अखिल भारतीय समन्वित खरपतवार प्रबंधन अनुसंधान परियोजना
All India Coordinated Research Project on Weed Management

वार्षिक प्रतिवेदन
Annual Report
2024

भा.कृ.अनु.प.-खरपतवार अनुसंधान निदेशालय, जबलपुर
ICAR-Directorate of Weed Research, Jabalpur
ISO 9001:2015 Certified

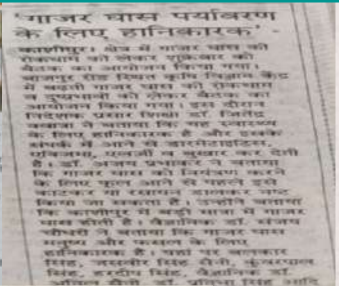
AICRP-WM in the NEWS

गाजर घास से चर्मरोग-अस्थमा सहित पशुओं में दूध की कमी

पंतनगर विवि में पार्थेनियम हिस्ट्रोफोरस पर जागरूकता एवं उन्मूलन सप्ताह शुरू

पंतनगर। जीबी पंत कृषि विवि के फसल अनुसंधान केंद्र पर गाजर घास (पार्थेनियम हिस्ट्रोफोरस) जागरूकता एवं उन्मूलन सप्ताह का शुभारंभ हुआ। इसकी शुरुआत डॉ. तेज प्रताप ने गाजर घास से मनुष्यों, पशुओं और पर्यावरण को होने वाले नुकसान की जानकारी दी। यह कार्यक्रम देशभर में 16 से 22 अगस्त तक आयोजित किया जा रहा है।

गाजर घास से चर्मरोग-अस्थमा सहित पशुओं में दूध की क



'गाजर घास पर्यावरण के लिए हानिकारक'

गाजर घास की सफाई कर जागरूक किया

पंतनगर। गाजर घास जागरूकता एवं उन्मूलन सप्ताह के तहत शनिवार को विश्वविद्यालय परिसर में गाजर घास की सफाई कर लोगों को जागरूक किया गया।

पीसीपी में आयोजित कार्यक्रम में वैज्ञानिकों ने कृषि स्नातक, स्नातकोत्तर एवं पीएचडी प्रोग्राम के लगभग 80 विद्यार्थियों, 15 कार्मिकों एवं 40 कृषि श्रमिकों को गाजर घास से फसलों, मनुष्यों एवं पशुओं में होने वाले नुकसान के बारे में बताया।

डॉ. तेज प्रताप ने गाजर घास के उन्मूलन पर प्रकाश डाला। डॉ. एसपी सिंह ने गाजर घास के नियंत्रण की विभिन्न विधियों की जानकारी दी। इस दौरान डॉ. रोहिताश्व सिंह, डॉ. विनीता राठौर आदि मौजूद रहे। संवाद

खरपतवार प्रबंधन की जानकारी दी

पंतनगर। विश्वविद्यालय में गाजर घास जागरूकता सप्ताह और प्रशिक्षण कार्यक्रम के अंतर्गत बुधवार को गांव परमा हल्द्वानी ब्लॉक में गाजरघास खरपतवार कार्यक्रम का आयोजन हुआ। इसमें परियोजनाधिकारी डॉ. एसपी सिंह ने किसानों को गाजर घास से होने वाली हानियों के बारे में बताया कि घास का प्रबंधन ठीक से नहीं करते हैं, जिससे यह पौधा दोबारा उग आता है।

खरपतवार शोध परियोजना के वैज्ञानिकों ने इसके पूर्ण उन्मूलन के उपायों को विस्तार से बताया। डॉ. तेज प्रताप ने किसानों को फसलों में खरपतवारों से होने वाले नुकसान तथा उनके उचित नियंत्रण के बारे में विस्तृत जानकारी दी गई। भुवनचन्द्र आर्या, गौरव चौबे, गोपाल जोशी, राजेश जोशी,

गाजर घास को पूरी तरह हटाने का लिया संकल्प

पन्तनगर। गोविंद बल्लभ पंत कृषि विश्वविद्यालय में गुरुवार को गाजरघास जागरूकता सप्ताह के समापन समारोह नॉरमन बोरलॉग फसल अनुसंधान केन्द्र पर आयोजित किया। परियोजनाधिकारी डॉ. एसपी सिंह, परियोजना के वरिष्ठ वैज्ञानिक डॉ.तेज प्रताप, अवतार सिंह रहे। यहां हुई प्रतियोगिता में स्नातकोत्तर, सस्य विज्ञान विभाग ने प्रथम, प्रान्जल, पीएचडी सदस्य विज्ञान विभाग द्वितीय, पारस आर्या स्नातकोत्तर,सस्य विज्ञान विभाग ने तृतीय स्थान पर रहे।

गाजरघास को पंतनगर से पूर्णतः हटाने का संकल्प

विवि के गाजरघास जागरूकता सप्ताह का हुआ समापन

गाजर घास से उत्तराखंड की जै
विविधता संकट में : डॉ. सिंह

तनगर। जीबी पंत कृषि विवि के गाजर घास जागरूकता सप्ताह के अंतिम दिन फसल अनुसंधान केंद्र के निदेशक शोध डॉ. एएस नैन की अध्यक्षता में कार्यक्रम का आयोजन हुआ।

परियोजनाधिकारी डॉ. एसपी सिंह ने कहा कि आज से 15 वर्ष पूर्व उत्तराखंड के पहाड़ी क्षेत्र में गाजर घास बहुत कम दिखाई देती थी, लेकिन आज हमारे जंगलों, रास्तों व फसलों में भी गाजर घास पहुंच चुकी है, जो बहुत ही चिंता की बात है। वरिष्ठ वैज्ञानिक डॉ. तेज प्रताप ने बताया कि गाजर घास मनुष्यों और पशुओं के लिए हानिकारक है। यहां फसल अनुसंधान केंद्र प्रभारी डॉ.

क्विज में अवतार विजयी

एसके वर्मा, निदेशक शोध डॉ. नैन, विनीता राठौर आदि थे। संवाद

कृषि विज्ञान केन्द्र में गाजर घास उन्मूलन जागरूकता कार्यक्रम मनाया, अनेक स्कूलों के छात्र-छात्राओं ने किया प्रतिभाग

गाजर घास का एक पौधा 25000 बीज पैदा करता है और यह अपना जीवन चक्र 4 महीने में पूरा कर लेता है, इससे मनुष्य में एलर्जी दमा आदि अन्य बीमारी पैदा हो जाती हैं: डॉक्टर पुरुषोत्तम कुमार

फसलों एवं स्वास्थ्य के लिए हानिकारक है गाजर घास

न्यूज डायरी

वैज्ञानिकों ने गाजर घास जागरूकता पखवाड़ा मनाया

पिथौरागढ़। कृषि विज्ञान केंद्र पिथौरागढ़ के वैज्ञानिकों ने गाजर घास जागरूकता पखवाड़ा मनाया। कार्यक्रम में विण और मूनाकोट ब्लॉक के 100 से अधिक किसानों ने भाग लिया। गाजर घास जागरूकता पखवाड़ा कृषि विज्ञान केंद्र के फार्म गैना, कृषि विज्ञान केंद्र के फार्म ऐंचोली, ग्राम गैना, खड़किनी, किरिगांव, सुंदरनगर, मैथाना गांव में किया गया। केंद्र के प्रभारी अधिकारी डॉ. जीएस बिष्ट, डॉ. अभिषेक बहुगुणा, डॉ. महेंद्र सिंह, डॉ. चेतन कुमार भट्ट, डॉ. कंचन आर्या, विनय कुमार रहे। संवाद

