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Proceedings

अखिल भारतीय समन्वित खरपतवार नियंत्रण अनुसंधान परियोजना

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XX Biennial Workshop of
All India Coordinated Research Project on Weed Control

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Held at
Kerala Agricultural University, Thrissur
17-18 April, 2012

खरपतवार विज्ञान अनुसंधान निदेशालय
महाराजपुर, जबलपुर–482 004ए ;म.प्र.द्ध
Directorate of Weed Science Research
Maharajpur, Jabalpur - 482 004, (MP)

Proceedings of
XX Biennial Workshop of
All India Coordinated Research Project
on Weed Control

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Kerala Agricultural University, KAU, Thrissur

Prepared by

Dr. R.P. Dubey
Dr. A.R. Sharma

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Venue: Kerala Agricultural University, Thrissur – 680 656 (Kerala)

Date: 17-04-2012

INAUGURAL SESSION

Dr. C.T. Abraham, Associate Dean, KAU, Thrissur and Principal Investigator, AICRP Weed Control at Thrissur centre welcomed the dignitaries and participants to the biennial workshop. Dr. P.V. Balachandran, Director of Extension, KAU in his presidential address highlighted the problems posed by aquatic weeds and weedy rice in the lowlands of Kerala state. He informed that the state of Kerala is proposed to be declared as an "organic state".

Inaugurating the workshop, Dr. T.R. Gopalakrishnan, Director of Research, KAU emphasized the importance of herbicides in the context of scarcity of labour, even at wages above Rs 450 per day. Machines for removal of water hyacinth from water ways and aquatic bodies need to be developed, he added. Herbicide should be used with caution as they may harm the ecosystem if used indiscriminately. Top priority should be given for strengthening the research on pesticide residues.

Dr. A.R. Sharma, Director, DWSR presented an outline of the areas of importance in weed management research in the light of several discussions held at the top level in ICAR. Later, he presented the research highlights of AICRP-WC during 2011-12.

During the inaugural function, the following publications were released by the dignitaries:

- Annual Report of AICRP-WC (2011-12)
- Consolidated reports on "Long-Term Tillage and Long-Term Herbicidal Weed Management in Different Cropping Systems, and Farm Trial and Impact analysis of Weed Management Under Different Cropping Systems by Dr. C. Chinnusamy *et al.* of TNAU, Coimbatore.
- Technical Bulletin in Telugu on "Weed-Management in Different crops" by Dr. M. Madhavi and Dr. T. Ram Prakash, ANGRAU, Hyderabad.

Dr. R.P. Dubey, In-charge AICRP-WC briefed about the programme of the workshop and its various technical sessions.

Some progressive farmers identified by KAU for adopting and disseminating weed management technologies were felicitated on the occasion.

Dr. P.S. John, Professor and Head, Agronomy, College of Horticulture, KAU proposed the vote of thanks.

TECHNICAL SESSION – I

Presentation of salient findings and recommendations of network trials conducted during 2011-12.

Chairman	**:**	Dr. P.K. Ashokan, Director (Acad.) and PGS, KAU, Vellanikkara
Co-Chairman	**:**	Dr. B. Mohan Kumar, Associate Dean, College of Forestry, KAU, Vellanikkara
Rapporteurs	**:**	Dr. S.S. Punia, CCSHAU, Hisar Dr. V.P. Singh, DWSR, Jabalpur

WS 1: Weed survey and surveillance

Dr. J. Deka, AAU, Jorhat presented the findings on weed survey and surveillance by different AICRP-WC centres.

- After 19 years, *Biophytum reinwardtii, Desmodium gangaticum, Mollugo pentaphylla, Passiflora foetida, Smilax perfoliata, Sonchus asper, Stephania japonica, Digitaria setigera , Echinochloa colona* and *Pragmites karka* extremely reduced and disappeared in Jhum cultivation in Assam.
- In Kerala, *Alternanthera philoxeroides* (Alligator weed) spreading in the low lands in the Kuttanad and Koleland regions, where one crop is rice is taken during summer .Weedy rice (*Oryza spp*. is a serious problem in major rice growing tracts of Kerala, namely, Kuttanad, Thrissur Kole and Palakad regions. *Leptochloa chinensis (*Chinese sprangletop) is a major weed problem of rice in the Kole lands and Kuttanad.
- *Mikania micrantha* is spreading alarmingly in plantation crops in the interior areas of East and South Eastern Coastal Plain Zone of Odisha.
- In eastern U.P.,new weeds eg. *Poa annua, Stellaria media; Solanum nigrum* and *Rumex acetosella* increasing gradually in *rabi* crops. Wild oat (*Avena fatua*) has almost disappeared from the wheat field.
- Heavy infestation of climbers as new weeds eg. *Ipomea* spp. and *Conyza canadensis* in sugarcane.
- *Avena ludoviciana* disappeared in wheat in North-eastern Haryana whereas, *Ammania baccifera* increased in transplanted rice.
- *Alternanthera sessilis* in upland rice has become a prominent weed in M.P.
- *Ageratum conyzoides, Commelina benghalensis* and *Brachiaria ramosa* have increased in Himachal Pradesh.
- In Punjab, *Eleusine* and *Leptochloa escape bispyribac* and thus dominate the weed flora.
- *Convolvulus arvensis* and *Cirsium arvense* are coming up as an important weeds.
- It was reported that *Malwa pusila* is replacing *Parthenium hysterophorus* and has become a threat for crop lands. *Alternanthra triandra* has emerged as a new havoc in Chhattisgarh.
- In Jharkhand, *Hyptis suaveolens* is emerging as a fast growing shrub.
- Severe infestation of *Echinochloa glabrescens, Echinochloa crusgalli* both in *boro* and *Kharif* rice and *Oryza nivara, Oryza minuta, Oryza barthii* and *Oryza rufipogon* in *Kharif* rice in west Bengal was reported.

No report on weed survey and surveillance was received from the following centres:
DBSKVV, Dapoli and UAS, Dharwad

Following specific comments were made:

- It was stressed that IVI values should be calculated carefully and all the centres should strictly follow the survey protocol.
- It was suggested to use GPS while conducting/reporting weed survey and surveillance studies, which would be useful in developing appropriate location-specific weed management strategies.
- Weedy rice should not be confused with wild rice.
- It was suggested that during weed survey and surveillance, information on the local weeding tools, medicinal or other uses of weeds should also be collected from the farmers.
- Quality data as per prescribed format should be collected, which should be properly analysed and presented with valid conclusions.

Dr. V.S.G.R. Naidu, from DWSR, Jabalpur presented the findings of studies on WS1.2 to WS1.9.

- It was stated that *Phalaris minor* has developed cross-resistance against clodinafop in certain areas of Haryana and Punjab. Pinoxaden at 50 g/ha, meso + iodosulfuron at 14.4 g/ha, sulfosulfuron + metsulfuron (RM) at 32 g/ha were found effective to control clodinafop-resistant biotypes. *Phalaris minor* showed > 60% survival with use of isoproturon even at 2.0 kg/ha at Pantnagar. Results of another study indicated that glyphosate 1.5 kg/ha was found to be most effective in reducing the propagation of *Cyperus rotundus*.
- Replacement of isoproturon with trifluralin in wheat reduced the weed seed bank of *P. minor* at Ludhiana. At Bengaluru centre, CO_2 enrichment increased the tolerance of C_3 weeds like *Chenopodium album* against glyphosate.
- Weedy rice infestation of 10-50% in direct-seeded rice was reported from Kangra, Hamirpur and Bilaspur districts of H.P.

