomy)
12.	Dr. Yogita Gharde	Sr. Scientist (Agril. Statistics)
13.	Dr. Jamaludheen A.	Agricultural Economics
14.	Mr. Sandeep Dhagat	Chief Technical Officer
15.	Mr. Pankaj Shukla	Asst. Technical Officer

INVITEES FROM AICRP-WM CENTRES

PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY (PJTSAU), HYDERABAD (TELANGANA)

16.	Dr T. Ram Prakash	Principal Scientist (Agro.) & Principal Investigator
17.	Dr B. Padmaja	Sr. Scientist (Agro)

ANAND AGRICULTURAL UNIVERSITY, ANAND

18.	Mr. D.D. Chaudhari	Agronomist & Principal Investigator

TAMILNADU AGRICULTURAL UNIVERSITY, COIMBATORE

19.	Dr. P. Murali Arthanari	Principal Investigator
20.	Dr. C. Bharathi	Jr. Residue Chemist

CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

21.	Dr. Todar Mal Poonia	Principal Investigator
22.	Dr. Ankur Chaudhary	Assistant Agronomist

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23.	Dr. D.S. Sasode	Agronomist & Principal Investigator
24.	Dr. Varsha Gupta	Jr. Agronomist

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25.	Dr. M.M. Mishra	Agronomist & Principal Investigator
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PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

27.	Dr. M.S. Bhullar	Agronomist & Principal Investigator
28.	Dr (Mrs) Parvinder Kaur	Residue chemist

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29.	Dr. V. Pratap Singh	Professor (Agronomy) & Principal Investigator
30.	Dr. S.P. Singh	Jr. Agronomist
31.	Dr. T.P. Singh	SRO, Agronomy

CSK HIMACHAL PRADESH KRISHI VISHVAVIDHYALAYA, PALAMPUR

32.	Dr. S.S. Rana	Agronomist & Principal Investigator

KERALA AGRICULTURAL UNIVERSITY, THRISSUR

33.	**Dr. P. Prameela**	Principal Investigator
34.	**Dr. Savitha Antony**	Assistant Professor

ASSAM AGRICULTURAL UNIVERSITY, JORHAT

35.	Dr. Khagen Kurmi	Principal Scientist & Principal Investigator
36.	Dr. I.C. Barua	Principal Scientist

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37.	Dr. K.N. Geetha	Principal Investigator
38.	Dr. (Mrs.) Kamala Bai S.	Jr. Agronomist

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39.	Dr. Shrikant Chitale	Senior Scientist & Principal Investigator
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42.	Dr. Roshan Choudhary	Jr. Agronomist

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52.	Dr. P. Jones Nirmalnath	Professor (Agril. Microbiology)

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53.	Dr. Dinesh Sah	Associate Professor and Co-PI

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86. Director
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89. Director

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109. Project Coordinator
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110 Project Coordinator

111. Project Coordinator
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AICRP on Sesame & Niger, Jawaharlal Nehru Krishi Viswa Vidyalaya Campus, Jabalpur 482004 Madhya Pradesh

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114. Syngenta India Ltd
Invoicing Processing Cell (CC-4700)
Amar Paradigm, S. No. 110/11/3, Baner Road, Pune 411045

115. Managing Director and CEO
PI Industries Limited
ML Batra Enterprises Compound, C – 21, Meerut Road Industrial Area,
Ghaziabad – 201 003

116. Vice President - International Marketing & Development
Gharda Chemicals Limited
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Bandra (West), Mumbai-400 050

117. Vice President- Public & Government Affairs
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118. ASPEE Group of Companies
4th floor, Aspee House
Aspee Enclave, Opp. I.O.B. Bank
Marve Road, Malad West
Mumbai - 400064

119. Krishi Rasayan Group
410 & 411, Dev Arcade,
Near Naranpura Rly Crossing,
Naranpura, Ahmedabad-380 013

120. Managing Director & CEO
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121. General Manager (Research Tech. Development)
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122. Sumitomo Chemical India Pvt. Ltd. 7th, Moti Mahant, 195, J. Tata Road
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