മാധ്യമം

എടയൂർ ഒടുങ്ങാട്ടുകുളത്തിലെ പായൽ നീക്കൽ

കള നിയന്ത്രണ വിഭാഗം ഉദ്യോഗസ്ഥർ സന്ദർശിച്ചു

କୃଷକ ମେଳା ଓ ଗାଜର ଘାସ ନିୟନ୍ତ୍ରଣ ସଚେତନତା ଶିବିର

SPREAD OF INVASIVE AQUATIC PLANTS POSES THREAT TO UPPER KUTTANAD WETLANDS

ड्रोन तकनीक से खरपतवार नाशी छिड़काव का प्रदर्शन

ଗାଜର ଘାସ ନିୟନ୍ତ୍ରଣ ସପ୍ତାହ ପାଳିତ

ପରିବେଶ ଓ ଜୀବଜଗତ ପ୍ରତି ସୃଷ୍ଟି କରୁଛି ବିପଦ

दैनिक भास्कर

City भास्कर

गाजरघास से रहती है अस्थमा की संभावना

कांकेर 20-08-2024

ड्रोन तकनीक से खरपतवार की दवा छिड़काव का किया प्रदर्शन

ସମ୍ବାଦ

ଗାଜର ଘାସ ନିୟନ୍ତ୍ରଣ ସଚେତନତା ଶିବିର

କେଏମବିବିରେ ଗାଜର ଘାସ ଭୟାବହତା ଉପରେ ସଚେତନତା ଶିବିର

పార్థీనియం కలుపు మొక్కల నివారణపై అవగాహన

కలుపు మొక్కల నివారణపై జాగ్రత్త వహించాలి

● ఏఐసీఆర్పీ శాస్త్రవేత్తలు రామ్ ప్రకాశ్, పద్మజ

త్రిపురారం,ఆగస్టు 22 : పంట పొలాలలో కలుపు మొక్కల నివారణపై రైతులు జాగ్రత్తలు వహించాలని ఏఐసీఆర్పీ(జాతీయ సహ పరిశోధన సంస్థ) శాస్త్రవేత్తలు రామ్ ప్రకాశ్, పద్మజ అన్నారు పార్థీనియం అవగాహన వారోత్సవాల్లో భాగంగా ఈనెల 16 నుంచి 22 వరకు త్రిపురారం కృషి విజ్ఞాన కేంద్రంలో నిర్వహిస్తున్న కార్యక్రమానికి హాజరై మాట్లాడారు. పంట పొలాల్లో వయ్యారిభామ కలుపు మొక్క వల్ల పంట దిగుబడి తగ్గిపోవడమే కాకుండా నానా రకాల జబ్బులు వస్తాయని యాజమాన్య పద్ధతుల ద్వారా కలుపు మొక్కలను తీసివేయాలని సూచించారు. ప్రోగ్రాం కోఆర్డినేటర్ శ్రీనివాసరావు అధ్యక్షతన జరిగిన కార్యక్రమంలో శాస్త్రవేత్తలు రైతులు పాల్గొన్నారు.

स्वदेश

गाजरघास से होने वाली हानियों के प्रति किया जागरूक

जैविक कीट चट कर गए जलकुंभी, कृषि विश्वविद्यालय के प्रयोग की सराह

अच्छी खबर — राजमाता विजयाराजे सिंधिया कृषि विश्वविद्यालय के वैज्ञानिकों ने उठाया बीड़ा

जनकताल को जलकुंभी से बचाने का काम होगा शुरू

தினகரன்

வேளாண் பல்கலையில்

பார்த்தீனியம் மேலாண்மை விழிப்புணர்வு முகாம்

தினமணி

வேளாண்மைப் பல்கலைக்கழகத்தில் பார்த்தீனியம் மேலாண்மை விழிப்புணர்வு முகாம்

இந்து தமிழ்

தமிழ்நாடு வேளாண்மை பல்கலைக்கழகத்தில்

பார்த்தீனியம் மேலாண்மை விழிப்புணர்வு முகாம்

अखिल भारतीय समन्वित खरपतवार प्रबंधन अनुसंधान परियोजना
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भा.कृ.अनु.प.- खरपतवार अनुसंधान निदेशालय
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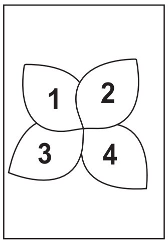
Cover page photographs



1. Application of pyroxasulfone 127.5 g/ha as PE *fb* Isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE for controlling *Rottboellia cochinchinensis* in maize.
2. Weed management in coconut plantation under Marigold + Horse gram intercropping.
3. Post-emergnce herbicide application with drone.
4. Impact of 2,4-D Sodium Salt 44% + Metribuzin 35% + Pyrazosulfuron Ethyl 1.0% WDG (Triskele) on *Striga* in sugarcane.

Preface

Weeds are one of the major biotic factors causing significant loss in productivity of different agro-ecosystems. Weeds pose a major threat to food security, biodiversity, ecosystem services and consequently to human health and wellbeing. In view of the emerging challenges in agriculture such as global climate change, water and energy shortage, deterioration of soil health; and issues in weed management due to development of herbicide resistance in weeds, scarcity of labour for manual weeding, adverse impact of herbicides on environment and biodiversity, etc., it is necessary to develop and popularize integrated weed management technologies incorporating various components of crop management for reducing production costs and increasing the productivity and farmer's income. Sincere efforts are being made through All India Coordinated Research Project on Weed Management (AICRP-WM) to develop location-specific integrated weed management technologies since its inception in 1978.

I take this opportunity to present the Annual Report of the AICRP-WM for the year 2024, highlighting the major research accomplishments and activities. During the year, major emphasis was given on developing sustainable weed management in conservation agriculture-based cropping systems, weed management in direct-seeded rice, wheat, maize, vegetables, plantation crops, etc., weed management in natural farming, management of herbicide-resistant weeds in wheat, biological control of Salvinia, management of parasitic weeds, estimation of herbicide residues in soil, water and crop produce, and on-farm research & demonstrations on herbicide spraying through drones. In addition, emphasis has been given on developing Weed Atlas and capacity building of the stakeholders.

During the year 2024, the AICRP-WM has published a total number of 59 research papers, 15 book chapters, 04 books, 23 technical/extension bulletins and 21 popular/technical articles. For the benefit of farmers and other stakeholders, 76 training programmes and 175 Front Line Demonstrations, 45 On-Farm Trials, 10 Radio talks, 11 TV programmes and 03 Kisan melas were organized. A countrywide Parthenium Awareness Programme during 16-22 August 2024 was also organized by all the Centres. In addition, 67 number of Package of Practice on weed management were developed by different centres, and 51 M.Sc. (Ag.) and 25 Ph. D. students completed their research work and submitted the theses under AICRP-WM.

I sincerely thank Dr Himanshu Pathak, Secretary, DARE and Director General, ICAR for his constant guidance and support in executing these project activities successfully. The encouragement and guidance provided by Dr A. K. Nayak, DDG (NRM), and Dr. A. Velmurugan, ADG (S&WM) are duly acknowledged. I wish to compliment the efforts of Dr. R.P. Dubey, Principal scientist & In-charge, AICRP-WM, for coordination, monitoring and evaluation of the technical programme. The contributions and cooperation of the Principal Investigators & Scientists from various cooperating centres is duly acknowledged. All the programme leaders, scientists and officials of the ICAR-DWR and AICRP-WM deserve appreciation for providing their invaluable inputs. I congratulate editorial team for bringing out this publication.

(J.S. Mishra)
Director

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कार्यकारी सारांश

EXECUTIVE SUMMARY

खरपतवार प्रबंधन पर अखिल भारतीय समन्वित अनुसंधान परियोजना (एआईसीआरपी–डब्ल्यूएम) विभिन्न कृषि–जलवायु क्षेत्रों के अंतर्गत राज्य कृषि विश्वविद्यालयों में 17 नियमित केंद्रों और 7 स्वैच्छिक केंद्रों के माध्यम से अपने नेटवर्क अनुसंधान कार्यक्रम का समन्वय करती है। वर्ष 2024 के दौरान प्रमुख उपलब्धियाँ नीचे दी गई हैं।

डब्ल्यू पी 1. स्थान–विशिष्ट टिकाऊ खरपतवार प्रबंधन पद्धतियों का विकास

- आनंद में, शुष्क सीधी बुवाई वाले चावल में बुवाई के पूर्व में पेंडिमिथैलिन 38.4% + पाइराजोसुलफ्यूरॉन इथाइल 0.85% जेडसी 785 ग्रा/हे, के बाद बुबाई के 25 दिन पर बिसपायरीबैक–सोडियम 38% + क्लोरिम्यूरॉन इथाइल 2.5% + मेटसल्फ्यूरॉन–मिथाइल 2.5% (डब्ल्यू/डब्ल्यू) डब्ल्यूजी 43 ग्रा/हे (तैयार–मिश्रण) के अनुप्रयोग से 87% की उच्च खरपतवार नियंत्रण दक्षता दर्ज की गई, इसके बाद खरपतवार नियंत्रण दक्षता बुवाई के 18–20 दिन बाद फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/डब्ल्यू + साइहेलोफॉप –ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ईसी 150 ग्रा/हे के अन्तर्गत दर्ज की गयी।
- भुवनेश्वर में, शुष्क सीधी बुबाई बाले चावल में, बुवाई के पूर्व पायराजोसल्फ्यूरॉन–इथाइल 22.5 ग्रा/हे के बाद बुवाई के 25 दिन पर फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/ डब्ल्यू + साइहैलोफॉप– ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ई सी 150 ग्रा/हे प्रभावी रूप से जटिल खरपतवारों को नियंत्रित करने में सक्षम है।
- भुवनेश्वर में, गीले मे सीधी बुवाई वाले चावल के अन्तर्गत, बुवाई से पूर्व पेंडिमिथैलिन 38.4% + पाइराजोसल्फ्यूरॉन इथाइल 0. 85% जेडसी 785 ग्रा/हे के बाद बुवाई के 25–30 दिन पर बिस्पायरिबैक–सोडियम 38% + क्लोरिम्यूरॉन एथिल 2.5% + मेटसल्फ्यूरॉन मिथाइल 2.5% (डब्ल्यू/डब्ल्यू) डब्ल्यूजी 43 ग्रा/हे (तैयार मिश्रण), जटिल खरपतवार वनस्पतियों को नियंत्रित करने में एक प्रभावी शाकनाशी संयोजन पाया गया है।
- पन्तनगर में, शुष्क सीधी बुवाई वाले चावल की फसल के अन्तर्गत, बुबाई के पूर्व प्रीटिलाक्लोर 30.0% + पाइराजोसल्फ्यूरॉन इथाइल 0.75% डब्ल्यूजी 615 ग्रा/हे के साथ बुवाई के 25 दिन पर फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/डब्ल्यू + साइहेलोफॉप –ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ईसी 150 ग्रा/हे प्रयोग के तहत उच्चतम अनाज उपज प्राप्त की गई। इसके बाद बुबाई के पूर्व पाइराजोसल्फ्यूरॉन इथाइल 22.5 ग्रा/हे के बाद बुबाई के 25 दिन के तहत फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13%