No report was received for the assigned experiments from some centres as mentioned below:

No.	Experiment	Centres which did not submit report
1.2a	Biology & management of isoproturon resistant *P. minor*	PAU, CCSHAU, GBPUAT
1.2b	Effect of dates of sowing on efficacy of clodinafop for controlling isoproturon resistant *P. minor* in wheat	PAU, CCSHAU, GBPUAT
1.2c	Inheritance of resistance to sulfosulfuron in *P. minor*	PAU, CCSHAU, GBPUAT
1.2d	Validation of isoproturon resistance	UAS (B), KAU(seeds of resistant lines were not sent to these centres hence not conducted)
1.4	Weed seed longevity of weeds associated with major cropping system under arable condition	PAU
1.5	Crop weed toxicity of herbicide and recovery time	PAU
1.6	Physiological studies in long-term network trials	AAU (J)
1.8	Study on biology and management of *Echinochloa* and weedy rice	RVSKVV, AAU (J), BAU and OUAT

Following specific comments were made:

- Physiological basis for herbicide resistance in certain weed species should be studied.
- Some reports on resistance development in *Echinochloa* against butachlor should be verified.
- Varying results on the effect of jaggary along with glyphosate application at different centers should be examined.
- Differentiation between wild rice and weedy rice should be clearly understood.
- Sunflower suppressed all weed species but not *Cyperus*. Such results should be confirmed further.
- Relative comparisons among different treatments should be avoided; rather, well synthesized quantitative data should be presented for meaningful interpretation.
- The centres which have not conducted the allotted experiments or not followed the protocol should give adequate justification for not doing so.

WS 2: Weed management in crops and cropping systems

Dr. J. Shekhar from CSK HPKVV, Palampur presented the research highlights under WS 2.1 to 2.5.

Direct-seeded rice, fenoxaprop + ethoxysulfuron (60+15 g/ha) applied at 25-30 days after sowing provided good control of weeds and resulted in the highest grain yield of rice. In wheat, metribuzin at 105.0 and 122.5 g/ha used as tank mixture with clodinafop, improved control of *P. minor* over clodinafop

alone. Tank mixing of pinoxaden at 50 g/ha with metsulfuron 4 g/ha / 2,4-D at 500 g/ha or carfentrazone at 20 g/ha or the sequential application of pinoxaden with carfentrazone-ethyl or metsulfuron-methyl provided excellent control of grassy and broad-leaved weeds in wheat.

Direct seeding of rice after onset of monsoons was found very effective at many centres, whereas at Thrissur, Parbhani and Pusa, sowing of rice before onset of monsoons was profitable.

Dr. R.R. Upasani, BAU, Ranchi presented salient finding of WS-2.6 and 2.8.

He reported that integration of herbicides, viz. oxyfluorfen at 0.23 kg/ha, pendimethalin at 0.75 kg/ha or atrazine 1.0 kg/ha with 1 mechanical weeding at 30 DAS reduced weed growth and provided the highest yield of maize. In the ratoon crop of sugarcane, atrazine at 2.0 kg/ha + 2,4-D at 0.5 kg/ha at 75-90 DAP or metribuzin 0.88 kg/ha (pre-em) fb one hoeing at 45 DAS fb 2,4-D (Amine salt) 0.75 kg/ha at 90 DAS was found effective for higher productivity.

Dr. C. Chinnusamy from TNAU presented salient findings of long-term tillage trial in different cropping systems.

He reported that in rice-based cropping system, particularly rice-rice system, conventional tillage (CT) with herbicide application in rice resulted in lower weed density and increased the yield. The effect on weed seed bank under both CT and zero tillage (ZT) showed more grassy weeds than broad-leaved and sedges. However, in rice-fallow system at Thrissur, higher weed-control efficiency, grain and straw yield of rice were found in CT-ZT combination than ZT alone.

While presenting salient findings of long-term herbicides trials (WS 2.9 and 2.10) in different cropping systems, Dr. Chinnusamy reported that there was weed shift from *Echinochloa colona* to *Panicum distychyon* in rice-rice cropping system at Coimbatore. Integration of butachlor + 2,4-D DEE + 100% inorganic N gave maximum yield of rice in the same system. However at Hisar, maximum yield of both crops under rice–wheat system was recorded under green manuring in integration with clodinafop 60 g/ha in wheat and butachlor 1500 g/ha in rice due to better weed control.

In rice-mustard cropping system, continuous use of butachlor or rotational use of pretilachlor / butachlor + fertilizer or organic matter caused disappearance of *Hydrolea zeylanica* and appearance of *Cynodon dactylon* and *Digitaria sanguinalis* at Sriniketan. At Bikaner, pre-plant incorporation of imazethapyr at 75 g/ha fb mechanical weeding at 30 DAS brought about significant reduction in weed dry biomass and resulted in higher grain yield of clusterbean in clusterbean-wheat cropping system.

Dr. V.P. Singh, GBPUAT, Pantnagar presented major findings of long-term studies on weed management in different cropping systems (WS 2.11 to 2.13).

Application of pendimethalin at 0.75 kg/ha + one manual weeding provided effective control of weeds in chickpea at most of the centres. Number of root nodules at harvest stage was not influenced significantly due to various herbicide treatments, and no change in pH, EC, OC and bulk density of rhizospheric soil was observed due to any of the herbicides.

Application of isoproturon at 0.75 kg/ha along with 0.1% surfactant or 1% urea was found most effective against weeds in wheat at GBPUAT, RAU (P) and CSAUAT.

No report was received for the assigned experiments from some centres as mentioned below:

Theme	Experiment	Centres which did not submit report
WS 2.2	Effect of rice establishment techniques under different weed	DBSKKV, KAU, MAU

	management practices	
WS 2.4	Evaluation of metribuzin in combination with clodinafop, sulfosulfuron and pinoxaden for weed control in wheat	CSAUAT, NDUAT, RAU (B)
WS 2.5	Bio efficacy of pinoxaden 5 EC in combination with broad leaf herbicides against complex weed flora in wheat	CCSHAU, RAU (B)
WS 2.13	Maize-chickpea/lentil/pea cropping system	Not reported : MAU
WS 2.7	Weed management in sugarcane ratoon	RAU (P), UAS(D)

Following specific comments were made:

- Data on weed dry weight given as 5-7 g/m^2 should be checked as this might not cause any economic loss in yield.
- Only SI units should be followed uniformly while presenting scientific data.
- Stimulatory effect of pyrazosulfuron on rice should be further investigated and verified
- Results obtained at different centres should be explained in relation to soil type, variety, rainfall and other local factors.
- Data of long-term experiments at different centres should be complied and analysed to draw valid conclusions. The PIs may send these data to HQs for through examination and analysis by the statistician.
- In long-term experiments, the effects on weed seed bank, and soil physico-chemical and microbiological properties should also be studied.
- All centres should continue the long-term trials. A new experiment on weed management in conservation agriculture may also be initiated.
- Available P and K status in soil, as well as their concentration and uptake by crops and weeds should be presented in elemental form.
- Minor and non-significant differences between treatments need not be emphasized.
- Economic analysis of data should be done for all field experiments, considering the cost of inputs / operations, and price of output in a realistic manner.
- Dr C. Chinnusamy of Coimbatore centre presented the report on long-term trials in a very systematic and effective manner.