The All India Coordinated Research Project on Weed Management (AICRP-WM) Coordinates its network research programme through 17 regular centres and 7 voluntary centres at SAU's under different agro-climate Zones. The salient achievements during the year 2024 are given below:

W P 1. Development of location-specific sustainable weed management practices

- At Anand, application of pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g a.i./ha as pre-emergence *fb* bispyribac-sodium 38% + chlorimuron ethyl 2.5%+ metsulfuron-methyl 2.5% (w/w) WG 43 g a.i./ha (Ready-mix) as post emergence at 25 DAS recorded higher WCE of 87% followed by florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g a.i./ha as post emergence at 18-20 DAS in dry direct-seeded rice.
- In dry direct-seeded rice, pyrazosulfuron-ethyl 22.5 g/ha as pre-emergence *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha post-emergence at 25 DAS effectively controls the complex weed flora at Bhubaneswar.
- At Bhubaneswar, pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as pre-emergence fb bispyribac-sodium 38% + chlorimuron ethyl 2.5% + metsulfuron methyl 2.5% (w/w) WG 43 g/ha (Ready-mix) post emergence at 25-30 DAS has been found to be an effective herbicide combination in controlling the complex weed flora in wet direct-seeded rice.
- In dry direct-seeded rice, highest grain yield achieved under pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha as pre-emergence *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as post emergence at 25 DAS followed by Pyrazosulfuron ethyl 22.5 g/ha as pre-emergence *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/h as post- emergence 25 DAS at Pantnagar.

डब्ल्यू/डब्ल्यू +साइहेलोफॉप–ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ईसी 150 ग्रा/हे का स्थान रहा है।

- बेंगलुरु में, शुष्क सीधे बोये चावल में, बुबाई के पूर्व पेंडिमिथैलिन 38.4% + पाइराजोसल्फ्यूरॉन इथाइल 0.85% जेडसी 785 ग्रा/हे के बाद बुबाई के 25 दिन पर फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/डब्ल्यू +साइहेलोफॉप –ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ई सी 150 ग्रा/हे या बुबाई के पूर्व प्रीतिलाक्लोर 30.0% + पाइराजोसल्फ्यूरॉन इथाइल 0.75% डब्ल्यूजी 615 ग्रा/हे के बाद बुबाई के 25 दिन बाद फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/डब्ल्यू + साइहेलोफॉप –ब्यूटाइल 10.64% डब्ल्यू/ डब्ल्यू ई सी 150 ग्रा/हे के रूप में प्रयोग करने से उच्च खरपतवार नियंत्रण दक्षता, अनाज उपज और बी सी अनुपात दर्ज की गई।
- कराइकल के तटीय डेल्टा क्षेत्र में सूखे सीधे बोये जाने वाले चावल के तहत, बुबाई से पूर्व पेनोक्ससुलम + पेंडिमिथालिन 625 ग्रा/हे के बाद बुबाई कि 25–30 दिन पर फेनोक्साप्रोप इथाइल 67 ग्रा/हे + एथोक्सीसल्फ्यूरॉन 18 ग्रा/हे या बुबाई से पूर्व पेंडिमिथालिन + पायराजोसल्फ्यूरॉन 785 ग्रा/हे के बाद फ्लोरपाइरॉक्सिफेन + साइहलोफॉप 150 ग्रा/हे के प्रयोग में कम खरपतवार घनत्व और उच्च अनाज की पैदावार दर्ज की गई।
- पंतनगर में, सीधे बोए गए चावल में, डीएसआर (सीटी+आर) – गेहूं (सीटी+आर)–जीएम (सीटी+आर) के बाद डीएसआर (सीटी)–गेहूं (सीटी)–जीएम (सीटी) के साथ उच्च अनाज उपज प्राप्त हुई। खरपतवार प्रबंधन उपचारों में, बुबाई के 2 दिन बाद पेंडीमेथालिन+पाइराजोसल्फ्यूरॉन 920 ग्रा/ह, के बाद बुबाई के 20 दिन पर ट्रायफामोन+एथोक्सीसल्फ्यूरॉन 67.5 ग्रा/हे और बुबाई के 2 दिन बाद पेंडीमेथालिन 678 ग्रा/हे के साथ बुबाई के 20 दिन पर बिस्पायरिबैक सोडियम 25 ग्रामहेक्टेयर के बाद बुबाई के 40 दिन पर हाथ से निराई इसके बाद खरपतवार बीज कटाई अनुप्रयोगों ने उच्चतम अनाज उपज दर्ज की।
- पंजाब में सीधी बुवाई वाले चावल में तर बत्तर तकनीक अंतर्गत, सबसे कम खरपतवार घनत्व और बायोमास हाथ से निराई के साथ पेंडीमेथालिन के बाद बिस्पायरिबैक–सोडियम में दर्ज किया गया। हालांकि, एकीकृत खरपतवार प्रबंधन दृष्टिकोण के परिणामस्वरूप अनाज की उपज भी अधिक हुई और फसल–खरपतवार प्रतिस्पर्धा भी कम हुई।
- सबौर में खरीफ 2024 अन्तर्गत शुष्क सीधे बुबाई बाले चावल में, सबसे अधिक अनाज की उपज, शुद्ध लाभ और बीसी अनुपात, बुबाई से पूर्व प्रीटिलाक्लोर 30.0% + पाइराजोसल्फ्यूरॉन इथाइल 0.75% डब्ल्यूजी 615 ग्रा/हे उपचार के तहत दर्ज किया गया, इसके बाद बुबाई के 25 दिन बाद फ्लोरपाइरॉक्सिफेन – बेंजिल 2.13% डब्ल्यू/डब्ल्यू + साइहैलोफॉप – ब्यूटाइल 10.64: डब्ल्य/डब्ल्यू ईसी 150 ग्रा/हे में दर्ज किया गया।

- At Bengaluru, in dry direct-seeded rice, the application of pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as pre-emergence *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as post emergence at 25 DAS or pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha as pre-emergence *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha post emergence at 25 DAS recorded higher WCE, grain yield, and B: C.
- In the coastal deltaic region of Karaikal under dry direct-seeded rice, penoxsulam + pendimethalin 625 g/ha as pre-emergence fb fenoxaprop ethyl 67 g/ha + ethoxysulfuron 18 g/ha as post emergence at 25-30 DAS or pendimethalin + pyrazosulfuron 785 g/ha as pre-emergence *fb* florpyrauxifen + cyhal-ofop 150 g/ha as post emergence recorded lower weed density and higher grain yield in rice crop.
- At Pantnagar, in direct-seeded rice, higher grain yield achieved with DSR (CT+R)-wheat (CT +R)-GM (CT+R) fb DSR (CT)-wheat (CT)- GM (CT). Among the weed management treatments pendimethalin+pyrazosulfuron 920 g/ha at 2 DAS fb triafamone+ethoxysulfuron 67.5 g/ha at 20 DAS and pendimethalin 678 g/ha at 2 DAS *fb* bispyribac sodium 25 g/ha at 20 DAS fb hand weeding at 40 DAS fb weed seed harvest recorded highest grain yield.
- At Punjab in the DSR tar-wattar technique, the highest weed density and biomass were observed in the untreated control, while the lowest was in incorporating hand weeding followed by pendimethalin as pre-emergence *fb* bispyribac-Na as post emergence. However, the IWM approach also resulted in higher grain yield and minimized crop-weed competition.
- At Sabour in DSR under *Kharif* 2024, the highest grain yield, net return, and B:C were recorded under treatment pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha pre-emergence, followed by florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha post emergence at 25 DAS.