WS 3: Management of parasitic / invasive / problematic / aquatic weeds

Dr. T.V. Ramchandra Prasad, UAS, Bangaluru presented results of experiments on management of parasitic weeds (WS 3.1 to 3.4).

He reported that summer ploughing *fb* pendimethalin at 1.0 kg/ha as sand-mix or imazethapyr at 75 g/ha as pre-plant incorporation provided effective control of *Cuscuta* in lucerne and niger. In onion, pemdimethalin at 1.0 kg/ha (PE) or imezethapyr at 100 g/ha (20 DAP) was effective to control *Cuscuta*.

Use of glyphosate 0.1 to 0.2% at 50 - 55 DAP in potato lowered the *Orobanche* infestation (12-14%) and gave higher tuber yield (28.6-29.2 t/ha) similar to hand removal of *Orobanche* at 10 days interval (34.8 t/ha) at Bengaluru.

In mustard crop, use of neem or caster cake (400 kg/ha at sowing in furrows) + glyphosate 50 g/ha + 1% ammonium sulfate at 60 DAS or glyphosate 25 g/ha at 30 DAS fb 50 g/ha at 60 DAS gave control of *Orobanche* by 80 to 90% and increased yield by 30% at Hisar whereas, neem cake 200 kg/ha + pendimethalin 0.5 kg/ha + HW at 60 DAS gave 24 to 33% more yield than farmers practice at Bikaner

Sugarcane fields infested with *Striga* should be treated with 2,4-D Na Salt at 1.0 kg/ha + 1% urea +1% soap solution at 70-75 DAP or atrazine at 1.0 kg/ha (PE) fb 2,4-D 1.0 kg/ha+ sugarcane mulching. For controlling *Loranthus* in mango, spray of ethrel at 800 ppm or padding of 2,4-D at 0.8 g/25 ml water

caused defoliation and controlled re-growth. Salt padding (1g/ml of water) during summer was also found beneficial.

Following specific comments were made:

- Technology developed at Hissar centre for management of *Orobanche* in mustard should be tried and validated at other centres.
- Additional contingency was requested for conducting trails on parasitic weeds because such trials are normally done on farmers' fields.
- Rotation use of herbicides was emphasized for effective weed control.

WS 4: Herbicide leaching behaviour, persistence, residues and toxicity

Chairman	**:**	Dr. T.R. Gopalkrishnan, Director of Research, KAU, Thrissur
Co-chairman	**:**	Dr. A. Augustine, Associate Director of Research, KAU, Thrissur
Rapporteurs	**:**	Dr. R.B. Patel, AAU, Anand Dr. N.S.T. Ramprakash, ANGRAU, Hyderabad

Dr. Shobha Sondhia, DWSR, Jabalpur presented the results of studies on herbicide residues in food chain, soil and ground water (WS 4.1), and studies on herbicide persistence in water (WS 4.2).

In her presentation she made the following points:

- Herbicide residues studies were carried out by 14 centers involving 19 herbicides applied to 7 crops.
- In rice-rice system, the residues of butachlor, pretilachlor and 2,4-D were below MRL in soil, grain and straw samples at crop harvest
- In rice-wheat system, the residues of isoproturon, butachlor, pretilachlor and 2,4-D in soil, grain and straw were below detectable limits and below MRL.

Results of the experiments under WS 4.3 to 4.6 were presented by Dr. Neelam Sharma, CSKHPKV, Palampur.

The conclusions drawn from studies on leaching behavior and persistence of herbicides, secondary metabolites, adsorption and desorption behaviour of herbicides were as follows:

- Results on leaching behavior of oxyfluorfen, 2,4-D, butachlor, pretilachlor, cyhalofop-p-butyl, atrazine and pendimethalin showed that most of the applied herbicides remained in the top 5-10 cm of the soil.
- On-farm trials on persistence of isoproturon, clodinafop, 2,4-D and sulfosulfuron in wheat; butachlor, pyrazosulfuron ethyl, pretilachlor, Almix and oxadiargyl in rice; atrazine in sorghum, pearlmillet and pendimethalin in cotton, groundnut and tomato showed that the residues were below MRL at harvest time in crop produce.
- Studies on secondary metabolites of herbicides showed that, time of application and dose have significant influence on concentration of HPFMA in soil and grain.
- Studies on adsorption and desorption behaviour of herbicides revealed that total amount of herbicides (butachlor, pretilachlor, oxyfluorfen, 2,4-D and atrazine) adsorbed increased with increasing initial concentration of equilibrium solution. Moisture levels did not have significant effect on the adsorption in case of water insoluble nature of the herbicides. Organic matter retained more quantity of herbicides.

No report was received for the assigned experiments from some as mentioned below:

Theme	Experiment	Centres which did not submit report
WS 4.1	Studies on herbicide residue in food chain, soil and ground water	Maize (PAU, MAU); soybean (MAU); wheat (PAU, NDUAT, CSAUAT, GBPUAT); rice (CSAUAT, GBPUAT, TNAU, PAU)
WS 4.2	Studies on Herbicide persistence in water	TNAU, GBPUAT for water hyacinth
WS 4.3	Characterization of leaching behavior of herbicide in soil	PAU, MAU, CSAUAT
WS 4.6	Adsorption and desorption behaviour of herbicides	GBPUAT, OUAT, PAU

Following specific comments were made:

- Minimum Detection Limit should be furnished by all the centers while presenting the residue data.
- Base data of residue studies in long-term experiments should be maintained.
- Recovery experiments must be conducted in all the herbicide residue experiments to evaluate sensitivity, accuracy and repeatability of the method. These studies should be carried out with herbicide standards of not more than 1.0–2.0 ppm concentration.
- All the residue chemists should adopt extraction methods with less number of steps to prevent losses of residues during extraction. Methods like QuEChERS can be adopted for better residue extraction and reliable results.
- Quality data should be generated in herbicide residue studies.
- Detection limits of different herbicides should be specified.
- Residue data, especially in case of long-term herbicide experiments should be presented as per the treatments enlisted in the technical programme for better interpretation of results.
- Herbicide residue experiments should be formulated and conducted to assess the threat posed by herbicide and their metabolites in to the food chain, causing health hazards to the people.
- Aquatic weed management experiments should only be conducted in actual field conditions on long-term basis instead of laboratory conditions.
- Depth of leaching, insoluble nature of the herbicides, degradation products of the herbicide in environment and residues in organic manures should be considered while formulating the research programmes on herbicide residues.

WS-5.0: Transfer of Technology

Chairman: Dr. P.V. Balachandran, Director of Extension, KAU, Thrissur
Co-Chairman: Dr. F.M.H. Khaleel, Head, Department of Extension, COH, Vellanikkara
Repporteurs: Dr. A.P. Singh, IGKV, Raipur
Dr. P.K. Singh, DWSR, Jabalpur

Dr. Sushilkumar from DWSR presented the results on *Parthenium* management through *Zygogramma bicolorata* (WS 5.1).

- He informed that in about 70% places, there was successful establishment of beetle coupled with widespread damage on *Parthenium*. However, in some areas, although there was presence of the beetle but no visible impact could be observed. The areas of low activity of beetles were: Jorhat, Anand, Kerela and Bikaner, while the area of high activity were: Gwalior, Pantnagar, Faizabad, Bangalore, Jabalpur, Raipur, Kanpur, Hyderabad and Coimbatore. The areas of mild activity

were: Sriniketan, Bhuwanewswar, Hyderabad and Coimbatore. There was no establishment of the beetle at Sriniketan centre in the past, but this year, establishment of the beetle was reported in Birbhum area. Dr. Sushil Kumar suggested to conduct survey and monitor the field regularly and carefully during rainy season as beetles hide themselves below the leave surface.

- Dr. Sushil Kumar also presented the data of biological control of water hyacinth by *Neochetina* spp. (WS 5.2). Release of bioagent was made at Hyderabad and Hisar centre. He informed about the release of the bioagent, *Cyrtobagous salviniae* against *Salvinia molesta* in Bangalore region. Dr. Sushilksumar requested other centres to select suitable ponds in their area infested with water hyacinth or *Salvinia molesta* so that bioagent could be released in future.

Dr. A.M. Jaulkar, RVSKVV, Gwalior presented the results of yield loss estimation (WS 5.3).

He made the following points:

- In irrigated rice, the mean yield loss across all centres was negligible (3%) between recommended and weeds-free practices, while it was 14% between farmers practice and weed-free. In monetary terms, the B:C ratio was higher under recommended, followed by weed-free and farmers practice. In upland rice, the mean yield loss was 9.9% and 22.7% under recommended and farmers' practices compared with weed-free, respectively.
- In irrigated wheat, the estimated yield loss under recommended practice over weed free situation ranged between 2.3% to 15.60%, whereas with farmer's practice it ranged in between 6.9% to 39.9%. In rainfed wheat, the yield loss under farmer's practice over weed free was estimated to be 36.6% due to non-adoption of chemical control method.
- The estimated yield loss under farmer practices over weed-free was comparatively higher in clusterbean (33.3), pearlmillet (21.2), soybean (20.3) and summer moong (23.2).
- In maize, the average yield loss under farmers practice was 21.7% due to weed infestation.
- In mustard, the estimated yield loss under recommended and farmer's practice was 1.6 to 16.3% over the weed-free.
- In tomato, the estimated yield loss was 17.2% under farmer practice compared with recommended practice.

Awareness and adoption level: Most farmers are aware about the cultural, chemical and mechanical weed management practices, but only 48% farmers go for adopting chemical herbicides.

Source of information: The SAU/ Extension agency was the major source of information in disseminating technical information to the farmers.

Anticipated yield loss: It was observed that the yield loss due to weed infestation was maximum (>60%) in wheat and rice, while it was minimum (10-15%) in cotton.

Dr. K. Govindarajan, TNAU, Coimbatore presented the findings of On-farm trials (OFTs) (WS 5.4) and impact analysis on weed management (WS 5.5).

- A total of 314 OFTs at various centres were conducted during 2011-12. Broad-leaved weeds dominated weed flora, followed by grasses. He informed that integrated weed management required Rs. 3000/ha while farmers' practice required Rs. 6000/ha. The productivity of crops increased by 23.4% by adopting the integrated weed management.

No report was received for the assigned experiments from some centres as mentioned below:

Theme	Experiment	Centres which did not submit report
WS 5.3:	Yield loss estimation	DBSKVV and UAS (D)
WS 5.4	On-farm trials:	RVSKVV, AAU (J), CCSHAU, DBSKKV, UAS (D
WS 5.5	Impact analysis on weed management	AAU (J), UAS (D), DBSKKV

Following specific comments were made:

- Feed back from farmers must be obtained in OFTs and FLDs.
- For conducting OFT a minimum area of 100m^2 and for FLD, 1 acre area should be used. In hill areas where the field sizes small, the area can be lower depending on availability.
- It should be clearly specified whether the B:C ratio is expressed based on gross returns or net returns. It is better to mention it on the basis of net returns, and can also be given as 'Net returns per Re invested'.
- Data on yield was found to be casually recorded.
- Uniform guidelines for studies on impact analysis should be formulated.
- Some model farmers should be identified, who can further disseminate the technologies.
- It was suggested to specify the 'Farmer's Practice' wherever mentioned.

TECHNICAL SESSION – II

Presentation of research highlights (station trials) by coordinating centres/volunteer centres

Chairman: Dr. A.R. Sharma, Director, DWSR, Jabalpur
Co-Chairman: Dr. C.T. Abraham, Associate Dean, College of Horticulture, Thrissur
Repporteurs: Dr. M.M. Mishra, OUAT, Bhubaneswar
Dr. Anil Dixit, DWSR, Jabalpur

- In the first presentation, Dr. S.S. Punia, CCSHAU, Hisar delivered a presentation on management of *Orobanche* in mustard. He emphasized that cultural management practices are not effective in management of *Orobanche* in mustard. Sequential application of glyphosate 25 and 50 g/ha applied at 30 and 50 DAS provided good control of *Orobanche*. He cautioned that it should be applied in the irrigated conditions only.
- Dr. Suresh Gautam, CSKHPKV, Palampur stated that integration of FYM @ 25 t/ha along with *Chromolaena* resulted in higher potato yield in potato–soybean cropping system. Bispyribac-sodium at 25-30 g/ha provided excellent control of weeds in rice.
- Dr. (Mrs.) M. Madhavi, ANGRAU, Hyderabad informed that soil solarisation was beneficial to reduce *Orobanche* infestation in tomato and brinjal on farmers field, whereas directed spray of imazethapyr and metribuzin did not show any effect. In onion, pre-emergence application of oxadiargyl at 90 g/ha, followed by quizalofop-p-ethyl at 50g/ha as post-emergence proved effective in controlling most of the weeds. In cabbage, pre-emergence application of oxyfluorfen at 0.25 kg/ha, followed by black polythene mulch gave efficient weed control and higher B:C ratio.
- Dr. R.L. Rajput, RVSKVV, Gwalior emphasized on integrated weed management in cowpea. Imazethapyr at 75 g/ha as post-mergence and pendimethalin at 1.0 kg/ha as pre-emergence application along with one hand weeding at 40 DAS gave good control of weeds in cowpea. In okra, two hand weedings at 30 and 50 DAS and mulching gave maximum pod yield.
- Dr. B. Duary, VB, Srinikethan briefed about the management of *Echinochloa* sps. in rice-rice cropping system. He opined that azimsulfuron and bispyribac-sodium are the two most effective herbicides in managing *Echinochloa* in rice. Oxyfluorfen at 0.1 kg/ha at 6-7 DAP provided good control of *Solanum nigrum* in potato.