- कल्याणी में मक्का आधारित फसल प्रणाली में, बुवाई के 15 दिन पर एट्राजीन+टोप्रामेजोन (टैंक मिक्स) (750+25.2) ग्रा/हे के साथ बुवाई के 20 दिन बाद फ्लूजिफोप–पी– ब्यूटाइल् + फोमेसेफेन (तैयार मिश्रण) 100 ग्रा/हे के बाद, बुवाई के 40 दिन पर हाथ से निराई उपचार, सबसे अच्छा उपचार संयोजन साबित हुआ, जिसमें उच्चतम अनाज उपज और स्टोवर उपज के साथ शुद्ध रिटर्न और बी सी अनुपात दर्ज किया गया।

- पालमपुर में सभी शाकनाशी उपचारों में पेंडीमेथालिऩ +पायराजोसल्फ्यूरॉन (आरएम) 785 ग्रा/हे. के उद्भव अनुप्रयोग के बाद पोस्ट – फ्लोरपाइरॉक्सिफेन–बेंजिल़ साइहेलोफॉप– ब्यूटाइल (आरएम) 150 ग्रा/हे., पेनोक्ससुलम + पेंडीमेथालिन (आरएम) 625 ग्रा/हे. के बाद पोस्ट के पूर्व – उद्भव अनुप्रयोग के बराबर फेनोक्साप्रोप 67 ग्राम/हे. एथोक्सीसल्फ्यूरॉन 18 ग्रा/हे, पेंडीमेथालिन का पूर्व–उद्भव अनुप्रयोग+पाइराजोसल्फ्यूरॉन (आरएम) 785 ग्राम/हे. के बाद पोस्ट – का उद्भव अनुप्रयोग बिस्पायराइबैक–सोडियम+मेटसल्फ्यूरॉन मिथाइल़ क्लोरिमुरॉन इथाइल (आरएम) 43 ग्रा/हे. और प्रीटिलाक्लोर + पाइराजोसल्फ्यूरॉन (आरएम) 615 ग्राम/हे. के बाद पोस्ट – फ्लोरपाइरॉक्सिफेन–बेंजिल + साइहेलोफॉप–ब्यूटाइल (आरएम) 150 ग्रा/हे. के अंतर्गत, अवलोकन के सभी चरणों में खरपतवार की अधिकांश प्रजातियों की खरपतवार की संख्या और शुष्क वजन काफी कम दर्ज किया गया ।

- पंतनगर में, रोपाई वाले चावल में, ड्रोन स्प्रेयर के माध्यम से फ्लोरपाइरॉक्सिफेन – बेंजिल 2.13% डब्ल्यू/डब्ल्य् +साइहेलोफॉप–ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ई सी (तैयार मिश्रण) 150 ग्राम/हेक्टेयर, के बाद पेनोक्ससुलम 1.02% + साइहेलोफॉप –ब्यूटाइल 5.1% ओ डी (तैयार मिश्रण) 135 ग्राम/हेक्टेयर के छिड़काव से उच्चतम अनाज उपज प्राप्त हुई।

- हिसार में, संरक्षित जुताई के तहत चावल–गेहूँ–फलीदार फसल प्रणाली में, जेड टी और सी टी + आर की तुलना में जेड टी़आर के तहत काफी अधिक अनाज की पैदावार दर्ज की गई, लेकिन सांख्यिकीय रूप से सी टी के बराबर पाई गई। खरपतवार प्रबंधन प्रथाओं में, बाकी उपचारों की तुलना में एकीकृत खरपतवार प्रबंधन तहत काफी कम खरपतवार घनत्व और उच्च अनाज उपज दर्ज की गई।

- रायपुर में गेहूं की फसल में, सभी चरणों में सी.टी.आर–सी.टी. + आर–सी.टी.आर –सी.टी. + आर के तहत, सी.टी., जेड टी और जेड टी + आर की तुलना में सबसे कम खरपतवार घनत्व पाया गया। हालांकि, शून्य जुताई के साथ सीधे बोये गये चावल के मामले में, पंक्तियों के बीच अवशेषों की एक परत के कवरिंग के कारण अकेले जेड टी की तुलना में अवशेषों के साथ शून्य जुताई के साथ सीधे बोये गये चावल के मामले में खरपतवार घनत्व कम

- In maize-based cropping system, combination of atrazine + topramezone (Tank mix) (750 + 25.2) g/ha as early post emergence at 15 DAS along with fluazifop-p-butyl + fomesafen (Ready-mix) 100 g/ha as post emergence at 20 DAS *fb* HW at 40 DAS proved as best treatment combination recording the highest yield parameters, seed and Stover yield along with highest net return and B:C at Kalyani.

- At Palampur , among all the herbicide treatments pre – emergence application of pendimethalin + pyrazosulfuron (RM) 785 g/ha followed by post – emergence application of florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha, remaining at par with pre – emergence application of penoxsulam + pendimethalin (RM) 625 g/ha *fb* post – emergence application of fenoxaprop 67 g/ha + ethoxysulfuron 18 g/ha, pre – emergence application of pendimethalin + pyrazosulfuron (RM) 785 g/ha *fb* post – emergence application of bispyribac- sodium + metsulfuron methyl + chlorimuron ethyl (RM) 43 g/ha and pre – emergence application of pretilachlor + pyrazosulfuron (RM) 615 g/ha fb post – emergence application of florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha recoded significantly lower weed count and dry weight of most of the weed species at all the stages of observation.

- Bio-efficacy of herbicides applied through drone and knapsack sprayer/power sprayer in transplanted rice, highest grain yield achieved under application of florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (Ready-mix) 150 g/ha followed by penoxsulam 1.02 % + cyhalofop-butyl 5.1% OD (Ready-mix) 135 g/ha through drone sprayer at Pantnagar.

- At Hisar, in the rice-wheat-legume cropping system under conservation tillage, the significantly higher grain yields were recorded under ZT+ residue retention as compared to ZT and CT+R but were found statistically at par with CT. Among weed management practices, significantly lower weed density and higher grain yield were recorded for IWM as compared to the rest of the treatments.

- At Raipur in wheat crops, the lowest weed density was found under CT+R-CT+R-CT+R over CT, ZT, and ZT+R at all the stages. However, in the case of DS with zero tillage, weed density was lower in ZT (DSR) with residue as compared to ZT alone due to the covering of a layer of residue between rows. Among weed management, the lower density of

था। खरपतवार प्रबंधन के बीच, कुल खरपतवारों का घनत्व एकीकृत खरपतवार प्रबंधन के तहत कम दर्ज किया गया, इसके बाद नियंत्रण पर अनुशंसित शाकनाशी का स्थान रहा।

- हिसार में मक्का आधारित फसल प्रणाली के अन्तर्गत सरसों मे संरक्षित जुताई प्रणाली के तहत, सी.टी. में जेड. टी. की तुलना में काफी अधिक बीज उपज दर्ज की गई साथ ही खरपतवार नियंत्रण उपचारों में, खरपतवार नियंत्रण की तुलना में पेंडिमेथालिन के बाद हाथ से निराई करने पर 40% अधिक उपज प्राप्त हुई।

- हिसार में चावल–गेहूं फसल प्रणाली के अन्तर्गत संरक्षित कृषि प्रणालियों में, पूर्ण चावल अवशेष भार के साथ स्मार्ट सीडर से बोए गए गेहूं में, सुपर सीडर से गेहूं की बुवाई, स्थिर ठूंठों के अंतर्गत जीरो टिल बुवाई, और परम्परागत जुताई गेहूं की तुलना में काफी अधिक अनाज की उपज दर्ज की गई, लेकिन सांख्यिकीय रूप से यह जीरो टिल हैप्पी सीडर से बोए गए गेहूं के बराबर थी।

- रायपुर में, मक्का की फसल में सबसे कम खरपतवार घनत्व और अधिकतम भुट्टा वजन, अनाज की उपज और नेट रिटर्न को जेडटी़आर–जेडटी़आर–जेडटी़आर के तहत देखा गया, इसके बाद सीटी+आर–सीटी+आर–सीटी+आर का स्थान रहा, जबकि खरपतवार प्रबंधन विकल्पों में, एकीकृत खरपतवार प्रबंधन (एट्राजीन 1.0 किग्रा/हेक्टेयर (बुबाई के 2 दिन बाद) टॉपरामिजोन 25.2 ग्राम/हेक्टेयर (बुबाई के 20 दिन बाद) हाथ से निराई (बुबाई के 40 दिन बाद) खरपतवार बीज की कटाई) के तहत कम खरपतवार दर्ज किए गए।

- आनंद में, ल्यूसर्न में कुसकुटा प्रबंधन के लिए 10 दिन पर पेन्डीमेथालिन 30% ई.सी. 500 और 750 ग्रा/हे तथा पेन्डीमेथालिन 30% + इमेजेथापायर 2% ई.सी. 640 और 800 ग्रा/हे का प्रयोग प्रभावी पाया गया, जिसमें 60 दिन बाद भी कुसकुटा का कोई उद्भव दर्ज नहीं किया गया तथा ल्यूसर्न के हरे चारे का उत्पादन अधिक हुआ।

- भुवनेश्वर में, चावल–मक्का–उड़द फसल प्रणाली में संरक्षित कृषि के तहत, अंकुरण के पूर्व में सी.टी.+आर के साथ पेन्डीमेथालिऩ+इमेजेथापायर 1 किग्रा/हेक्टेयर का प्रयोग करने पर उड़द की उच्चतम बीज उपज और खरपतवार नियंत्रण दक्षता दर्ज की गई।

- कोयंबटूर में संरक्षित कृषि के अंतर्गत कपास–बेबी कॉर्न फसल प्रणाली में, बेबी कॉर्न में, जुताई विधियों और खरपतवार प्रबंधन प्रथाओं में, सीटी+आर–सीटी+आर–सीटी+आर प्रणाली और बुबाई के 2 दिन बाद एट्राजीन 50 डब्ल्यूपी 1.0 किग्रा/हेक्टेयर, के बाद बुबाई के 20 दिन पर टॉपरामेजोन 33.6 एससी 25.2 ग्राम/हेक्टेयर के बाद बुबाई के 40 दिन बाद हाथ से निराई के बाद खरपतवार बीज की कटाई में आधिकतम खरपतवार नियंत्रण दक्षता, भुट्टा उपज और शुद्ध लाभ दर्ज किया गया।

total weeds was recorded under IWM, followed by the recommended herbicide over control.