- Dr M.J. Mane, DBSKKV, Dapoli emphasized on the effect of various establishment methods under different weed management practices in rice. He informed that variety 'Ratnagiri-2' was better in terms of weed suppression ability.
- Dr. T.V. Ramachandra Prasad, UAS, Bengaluru highlighted that in transplanted rice bispyribac-sodium at 20.0-22.5 g/ha at 20-25 DAP, fenoxaprop-p-ethyl at 83.3 g/ha and quizalofop-p-ethyl at 37.5 g/ha have been recommended for control of grassy weeds in groundnut and onion on farmers field.
- Dr. S.K. Guru, GBPUAT, Pantnagar informed that 10 rice genotypes were evaluated for their competitive ability against weeds. Parameters that can be related to the competitive nature of the rice genotypes include grain yield and biological yield under weedy conditions, tiller numbers, shoot dry matter production at early vegetative stages, leaf number, area and LAI, nitrogen content and chlorophyll content of the leaves. Syringic acid, pohydroxy benzoic acid, 8-hydroxy quinoline, protocatechnic acid and caffeic acid occurred in higher concentration under weedy conditions, which were contributing towards allelopathic ability of the competitive genotypes.
- Dr. Anil Kumar, SKUAST, Jammu pointed out that in maize-wheat cropping system, metribuzin showed promising results, whereas in rice-wheat system, application of butachlor 1.5 kg/ha in rice and isoproturon 1.0 kg/ha + 1% urea (tank mixed) in wheat provided good control of weeds. He informed that weed database has been developed for Dal lake in Srinagar.
- Dr. R. Balasubhramanayan, TNAU, Madurai showed that post-emergence application of fenoxaprop-p-ethyl and ethoxysulfuron provided broad-spectrum weed control and enhanced rice productivity. Rice under SRI performed better, followed by conventional transplanting. Similarly, cono-weeding was found effective, followed by pre-emergence application of pyrazosulfuron-p-ethyl + mechanical weeding.
- After the presentation of station trials and presentation from the volunteer centres, scientists from different crops and horticultural institutes of ICAR, viz. CRIJAF, Barrackpore; VPKAS, Almora; DOR, Hyderabad; DRR, Hyderabad; NBAII, Bangalore; CIAH, Bikaner and CRRI, Cuttack presented their views and outline of works related to weed management.
- Dr. Mukesh Kumar from CRIJAF, Barrackpore presented the weed problems in jute, particularly of *Trianthema.* Dr. B. Duary suggested using pretilachlor + safener for its control.
- Dr. Mangal Deep Tuti from VPKAS, Almora stated that they are working on areas like energy budgeting of small weeding tools, conservation tillage, long-term effect of fertility experiments on weed seed bank. He sought collaboration from AICRP-WC centres working in hill agriculture.
- Dr. G. Suresh from DOR, Hyderabad expressed concern over unavailability of post-emergence herbicides in oilseed crops.
- Dr. B. Sreedevi from DRR, Hyderabad sought collaboration for residue analysis from ANGRAU, centre.
- Dr. P. Sreerama Kumar from NBAII, Bengaluru informed that more emphasis should be given on import of bioagents in the XII plan. He stated that quarantine facilities at NBAII could be utilized by DWSR and its centres. Dr. B.R. Choudhary from CIAH, Bikaner stated that weed problems were not serious in desert areas. One hand weeding is recommended in all vegetable crops along with drip irrigation and mulching.
- Dr. Sanjay Saha from CRRI informed that they are working on all aspects of weed management in different rice ecologies.

Formulation of Network technical programme for 2012-13 and 2013-14
Chairman: Dr. A.R. Sharma, Director, DWSR, Jabalpur
Convener: Dr. RP Dubey, DWSR, Jabalpur

Network Technical programme was formulated for 2012-13 and 2013-14 in five different groups:

Dr. S.S. Punia, presented the proposed technical programme for WS1, WS 2 and WS 3.

- Survey work on efficacy of different herbicides in *P. minor* and on weedy rice will be conducted by selected centres.
- New programme was finalized on management of resistant *P. minor* through pot and field studies in wheat; and on complex weed flora in transplanted and direct-seeded rice.
- A new trial on weed management in 'turmeric' was finalized as this crop is heavily infested by the weed. Another study on weed management in pulse crops, 'mungbean and urdbean' was proposed as there is no herbicide which can provide complete control of weeds; the residual effects of herbicides on succeeding crop will be evaluated.
- The centres which have not completed five years will continue with the long-term tillage trial.
- The long-term herbicide trial will also continue at all the coordinating centres.

Dr. R. Devendra gave an account of the proposed programme on 'Weed survey, Physiological and Climate Change Studies':
- Weed surveillance will continue to know the shift in weed flora and new emerging weeds with introduction of improved production practices
- Effect of glyphosate on propagation potential of perennial weeds and herbicide resistance studies will continue.
- Weed longevity studies will continue.
- It was difficult to separate the effect of CO_2, humidity and temperature in climate change studies, and requested for provision of CO_2 chamber for effective climate change studies.
- Biology and management of *Echinochloa* and weed seedling identification by Jorhat centre will continue
- Weed seed bank studies in long-term trials will continue.

Dr. C. Kannan presented the proposed programme for parasitic weeds . He presented a proforma for collecting information on the occurrence of *Orobanche* in the country and its management.

Dr Shobha Sondhia presented the proposed technical programme for 'Herbicide residue studies'. She stated that the progrmame of work will involve characterization/leaching behavior of herbicides and their persistence in soil/crop produce, secondary metabolites and adsorption/desorption studies; residues studies in all the long-term trials and OFTs will be evaluated. All studies will be conducted through GC/HPLC. The centre which do not have these facilities will collaborate with the nearest coordinating centres for residue analysis.

Dr. P.K. Singh presented the proposed proforma for collection of information on transfer of technology and impact analysis. He also presented the guidelines for conducting OFTs and FLDs.

The following points were made for strengthening of the TOT programme:

- Essential observations as mentioned in the technical programme must be recorded.
- OFTs will be conducted by all the centres, involving 2-3 most appropriate treatments along with farmers' practice.

- New FLDs on improved weed management technologies will be initiated from 2012. The FLDs will be in specified crops and involve all categories of farmers.
- The impact analysis of OFTs and FLDs should be conducted after two years.
- A consolidated report of the concluded experiments should be prepared and submitted to the coordinating unit.
- Director, DWSR pointed out that all the scientists of AICRP centres, irrespective of discipline should actively participate in the transfer of technology programmes.
- All the centres should follow the guidelines, already circulated, for testing of new herbicides. Some of the PIs informed that besides AICRP-WC protocols the SAUs also allot herbicides received from industry for testing.

The Industry personnel reported launching of new products like ecosulfuron, orthosulfomuron, and a few other products from UPL.