- At Hisar, under the conservation tillage system on maize based cropping system, significantly higher seed yield of mustard was recorded in CT as compared to ZT. Among weed control, Application of pendimethalin fb hand weeding resulted in 40% higher seed yield as compared to weedy check.

- Under conservation agriculture systems in the rice-wheat cropping system in Hisar, the significantly higher grain yield was recorded under smart seeder-sown wheat with a full rice residue load compared to sowing of wheat with a super seeder, zero till sowing under anchored stubbles, and conventional till wheat, but was statistically at par with zero till happy seeder-sown wheat.

- At Raipur, in maize crop the lowest weed density and maximum cob weight, grain yield and net return were observed under ZT+ R- ZT+ R- ZT+ R followed by CT+R- CT+R-CT+R as compared to same tillage practice with residue incorporation and Among WM options, lesser weeds were recorded under IWM.i.e. atrazine 1.0 kg/ha at 2 DAS *fb* topramezone 25.2 g/ha at 20 DAS *fb* hand weeding (40 DAS) fb weed seed harvest at all the observational stages.

- At Anand, the application of pendimethalin 30% EC 500 and 750 g a.i./ha and pendimethalin 30% + imazethapyr 2% EC 640 and 800 g a.i./ha at 10 DAS was found effective for Cuscuta management in Lucerne, in which no emergence of Cuscuta was recorded even after 60 DAS with higher green fodder production of Lucerne.

- In Bhubaneswar, the application of pendimethalin + imazethapyr 1 kg/ha as pre-emergence along with CT+R was recorded in the highest seed yield of black gram and WCE under conservation agriculture in the rice-maize-black gram cropping system.

- In the cotton-baby corn cropping system under conservation agriculture at Coimbatore, in baby corn, among the tillage methods and weed management practices, the CT+R-CT+R-CT+R system and atrazine 50 WP 1.0 kg/ha at 2 DAS *fb* topramezone 33.6 SC 25.2 g/ha at 20 DAS *fb* hand weeding on 40 DAS *fb* weed seed harvest recorded higher WCE, cob yield, and net return at 45 DAS.

- हिसार में गेहूं की फसल के अंतर्गत, जेड.टी.+आर में जेड.टी. और सी.टी.+आर की तुलना में अधिक उपज दर्ज की गई, जो लगभग सी.टी. के बराबर थी। जबकि *रूमेक्स डेंटेटस* और *मेडिकागो डेंटिकुलाटा* का घनत्व सी.टी. की तुलना में जेड.टी. के अंतर्गत अधिक दर्ज किया गया, लेकिन *फेलारिस माइनर* के लिए विपरीत दर्ज हुआ।

- हैदराबाद में, कपास–मक्का–हरी खाद संरक्षित कृषि प्रणालियों में, सकल लाभ, शुद्ध लाभ और बी–सी अनुपात, सी.टी. की तुलना में जेडटी और जेडटी+आर भूखंडों में बेहतर थे, जबकि रासायनिक खरपतवार नियंत्रण के साथ जेडटी+आर में उच्चतम बी–सी अनुपात प्राप्त हुआ, इसके बाद रासायनिक खरपतवार नियंत्रण के साथ जेडटी का स्थान रहा।

- कोयम्बटूर में, खरीफ मौसम के दौरान कपास की फसल में, 60 दिन पर, सी.टी.+आर–सी.टी.+आर–सी.टी.+आर प्रणाली के साथ 2 दिन पर पेन्डीमेथालिन 30 ई.सी. 1.0 किग्रा/हेक्टेयर के बाद पाइरिथियोबैक सोडियम 6% + क्विजालोफॉप इथाइल 4% ई.सी. 125 ग्राम/हेक्टेयर के प्रयोग तथा 50–55 दिन पर पैराक्वेट डाइक्लोराइड 24 एस.एल. 500 ग्राम/हेक्टेयर के निर्देशित छिड़काव (पंक्ति के बीच) के प्रयोग से उच्चतर खरपतवार नियंत्रण दक्षता और शुद्ध लाभ दर्ज किया गया।

- दीर्घकालिक परीक्षण (2022 में शुरू हुआ) पालमपुर में संरक्षित जुताई के तहत उगाई गई सोयाबीन–गेहूं फसल प्रणाली के लिए प्रभावी खरपतवार प्रबंधन रणनीति का पता लगाने के लिए आयोजित किया गया था। दोनों फसलों में शून्य जुताई अवशेष प्रतिधारण तथा पारंपरिक जुताई अवशेष प्रतिधारण के साथ सोयाबीन में बुबाई के 30 दिन बाद तथा बुबाई के 60 दिन बाद पर घासीय खरपतवारों, चौड़ी पत्ती वाले खरपतवारों तथा सेज की संख्या तथा शुष्क भार में उल्लेखनीय रूप से कमी देखी गई। खरपतवार प्रबंधन उपचारों में बुबाई के 30 दिन बाद सभी तीन श्रेणी के खरपतवारों (चौड़ी पत्ती वाले खरपतवार, घास के खरपतवार और सेज) की काफी कम गिनती और सूखे वजन को उपचार में दर्ज किया गया था, जिसमें दोनों फसलों में खरपतवारों को शाकनाशी (एच–एच) के उपयोग के माध्यम से प्रबंधित किया गया।

- पालमपुर में पिछली फसल के अवशेषों के प्रतिधारण के साथ–साथ शून्य जुताई के साथ दोनों फसलों की खेती के परिणामस्वरूप घास के खरपतवारों, चौड़े पत्तों वाले खरपतवारों और सेज की काफी कम संख्या हुई, हालांकि सभी उपचारों में केवल गेहूं की फसल को शून्य जुताई अवशेषों के साथ उगाया गया था, जिसके परिणामस्वरूप खरपतवार की संख्या और शुष्क वजन भी कम हुआ। उच्चतम गेहूं समकक्ष उपज तब प्राप्त की गई जब प्रणाली में दोनों फसलों को शून्य जुताई अवशेषों के साथ उगाया गया जबकि दोनों फसलों में पारंपरिक जुताई के परिणामस्वरूप गेहूं के बराबर उपज कम हुई। खरपतवार नियंत्रण उपचारों में सकल लाभ, शुद्ध प्रतिफल और लाभ लागत अनुपात के उच्च मूल्य देखे गए जहां खरपतवारों को नियंत्रित करने के लिए केवल शाकनाशी का उपयोग किया गया था।

- Under wheat crop in Hisar, higher yield was recorded under ZT+R than ZT and CT+R, which was equal to CT. While the density of *Rumex dentatus* and *Medicago denticulata* was recorded higher under ZT than CT, which was the opposite for *Phalaris minor*.

- At Hyderabad, in cotton-maize-green manure conservation agriculture systems, the gross returns, net returns, and B-C ratio were superior in ZT and ZT+R plots compared to CT, while the highest B-C ratio was obtained in the ZT+R coupled with chemical weed control, followed by ZT with chemical weed control.

- At Coimbatore, in the cotton crop during the *kharif* season, at 60 DAS, higher WCE and net return were recorded with the CT+R-CT+R-CT+R system and the application of pendimethalin 30 EC 1.0 kg/ha at 2 DAS fb pyrithiobac sodium 6% + quizalofop ethyl 4% EC 125 g/ha at the 4-6 weed leaf stage fb directed spray (inter-row) of paraquat dichloride 24 SL 500 g/ha at 50-55 DAS.

- A long-term trial (started in 2022) was conducted at Palampur to find out effective weed management strategy for soybean – wheat cropping system cultivated under conservation tillage. Significantly lower count and dry weight of grassy weeds, broad - leaved weeds and sedges at 30 DAS and 60 DAS in soybean were observed with zero tillage + residue retention in both crops and conventional tillage + residue retention. Among weed management treatments significantly lower count and dry weight of all the three category of weeds (broad – leaved weeds, grassy weeds and sedges) at 30 DAS were recorded in treatment in which weeds in both the crops were managed through use of herbicides (H – H).

- At Palampur, cultivating both the crops with zero tillage along with the retention of residue of the previous crop resulted in significantly lower count of grassy weeds, broad – leaved weeds and sedges though all treatments in which only wheat crop was raised with zero tillage + residue also resulted in lower weed count and dry weight. Highest wheat equivalent yield was obtained when both crops in the system were raised with zero tillage + residue while conventional tillage in both crops resulted in lower wheat equivalent yield. Among weed control treatments higher values of gross return, net return and benefit cost ratio was observed where only herbicides were used to control weeds.

- पंतनगर में चावल–सब्जी मटर–मक्का फसल प्रणालियों में, मटर फली उपज, गन्ना उपज, और चावल अनाज उपज पारंपरिक खेती के तहत सबसे अधिक प्राप्त की गई, इसके बाद जैविक और प्राकृतिक खेती का स्थान रहा।

- रायपुर में, जैविक तरीके से उगाए गए टमाटरों में, कृषिगत और यांत्रिक खरपतवार प्रबंधन विकल्पों में से, कुल फल उपज, सबसे कम खरपतवार सूचकांक और खेती की उच्चतम लागत बाकी उपचार की तुलना में पॉलीथीन मल्च (20 माइक्रोन मोटाई) के तहत काफी अधिक थी। हालांकि, धान के भूसे की मल्च (5 टन/हे) और स्टेल सीडबेड के बाद, रोपण के 20 और 40 दिन पर हाथ से निदाई करने से बीसी अनुपात अधिक दर्ज किया गया।

- उदयपुर में, मक्का–सौंफ प्राकृतिक कृषि प्रणाली के अंतर्गत, मक्का फसल में, स्टेल सीडबेड कम अंतराल (25% तक)पिछली फसल के अवशेषों के साथ मल्चिंग, बुवाई के 20–30 दिन बाद एक हाथ से निराई को सबसे कम खरपतवार घनत्व, शुष्क पदार्थ और खरपतवार नियंत्रण दक्षता दर्ज की गयी, जबकि उड़द (2:2) के साथ अंतर–फसल ने उच्चतम बीसी अनुपात दर्ज किया गया।

- उदयपुर में, जैविक रूप से उगाई गई बेबी कॉर्न–मेथी फसल प्रणाली में, मेथी फसल के अंतर्गत, खरपतवार नियंत्रण की तुलना में स्टेल सीडबेड और मृदा सौरीकरण में खरपतवार घनत्व काफी कम पाया गया है, जबकि अधिकतम बी सी अनुपात अंतर–कल्चर के साथ बुबाई के 20 दिन पर और बुबाई कि 40 दिन पर यांत्रिक निराई करने पर दर्ज किया गया।

- हैदराबाद में जैविक कृषि के अंतर्गत टमाटर–चुकंदर–तरबूज फसल प्रणाली में, सभी तीनों फसलों के लिए पॉली मल्च़ बुबाई के 30 दिन बाद अंतर–पंक्ति में हाथ से निराई करने पर सबसे अधिक सकल लाभ, शुद्ध लाभ और बी–सी अनुपात दर्ज किया गया, इसके बाद अंतरफसल हरी पत्ती वाली सब्जी के बाद रोपाई के 40 दिन पर हाथ से निराई और चावल के भूसे की मल्च 5 टन/हे बुबाई के 30 दिन पर अंतर–पंक्ति हाथ से निराई का स्थान रहा।

- हैदराबाद में जैविक कृषि के अंतर्गत मूंग–प्याज फसल प्रणाली में, उच्चतम बीज उपज, शुद्ध लाभ और खरपतवार नियंत्रण दक्षता, स्टेल सीडबेड के साथ 15 और 30 दिन पर हाथ से निराई में दर्ज की गई, उसके बाद पॉलीमल्च, चावल के भूसे की मल्चिंग और बुवाई के 15 से 20 दिन गुड़ाई के बाद अंतः पंक्ति में हाथ से निदाई में दर्ज की गई।

- जम्मू में, जैविक बासमती चावल के अंतर्गत, उच्चतम खरपतवार नियंत्रण दक्षता और अनाज की उपज मेट्सल्फ्यूरॉन–मिथाइल के साथ पौधों के बीच की दूरी 15x10 सेंटीमीटर में दर्ज की गई, जिसमें उच्चतम बी सी अनुपात और शुद्ध रिटर्न 25x10 सेंटीमीटर के पौधों के बीच की दूरी के साथ रोपाई के 20 और 40 दिन बाद कोनोवीडर में दर्ज किया गया।

- At Pantnagar in rice-vegetable pea-sweet corn cropping systems, vegetable-pea pod yield, sugarcane yield, and rice grain yield were obtained highest under conventional farming, followed by organic and natural farming.

- At Raipur, in organically grown tomato, among the cultural and mechanical weed management options, the total fruit yield, lowest weed index, and highest cost of cultivation were significantly higher under polythene mulch (20 µ thickness) than in the rest of the treatments. However, using paddy straw mulch (5 t/ha) and stale seedbed fb HW at 20 and 40 DAP recorded a higher BC ratio.

- In Udaipur, under the maize-fennel natural farming system, in maize, the stale seedbed + reduced spacing (up to 25%) + mulching with previous crop residues + one-hand weeding at 20 and 30 DAS was recorded as the lowest weed density, dry matter, and weed control efficiency. while intercropping with blackgram (2:2) produced the highest BC ratio.

- At Udaipur, in the organically grown baby corn-fenugreek cropping system, in fenugreek, the significantly lower weed density has been found in the stale seedbed and soil solarization in comparison to the weedy check. whereas the maximum B:C was recorded with inter-culture at 20 DAS *fb* mechanical weeding at 40 DAS.

- In the tomato-beetroot-watermelon cropping system under organic agriculture at Hyderabad, the highest gross returns, net returns, and B-C ratio were recorded in poly mulch + intra-row HW at 30 DAS applied for all three crops, followed by intercrop green leaf vegetable *fb* HW at 40 DAT and rice straw mulch 5 t/ha + intra-row HW at 30 DAS.

- In green gram-onion cropping system under organic agriculture at Hyderabad, the highest seed yield, net return and WCE were recorded with stale seed bed fb HW at 15 and 30 DAS followed by polymulch, rice straw mulch and hoeing at 15 and 30 DAS *fb* intra row HW.

- At Jammu, under organic basmati rice, the highest WCE and grain yield were recorded in MSM with close plant spacing of 15 x 10 cm. However, the highest B:C and net return were recorded in the conoweeder at 20 & 40 DAT with plant spacing of 25 x 10 cm.

- कोयम्बटूर में, प्राकृतिक खेती के अंतर्गत बैंगन– सँवा –हरी खाद फसल प्रणाली में, बैंगन में, रोपाई के 20 और 40 दिन पर हाथ से निराई करने पर उच्च खरपतवार नियंत्रण दक्षता, सब्जी उपज, शुद्ध लाभ और बीसी अनुपात दर्ज किया गया। इसके बाद 5 टन/हे कि दर से पिछली फसल की पलवार के बाद रोपाई के 40 दिन पर हाथ से निराई और रोपाई के 40 दिन स्टेल सीडबेड के बाद हाथ से निराई उपचार का स्थान रहा।

- बेंगलुरु में प्राकृतिक रूप से उगाए गए कुटकी–कुलथी फसल प्रणाली में, 20 और 40 दिन पर हाथ से निराई करने से उच्च खरपतवार नियंत्रण दक्षता और शुद्ध लाभ दर्ज किया गया, इसके बाद 20 और 40 दिन पर अंतर–खेती हाथ से निराई और स्टेल सीडबेड तकनीक + 30 दिन पर + एक हाथ से निराई उपचार का स्थान रहा।

- पालमपुर में मक्का में सोयाबीन की अंतरफसल के साथ–साथ दो बार हाथ से निराई–गुड़ाई करने पर सभी प्रेक्षण चरणों में खरपतवारों की संख्या और खरपतवारों का शुष्क भार कम पाया गया (लगभग खरपतवार मुक्त स्थितियों के समान) जो खरपतवारों के प्रकोप को कम करने के लिए इन तरीकों की प्रभावशीलता को दर्शाता है।

- पालमपुर में गेहूं में खरपतवारों की कम संख्या और खरपतवारों के सूखे वजन को प्रदर्शित करने वाले उपचारों में 45 बुबाई के बाद पर उगाई गई स्टेल सीड क्यारी + मल्च 5 टन/हे. + हाथ से निराई, स्टेल सीड बेड + मल्च 5 टन/हे. + हाथ से निराई, उठाया गया स्टेल सीड बेड़ हाँथ से निराई और स्टेल सीड बेड + हाँथ से निराई शामिल थे। इन सभी उपचारों के परिणामस्वरूप गेहूं की उपज भी अधिक हुई। जैसा कि गेहूं में देखा गया था, उगाई गई स्टेल सीड क्यारी. मल्च 5 टन/हे + हाँथ से निराई में 45 दिन बुबाई के बाद उपचार पर बुबाई के 30 दिन के बाद खरपतवारों की काफी कम गिनती और सूखा वजन देखा गया जो स्टेल सीड बेड मल्च 5 टन/हे + हाँथ से निराई, उठाए गए स्टेल सीड बेड़+हाथ से निराई और स्टेल सीड बेड़ + हाथ से निराई के बराबर थे। इसके अलावा मक्का में सोयाबीन की अंतरफसल के परिणामस्वरूप खरपतवारों की संख्या भी बुबाई के 60 दिन बाद कम हो गई।