PLENARY SESSION

Chairperson	**:**	Dr. P.B. Pushpalatha, Registrar, KAU, Thrissur
Co-Chairman	**:**	Dr. A.R. Sharma, Director, DWSR, Jabalpur
Rapporteurs	**:**	Dr. C.T. Abraham, KAU, Thrissur Dr. R.P. Dubey, DWSR, Jabalpur

The rapporteurs of different technical sessions presented the summary/recommendations and research highlights.

Dr. Pushpalatha, Registrar of the University appreciated the work being undertaken in AICRP-WC and suggested to harness the beneficial qualities of weeds, e.g. qualitative improvement of weedy rice and extraction of natural pigments from weeds.

Dr. A.R. Sharma remarked that the technical programme once finalized should be followed by the respective centres without any deviation. He emphasized the importance of technology transfer and hoped that scientists of all the disciplines working in the project should devote at least 25% of their time for extension activities.

Scientists of the project, *viz.* Dr. T.V. Ramchandra Prasad, Dr. S.S. Mishra, Dr. O.L. Sharma, and Dr. K.S. Yadav were given warm farewell as these will be attaining superannuation during 2012.

At the end, Dr. R.P. Dubey, DWSR, Jabalpur proposed the vote of thanks.

Overall Recommendations

I. Research

1. Weed survey and surveillance

i. Weed survey work is going on for the last several years. It is essential to compile this information in a systematic manner and computerize for uploading on the website.

ii. Some routine weed survey related activities can be dispensed with emphasis may be given to weed surveillance to monitor appearance of new weed species, and weed shifts due to weed management practices.

iii. Prescribed guidelines / protocols are not followed for weed survey / surveillance at more centres, and the observations / records are made in a very casual and unscientific manner. Information collected should be scientific through GPS, continuous and properly tabulated and analyzed.

iv. GPS should be used while conducting/reporting weed survey and surveillance studies, which would be useful in developing appropriate location-specific, weed management strategies.

v. Visible effects on weed dynamics due to changes in weather / climate changes over the years should be documented.

vi. Useful qualities of specific weeds should be identified and put to some practical use.

2. Weed biology and physiology

i. All centres should identity 5 major species in cropped / non-cropped lands of their jurisdiction / state. An article on the current state of knowledge with respect to their infestation, biology and management should be prepared.

ii. A compilation on major weeds of India should be compiled based on the information available from different states / regions.

iii. Centres where facilities exist should take up studies on the effect of climate change (CO_2, temperature, UV radiations) on the identified weeds species, and on crop-weed associations.

iv. Weeds showing resistance to continued use of a herbicide should be identified. A scientific analysis of herbicide resistance *vis-a-vis* herbicide efficacy should be made.

v. Basic physiological studies should be planned on resistance development and its management.

3. Weed management in crops and cropping systems

i. The centres which have not initiated long-term herbicide trials, should do the same now.

ii. Effects on soil physico-chemical and biological / microbiological properties, crop performance and weed dynamics should be properly monitored in long-term experiments. Accordingly, seasonal / yearly change in these parameters over a period should be scientifically presented.

iii. At most places, zero tillage has shown good results. Such studies should be continued for indefinite period in fixed plots. Emphasis should be given to integrated weed management in conservation agriculture systems considering all the relevant principles i.e. minimum soil disturbance, residue / cover management, and dynamic crop rotations.

iv. Station trials may be undertaken on location-specific problems in individual crops.

v. Studies on weed management in organic farming systems should be taken-up in high-value crops.

vi. Weed management should also be undertaken in horticulture (fruits, vegetables, ornamentals) / plantation crops – based systems in the relevant centres / universities.

vii. Studies on canopy development, rhizospheric environment and nutrient uptake patterns of both crops and weeds should be made.

viii. Economic analysis is a must in all field trials including OFTs and FLDs. The benefits or otherwise of any weed management practice should be clearly quantified in realistic economic terms.

ix. Data on crop and weed growth parameters should be recorded periodically, and scientific growth analysis should be done. Regression analysis can be done to work out crop-weed relationships.

x. A compiled report on the previously conducted and concluded experiments including long-term tillage / herbicide trials should be presented in the annual reports of the respective centres and submitted to the coordinating unit.

xi. Data must be collected systematically, and only statistically analyzed quantitative data should be presented.

xii. In long-term experiments, base year data and yearly variations in treatment responses should be recorded and presented.

xiii. A system-based approach to weed management should be pursued. The direct, residual and cumulative effects of weed management practices / herbicides should be investigated in a system mode on a long-term basis.

xiv. An experiment on conservation agriculture will be formulated and finalized after feedback from all the centres.

4. Herbicide residues and environmental quality

i. In all long-term field trials, the herbicide residues including secondary metabolites in soil and plant (grain, stover / fodder) should be monitored on a continuous long-term basis, at least in the selected herbicidal treatments.

ii. Controlled studies on leaching behavior, persistence, adsorption etc. should be carried out using commonly used herbicides.

iii. Herbicide residues in water bodies should be monitored, along with effects on aquatic flora and fauna.

iv. Bioassay studies should normally be avoided. The centres which do not have facilities for herbicide residue analysis, they can collaborate with nearby centres or avail the facilities at HQs.

v. It is also desirable to collect herbicide samples of different brands from the market on regular basis and analyzed for their active ingredient.

vi. Herbicide residue data, especially in case of long-term experiments, should be presented as per the treatments enlisted in the technical programme for better interpretation of results.

vii. Herbicides residue experiments should be formulated and conducted to assess the threat posed by herbicides and metabolites by their entry into food chain and thus causing health hazards to the people. Depth of leaching, insoluble nature of the herbicides, degradation products of the herbicide in environment, and residues in organic manures should be considered.

5. Management of problematic / invasive / parasitic / aquatic weeds

i. Centres having similar weed problems should work together in a network / mission mode, study their biology / ecology and integrated management including through biological means.

   a) *Orobanche* – Hissar, Bikaner, Gwalior, Bangaluru, Coimbatore, Bhubaneswar, Hyderabad centres – with coordination from DWSR/ DRMR
   b) *Striga* – Hyderabad, Dharwad, Bangalore, Coimbatore, Gwalior centres
   c) *Cuscuta* – Coimbatore, Bhubaneswar, Parbhani, Bengaluru, Dharwad, Pusa, Hyderabad, Dapoli
   d) Weedy rice and *Echinochloa* – Thrissur, Coimbatore, Raipur, Faizabad, Palampur, Gwalior, Bhubaneswar centres

e) Aquatic weeds (water hyacinth and others) – Thrissur, Jorhat, Bhubaneswar, Coimbatore, Bangaluru, Pusa centres
f) *Phalaris minor* – Ludhiana, Pantnagar, Hissar, Palampur, Faizabad, Gwalior centres
g) *Parthenium* – All centres
h) Tea gardens – Jorhat, Palampur, Coimbatore, Thrissur centres
i) Coconut and rubber – Thrissur, Coimbatore, Bhubaneswar, Hyderabad, Dharwad centres
j) Fruit crops – Anand, Dapoli, Parbhani centres
k) Hill ecosystem – Palampur, Pantnagar, Ludhiana, Jorhat centres

ii. Aquatic weed management experiments should also be conducted in actual field conditions on long-term basis, besides laboratory conditions.

6. Transfer of technology

i. Scientists of all centers should devote a minimum of 25% of their time for training / extension activities, including on-farm trials, frontline demonstrations and impact analysis.
ii. Emphasis should be given on disadvantageous / tribal areas for dissemination of technologies.
iii. Effective collaboration must be made with other disciplines, AICRPs in the same university, KVKs, NGOs and GOs (state department of agriculture / horticulture) for dissemination of technologies.
iv. Concept of weed free-village should be developed, and 4-5 such villages may be adopted for a period of 2 years.
v. Productivity, profitability and impact analysis of weed management interventions should be worked out. Impact analysis should indicate the coverage of area, improvements in livelihood security and rural transformation, etc.
vi. OFTs should include not only herbicidal treatments for weed control but also the mechanical tools including power weeders for integrated weed management.
vii. Herbicide residue analysis can also be done in some of the OFTs and aquatic bodies where a particular herbicide has been used over a period.
viii. Biological control of *Parthenium* and water hyacinth should be demonstrated in the city premises and in villages at prominent locations. Select 1-2 large ponds / water bodies in the city /village infested with water hyacinth and show the effect of biological control.
ix. Extensive reliance on herbicides alone is not desirable; and hence an effective extension strategy for integrated weed management involving chemical and non-chemical approaches should be followed.

II. Administrative

i. Vacant positions at coordinating centres should be filled immediately by the respective SAUs.
ii. Frequent shifting of scientists from the project should be avoided.
iii. Funds and vehicle provided for the project should not be used in other works by the SAUs.
iv. Separate provision for funds should be proposed under XII plan for conducting FLDs and OFTs under transfer of technology.
v. Performance of some centres is not up to the mark as they did not conduct the allotted experiments as per protocol, and also did not publish papers. Such centres must improve their performance, failing which, appropriate action including shifting / closure of these centers will be recommended to the ICAR.

III. General points

i. Research articles published by most scientists of coordination centres are not high quality. We must generate quality data and publish articles in high ranked journals.

ii. Efforts must be made to win awards / recognitions at the national / state level. We must also contest for the ICAR's Award for AICRPs.
iii. Centers with significant contributions during the year / biennium should be recognized. Those not performing so well should also be identified and exposed.
iv. Centers should not merely become a testing agency for herbicides and HTCs of MNCs, and provide results according to their liking. We must become equal partners in the development, evaluation and dissemination of a herbicide technology with the industry.
v. Data of long-term experiments conducted by different centers should be sent to the HQs for pooled / combined analysis and working out location x treatment interactions.
vi. A statistician has been appointed at the HQs and can be associated with the planning, design, layout and analysis of network experiments.
vii. Annual reports are submitted by some centres very late and that too in a very poor shape. Good quality reports with properly analyzed data should be submitted well before the due date. Reports submitted after the last date and those of very poor quality will not be considered.
viii. There shall be a proper system of monitoring of work of different centres from the HQs.
ix. Voluntary centers should undertake trials of their relevance under the guidance of Nodal Officer from the HQs.
x. Resources and facilities available at different centres including HQs should be mutually-shared. Centres not having adequate facilities for residues analysis can avail the same at other nearby centres or the HQs.
xi. A proforma for data recording based on the protocol for each experiment / study should be prepared. The records of data collected from different experiments should be should be made available for verification by the monitoring team.
xii. Number of trials should be fixed for each centre depending on the strength of research personnel.
xiii. All the scientists of the coordinating centre, irrespective of discipline, must be actively involved in transfer of technology.
xiv. For all concluded experiments, a comprehensive report highlighting salient research findings along with tables, figures should be presented. Conclusions / recommendations and future lines of work should be mentioned.
xv. A profoma for recording data should be developed, and followed uniformly by all participating centres.
xvi. Number of experiments including stations, OFT and FLDs for each centre should be specified based on the manpower available at the centre.
xvii. Studies on weed utilization are very few. This area also requires strengthening.

All India Coordinated Research Project on Weed Control
17-18 April, 2012
Venue: Kerala Agricultural University, Thrissur – 680 656 (Kerala)

LIST OF PARTICIPANTS

DIRECTORATE OF WEED SCIENCE RESEARCH, JABALPUR

1.	Dr. A.R. Sharma	Director
2.	Dr. P.K. Singh	Principal Scientist (Agril. Extension)
3.	Dr. V.P. Singh	Principal Scientist (Agro.)
4.	Dr. Sushilkumar	Principal Scientist (Entomology)
5.	Dr. Anil Dixit	Principal Scientist (Agro.)
6.	Dr. R. P. Dubey	Sr. Scientist (Agro.)
7.	Dr. K.K. Barman	Sr. Scientist (Soil Science)
8.	Dr. Shobha Sondhia	Sr. Scientist (Residue Chemistry)
9.	Dr. V.S.G.R. Naidu	Sr. Scientist (Eco. Botany)
10.	Dr. C. Kannan	Sr. Scientist (Plant Pathology)
11.	Dr. M.S. Raghuwanshi	Sr. Technical Officer
12.	Sri O.N. Tiwari	Technical Officer
13.	Sri Pankaj Shukla	Technical Officer

ACHARYA N G RANGA AGRICULTURAL UNIVERSITY, RAJENDRANAGAR, HYDERABAD

14.	Dr. M. Madhavi	Sr. Scientist (Agro.) & Principal Investigator
15.	Dr T. Ram Prakash	Scientist (Residue Chemist)

ANAND AGRICULTURAL UNIVERSITY, ANAND

16.	Dr. R.B. Patel	I/C Agronomist & Principal Investigator
17.	Dr. B.D. Patel	Jr. Agronomist
18.	Dr. B.T. Sheta	Jr. Residue chemist
19.	Sh. M. I. Meisuriya	Jr. Physiologist

N.D. UNIVERSITY OF AGRICULTURE & TECHNOLOGY, FAIZABAD

20.	Dr. Jai Dev Sharma	Agronomist & Principal Investigator
21.	Dr. Ashok Kumar Singh	Jr. Agronomist
22.	Dr. S.S. Singh	Jr. Residue Chemist
23.	Dr. Raj Kumar	Jr. Microbiologist

TAMILNADU AGRICULTURAL UNIVERSITY, COIMBATORE

24.	Dr. C. Chinnusamy	Professor & Principal Investigator
25.	Dr. P. Murali Arthanari	Jr. Scientist (Agronomy)
26.	Dr. K. Govindarajan	Jr. Scientist (Economics)
27.	Dr. P. Janaki	Jr. Residue Chemist

CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

28.	Dr. S.S. Punia	Sr. Agronomist & Principal Investigator
29.	Dr Anil Duhan	Jr. Residue Chemist

RAJMATA VIJAYARAJE SCINDIA KRISHI VISHWA VIDYALAYA, GWALIOR

30.	Dr. R.L. Rajput	Principal Investigator
31.	Dr. A.M. Jaulkar	Sr. Scientist (Economics)
32.	Dr. Asha Arora	Pr. Scientist (Residue Chemistry)
33.	Dr. K.S. Yadav	Pr. Scientist (Agronomy)