- गुंटूर में, जैविक रूप से उगाए गए कपास में, किसानों ने 20–दिन के अंतराल पर 3 बार निराई–गुड़ाई की, उसके बाद 20 और 40 दिन पर 2 पंक्तियों में निराई–गुड़ाई का अभ्यास किया और उल्लेखनीय रूप से उच्च खरपतवार नियंत्रण दक्षता, उपज और लाभ दर्ज किया, जो चौड़ी क्यारियों पर बुवाई और स्टेल सीडबेड क्यारी की तैयारी में प्लास्टिक मल्च़ 20 और 40 दिन पर हाथ से निराई–गुड़ाई उपचार के बराबर था।

- राजस्थान के उदयपुर में मक्का–चना फसल प्रणाली के अंतर्गत, चने में, बुबाई के 20 दिन बाद टोप्रामेजोन (25.2 ग्रा/हे) के प्रयोग से उच्चतम खरपतवार नियंत्रण दक्षता और उपज पाई गई, इसके बाद पेन्डीमेथालिऩ इमेजेथापायर (750 ग्रा/हे) के बाद, बुबाई के 40 दिन बाद हाथ से निदाई में दर्ज किया गया।

- In the brinjal-barnyard millet-green manure cropping system under natural farming, during the kharif season, in brinjal, the significantly higher WCE, vegetable yield, net returns, and BC ratio were recorded with hand weeding at 20 and 40 DAP, followed by previous crop mulch at 5 t/ha *fb* HW at 40 DAP and stale seedbed *fb* HW at 40 DAP at Coimbatore.

- In the naturally grown little millet-horse gram cropping system at Bengaluru under little millet, hand weeding at 20 and 40 DAS recorded higher weed control efficiency and net return, followed by inter-cultivation + hand weeding at 20 and 40 DAS and the stale seedbed technique + one hand weeding at 30 DAS.

- At Palampur, Intercropping soybean in maize along with 2 hand weedings with or without mulch recoded lower weed count and weed dry weight at all the observation stages (almost similar to weed free conditions) indicating the effectiveness of these approaches for lowering weed infestation.

- The treatments that exhibited lower weed count and dry weight of weeds in wheat included Raised Stale Seed bed + Mulch 5t/ha + HW at 45 DAS, Stale Seed Bed + Mulch 5 t/ha + HW, Raised Stale Seed Bed + HW and Stale Seed Bed + HW. All these treatments also resulted in higher wheat yield. As was observed in wheat significantly lower count and dry weight of weeds at 30 DAS were observed in Raised Stale Seed bed + Mulch 5t/ha + HW at 45 DAS treatment which were at par with Stale Seed Bed + Mulch 5 t/ha + HW, Raised Stale Seed Bed + HW and Stale Seed Bed + HW. Also intercropping soybean in maize also resulted in lower number of weeds at 60 DAS.

- At Guntur, in organically grown cotton, the farmers practiced (3 hoeings at 20-day intervals, followed by 2-line weeding at 20 & 40 DAS) and recorded significantly higher WCE, yield, and economics, which were comparable to plastic mulch at sowing on broad beds and stale seedbed preparation + hand weeding at 20 & 40 DAS of cotton.

- At Udaipur Rajasthan, under maize–chickpea cropping system, in chickpea, the application of topramezone (25.2 g/ha) as early post emergence at 20 DAS has been found highest WCE and yield, followed by pendimethalin + imazethapyr (750 g/ha) pre-emergence fb HW at 40 DAS.

- हैदराबाद में मक्का–चना फसल प्रणाली में, मक्का में एट्राजीन + मेसोट्रायोन और चने में पेंडीमेथालिन + इमेजेथापायर + हाथ से निराई के प्रयोग से उच्च खरपतवार नियंत्रण दक्षता, मक्का समतुल्य उपज, सकल लाभ, उच्च शुद्ध लाभ और बी–सी अनुपात पाया गया जो दोनों फसलों में 2 बार हाथ से निराई के बराबर था।

- कोयम्बटूर में, चावल–उड़द फसल प्रणाली में, कम खरपतवार घनत्व और शुष्क भार के साथ उच्च खरपतवार नियंत्रण दक्षता और बीज उपज, चाबल में बुबाई के पूर्व बेन्सल्फ्यूरॉन–मिथाइल 0.6% + प्रिटिलाक्लोर 6% जीआर 660 ग्रा/हे के बाद बिस्पायरिबैक सोडियम 10 एससी 25 ग्रा/हे और उड़द में क्लोडिनाफॉप–प्रोपार्गिल 8% + एसीफ्लोरफेन सोडियम 16.5% ईसी 185 ग्राम/हेक्टेयर के प्रयोग करने पर दर्ज किया गया।

- पुडुचेरी के कराईकल के तटीय डेल्टा क्षेत्र में, कपास + ढैंचा अंतरफसल प्रणाली में, बुबाई के पूर्व 640 ग्राम/हेक्टेयर पर पेंडीमेथालिन 38.7 सी.एस. तथा बुबाई के 25 दिन बाद 45 ग्रामध्हेक्टेयर पर क्विजालोफॉप इथाइल 10 ई.सी. के प्रयोग से अन्य शाकनाशी उपचारों की तुलना में कपास के बीज की अधिक उपज प्राप्त हुई।

- पंतनगर में, प्रत्यारोपित रागी के तहत, बुबाई के पूर्व प्रीटिलाक्लोर+बेन्सल्फ्यूरॉन 600 ग्रा/हे के प्रयोग से सर्वाधिक अनाज उपज प्राप्त की गई, इसके बाद में बुबाई के पूर्व प्रीटिलाक्लोर+पाइराजोसल्फ्यूरॉन डब्ल्यूजी 615 ग्रा/हे का स्थान रहा।

- हिसार में मूंग की फसल के तहत, पेंडिमेथालिऩ इमेजेथापायर 1000 ग्रा/हे (तैयार मिश्रण), के बाद फ्लूजीफॉप– पी–ब्यूटाइल + फोमेसेफेन (तैयार मिश्रण) 250 ग्रा/हे के प्रयोग से कम खरपतवार शुष्क पदार्थ संचय, उच्च खरपतवार नियंत्रण दक्षता और शुद्ध रिटर्न दर्ज किया गया, इसके बाद पेंडिमेथालिऩ+इमेजेथापायर 1000 ग्रा/हे,के बाद प्रोपेक्विजाफॉप+इमेजेथापायर (तैयार मिश्रण) का स्थान रहा।

- हिसार में बाजरे की फसल के अंतर्गत, टेंबोट्रियोन (100 ग्रा/हे) और टेंबोट्रियोन+एट्राजीन (80+500) ग्रा/हे के प्रयोग से क्रमशः 44.7% और 39.9% अधिक उपज और घास और सेज पर 92.6% और 88.2% खरपतवार नियंत्रण दक्षता दर्ज की गयी है। इसके अतिरिक्त, इन शाकनाशियों से *डिजेरा आर्वेन्सिस* पर पूरी तरह से नियंत्रण पाया गया।

- रायपुर में चावल की फसल के अंतर्गत, बुबाई के 20 दिन बाद फ्लोरपाइरॉक्सिफेन – प्रोपाइल + पेनोक्ससुलम 40.63 ग्रा/हे (तैयार मिश्रण) के प्रयोग से *साइपरस डिफॉर्मिस* के लिए 100% खरपतवार नियंत्रण दक्षता दर्ज कि गयी, जबकि अंकुरण के पूर्व पाइराजोसुलफ्यूरॉन 20 ग्रा/हे के साथ बुबाई के 20 दिन पर

- At Hyderabad in the maize-chickpea cropping system, the higher WCE, maize equivalent yield (MEY), gross returns, higher net returns, and B-C ratio were found in atrazine + mesotrione applied to maize and pendimethalin + imazethapyr + HW to chickpea which was at par with 2 HW in both the crops.

- At Coimbatore, in the rice-blackgram cropping system, the lower weed density and dry weight with higher WCE and seed yield were recorded with bensulfuron-methyl 0.6% + pretilachlor 6% GR 660 g/ha as pre-emergence *fb* bispyribac sodium 10 SC 25 g/ha as post emergence applied in the rice crop and early post emergence clodinafop-propargyl 8% + acifluorfen sodium 16.5% EC 185 g/ha in blackgram.

- In the Cotton + dhaincha inter cropping system, pendimethalin 38.7 CS at 640 g/ha as pre-emergence followed by quizalofop ethyl 10 EC at 45 g/ha as post-emergence, at 25 DAS resulted in a higher seed cotton yield compared to other herbicidal treatments in the coastal deltaic region of Karaikal, Puducherry.