RAJENDRA AGRICULTURAL UNIVERSITY, PUSA, BIHAR

34.	Dr. Yogeshwar Singh	Jr. Agronomist & Principal Investigator
35.	Mr. Dharminder	Jr. Scientist, Agronomy
36.	Dr. R.K. Pandey	Jr. Microbiologist

VISHWA BHARATI, SRINIKETAN

37.	Dr. B. Duary	Associate Professor & Principal Investigator
38.	Dr. D.C. Mandal	Assistant Taxonomist
39.	Mr. A. Hossain	Assistant Agronomist

BIRSA AGRICULTURAL UNIVERSITY, KANKE, RANCHI

40.	Dr. R.R. Upasani	Professor & Principal Investigator
41.	Mr. A. N. Puran	Jr. Microbiologist

ORISSA UNIVERSITY OF AGRICULTURE & TECHNOLOGY, BHUBANESHWAR

42.	Dr. S.S. Mishra	Agronomist & Principal Investigator
43.	Dr. M.M. Mishra	Jr. Agronomist
44.	Mr. C.R. Sarangi	Jr. Scientist (Residue Chemist)

PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

45.	Dr. M.S. Bhullar	Agronomist & Principal Investigator

G.B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR (U.P.)

46.	Dr. V. Pratap Singh	Professor (Agronomy) & Principal Investigator
47.	Dr. R. Singh	Professor (Agronomy)
48.	Dr. S.K. Guru	Jr. Scientist (Physiology)
49.	Dr. Shishir Tandon	Jr. Scientist (Residue Chemistry)
50.	Dr. T.P. Singh	SRO, Agronomy

CSK HIMACHAL PRADESH KRISHI VISHVAVIDHYALAYA, PALAMPUR

51.	Dr J. Shekhar	Head ,Agronomy & Principal Investigator
52.	Dr. Suresh Gautam	Agronomist
53.	Dr. (Mrs) Neelam Sharma	Residue Chemist
54.	Mr. Rajinder Kumar	Jr. Microbiologist

MARATHWADA AGRICULTURAL UNIVERSITY, PARBHANI

55.	Dr. A.S. Jadhav	Agronomist & Principal Investigator
56.	Mr. N.S. Jadhav	Jr. Residue Chemist

CS AZAD UNIVERSITY OF AGRICULTURE & TECHNOLOGY, KANPUR

57.	Dr. R.A. Yadav	Assoc. Prof. (Agronomy)& Principal Investigator
58.	Dr. M.Z. Siddiqui	Jr. Agronomist
59.	Dr. K.N. Singh	Jr. Residue Chemist

KERALA AGRICULTURAL UNIVERSITY, THRISSUR

60.	Dr. C.T. Abraham	Professor & Principal Investigator
61.	Dr. K.M. Durgadevi	Residue Chemist
62.	Dr. T. Girija	Physiologist
63.	Dr. P.K. Ashokan	Director (Acad.) and PGS, KAU,
64.	Dr. B. Mohan Kumar	Associate Dean, College of Forestry, KAU

ASSAM AGRICULTURAL UNIVERSITY, JORHAT

65.	Dr. J. Deka	Principal Scientist & Principal Investigator
66.	Dr. N.C. Deka	Principal Scientist, Agronomy
67.	Dr. I.C. Barua	Principal Scientist, Ecology,
68.	Dr. N. Borah	Jr. Residue Chemist

UNIVERSITY OF AGRICULTURAL SCIENCES, BANGALORE

69.	Dr. T.V. Ramachandra Prasad	Professor (Agronomy) & Principal Investigator
70.	Dr. R. Devendra	Professor (Physiology)
71.	Dr. G. R. Hareesh	Residue Chemist
72.	Dr. M.T. Sanjay	Jr. Agronomist

RAJASTHAN AGRICULTURAL UNIVERSITY, BIKANER

73.	Dr. O.L. Sharma	Agronomist & Principal Investigator

I.G. KRISHI VISHVA VIDYALAYA, RAIPUR

74.	Dr. A.P. Singh	Principal Scientist & Principal Investigator

Dr. BALASAHEB SAWANT KONKAN KRISHI VIDHYA PEETH, DAPOLI

75.	Dr. M.J. Mane	Agronomist & Principal Investigator
76.	Mr. Y.R. Govekar	Jr. Microbiologist

UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD

77.	Dr. Ramesh Babu	Professor (Agronomy) & Principal Investigator

78. Dr. P. Jones Nirmalanth — Jr. Microbiologist

PRINCIPAL INVESTIGATORS OF DWSR VOLUNTEER CENTRES

SHER-E-KASHMIR UNIVERSITY OF AGRICULTURE AND TECHNOLOGY OF JAMMU, J&K

79. Dr. Anil Kumar — Professor, Department of Agronomy

DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA

80. Dr. Jayant Panjabrao Deshmukh — Asstt. Professor

81. Mr. Parikshit Shingrup — Asstt. Professor

SARDAR VALLABH BHAI PATEL UNIVSERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT-250110 (U.P.)

82. Dr. S.S. Tomar — Asstt. Professor, Department of Agronomy

TAMILNADU AGRICULTURAL UNIVERSITY, AGRICULTURAL COLLEGE & RESEARCH INSTITUTE, MADURAI

83. Dr. R. Balasubramanian — Professor & Head, Department of Agronomy

PARTICIPANTS FROM OTHER ICAR INSTITUTES

84.	Dr. B. Sreedevi, Sr. Scientist (Agro)	DRR, Rajendranagar, Hyderabad
85.	Dr. B.R. Choudhary, Scientist	Central Institute for Arid Horticulture, Bikaner
86.	Dr. Sanjay Saha, Sr. Scientist (Agro)	CRRI, Cuttack
87.	Dr. C.K. Thankamani, Pr. Scientist	IISR, Kozhikode, (Calicut)
88.	Dr. P.M. Govindakrishnan, Sr. Scientist (Agro)	CPRI, Shimla
89.	Dr. Mangal Deep Tuti, Scientist	VPKAS, Almora
90.	Dr. Mukesh Kumar, Scientist	CRIJAF, Barrackpore
91.	Dr. S. Simi, Asstt. Professor	AICRP on Floriculture, COH, Vellanikkara
92.	Dr. G. Suresh, Sr. Scientist	DOR, Rajendranagar, Hyderabad
93.	Dr. P. Sreerama Kumar, Sr. Scientist	NBAII, Bengaluru

INVITEES FROM HERBICIDE INDUSTRY

94.	Mr. P. Nateen	Bayer Crop Science Ltd., Coimabatore
95.	Mr. K.S. Patro	HPM Chemicals and Fertilizers Ltd., Delhi
96.	Mr. Chirag Patel, Asstt. Manager	United Phosphorus Ltd., Mumbai
97.	Mr. T. Balasubramani	IsAgro (Asia) Ltd., Mumbai