- At Pantnagar, the highest grain yield was achieved under pretilachlor + bensulfuron 600 g/ha as pre-emergence, followed by pretilachlor + pyrazosulfuron WG 615 g/ha as pre-emergence in transplanted finger millet.

- At Hisar under green gram, the application of pendimethalin + imazethapyr 1000 g/ha (Ready-mix) as a pre-emergence fb fluazifop-p-butyl + fomesafen (Ready-mix) 250 g/ha as post emergence recorded lower weed dry matter accumulation, higher WCE, and net returns followed by pendimethalin + imazethapyr 1000 g/ha as a pre-emergence *fb* propaquizafop + imazethapyr (Ready-mix).

- Under pearl millet at Hisar, the application of tembotrione (100 g/ha) and tembotrione + atrazine (80 + 500 g/ha) has been recorded as 44.7% and 39.9% higher yields and 92.6% and 88.2% control of grasses and sedges, respectively. Additionally, *Digera arvensis* was completely controlled with these herbicides.

- At Raipur under rice crop, florpyrauxifen-propyl + penoxsulam 40.63g/ha post-emergence 20 DAT (Ready-mix) has resulted 100% WCE to Cyperus difformis, with at par in pyrazosulfuron 20 g/ha as pre-emergence fb penoxsulam 22.5 g/ha at 20 DAT

पेनोक्ससुलम 22.5 ग्रा/हे के बराबर है। जबकि उच्चतम शुद्ध लाभ और बीसी अनुपात बुबाई के 20 दिन पर ट्रायफामोन+ इथोक्सीसल्फ्यूरॉन 67.50 ग्रा/हे (तैयार मिश्रण) पर पाया गया और बिसपायरीबैक सोडियम 25 ग्रा/हे बुबाई के 20 दिन बाद प्रयोग *साइपरस डिफॉर्मिस* के विरुद्ध प्रतिरोधी पाया गया।

- केरल में, गैर–फसल क्षेत्र में खरपतवार निगरानी के दौरान दो प्रमुख आक्रामक प्रजातियों की पहचान की गई: मलप्पुरम के नारियल बागानों में *हुलथोलिया मिमोसोइड्स* और कोट्टायम जिले के बैकवाटर क्षेत्र में *हंगुआना एंथेलमिंथिका*।
- केरल में, फॉक्सटेल में, लोबिया और पुआल मल्चिंग के साथ लाइव मल्चिंग ने स्टेल सीडबेड तकनीक और गैर–खरपतवार नियंत्रण की तुलना में खरपतवार नियंत्रण दक्षता और उपज में उल्लेखनीय वृद्धि दर्ज की गयी।
- भुवनेश्वर में, यूएएसडी.एएमएफ कंसोर्टियम (4 किग्रा/एकड़) की रोपाई के 25 और 50 दिन पर नीम केक 200 किग्रा/हेक्टेयर के बाद एथोक्सीसल्फ्यूरॉन (25 ग्रा/हे) का प्रयोग बैंगन में ओरोबैंकी के संक्रमण को नियंत्रित करने में अत्यधिक प्रभावी पाया गया।
- हैदराबाद में, ज्वार की फसल के अंतर्गत, खरपतवार प्रबंधन उपचारों में, खरपतवार मुक्त उपचार पर अधिकतम अनाज उपज दर्ज की गई, इसके बाद एट्राजीन के बाद बुबाई के 30 दिन पर यांत्रिक निराई और एट्राजीन के बाद टोप्रामेजोन (500+25.2) ग्रा/हे का स्थान रहा, जो एट्राजीन के बाद 2,4–डी अमीन साल्ट (750 और 750) ग्रा/हे के बराबर था।
- हैदराबाद में सूरजमुखी में सबसे अधिक बीज उपज और खरपतवार नियंत्रण दक्षता, बुबाई के 20 और 40 दिन बाद हाथ से निदाई पर दर्ज की गई, इसके बाद क्विजालोफॉप इथाइल 4%+ ऑक्सीफ्लोरोफेन 6% ई सी (तैयार मिश्रण) का स्थान रहा जो पाइरोक्सासल्फोन 85% डब्ल्यू जी+ ऑक्सीफ्लोरोफेन 23.5% ई सी, और पेन्डीमेथालिन 38.7% सी एस के लिए तुलनीय दर्ज की गई।
- ग्वालियर में, बरसीम में, बुबाई के 10 दिनों पर पेंडिमेथालिन 500 ग्रा/हे तथा पहली कटाई के बाद इमेजेथापायर 40 ग्रा/हे तथा अंतिम कटाई के बाद इमेजेथापायर 50 ग्रा/हे का प्रयोग करने से बरसीम में अमरबेल के संक्रमण को कम करने तथा उत्पादकता और लाभप्रदता बढ़ाने में मदद मिली।
- जम्मू में गेहूं में बुबाई के पूर्व पाइरोक्सासल्फोन 100 ग्रा/हे और पेंडीमेथालिन 800 ग्रा/हे का उपयोग करने से खरपतवार नियंत्रण दक्षता, खरपतवार घनत्व, अधिकतम गेहूं उपज, शुद्ध लाभ और बीसी अनुपात में उल्लेखनीय वृद्धि हुई। दूसरी ओर, पिनोक्साडेन 50 ग्रा/हे+मेट्रिब्यूजिन 175 ग्रा/हे के अनुप्रयोग द्वारा *फलारिस माइनर* का घनत्व और बायोमास में काफी कमी आई।

while highest Net return and B:C were found under triafamone + ethoxysulfuron 67.50 g/ha post emergence 20 DAT (Ready-mix) and *Cyperus difformis* resitance against the application of bispyribac Na 25 g/ha at 20 DAT.

- Two major invasive species were identified during weed surveillance in non-crop area: *Hultholia mimosoides* in coconut plantations of Malappuram and *Hanguana anthelminthica* in the backwater area of Kottayam district, Kerala.
- At Kerala, in foxtail millet, live mulching with cowpea and straw mulching significantly enhanced weed control efficiency and yield as compared to the stale seedbed technique and unweeded control.
- In Bhubaneswar, the application of neem cake (200 kg/ha) fb ethoxysulfuron (25 g/ha) at 25 and 50 DAT *fb* UASD-AMF consortium (4 kg/acre) was found to be highly effective in controlling the *Orobanche* infestation in brinjal.
- At Hyderabad, under the sorghum crop, among the weed management treatments, the maximum grain yield was recorded on the weed-free treatment, followed by atrazine fb mechanical weeding at 30 DAS and atrazine fb topramezone (500 + 25.2 g/ha), which was at par with atrazine *fb* 2,4-D amine salt (750 & 750 g/ha).
- The highest seed yield and WCE were recorded in 2 HW at 20 and 40 DAS, followed by quizalofop ethyl 4% + oxyfluorfen 6% EC (Ready-mix) as compared to pyroxasulfone 85% WG, oxyfluorfen 23.5% EC, and pendimethalin 38.7% CS in sunflower at Hyderabad.
- In Berseem, the early post-emergence application of pendimethalin 500 g/ha at 10 DAS and the application of imazethapyr 40 g/ha following the first cut and imazethapyr 50 g/ha following the last cut help to reduce Cuscuta infestation and increase productivity and profitability in the management of problematic weeds at Gwalior.
- At Jammu, among tillage and weed control in conservation agriculture on wheat, the ZT+R and mesosulfuron+iodosulfuron 14.4 g/ha at 30 DAS *fb* HW at 45 DAS was observed to significantly lower weed density, higher yield, and B:C than other treatments.

- बेंगलुरु में मक्का की फसल में, *रोटोबैलिया कोचिनचाइनेंसिस* को अन्य खरपतवारनाशकों की तुलना में पायरोक्सासल्फोन 127.5 ग्रा/हे और आइसोक्साफ्लुटोल+थिएनकार्बाजोन–मिथाइल (90+36) ग्रा/हे द्वारा अधिक प्रभावी ढंग से नियंत्रित किया गया।
- बेंगलुरु में शहतूत में, ग्लाइफोसेट और पैराक्वाट की तुलना में इण्डाजिफ्लेम 20% + ग्लाइफोसेट आईपीए 540 एससी (1.65+44.63)% डब्ल्यू/डब्ल्यू 1050 ग्रा/हे को खरपतवारों को नियंत्रित करने के लिए उपयुक्त विकल्प पाया गया है।
- बेंगलुरु में, विभिन्न जुताई और खरपतवार नियंत्रण पद्धतियों में, अवशेष के साथ पारंपरिक जुताई और बुबाई के 2 दिन बाद एट्राजीन 1.0 किग्रा/हे के बाद, बुबाई के 20 दिन बाद टॉपरामेजोन 25.2 ग्राम/हे के बाद, बुबाई के 40 दिन पर हाथ से निराई के बाद, खरपतवार बीज की कटाई ने खरीफ मक्का में सबसे कम खरपतवार घनत्व, शुष्क वजन और उच्चतम अनाज उपज दर्ज की है।
- जोबनेर में, खरपतवार मुक्त उपचार में अधिकतम बीज उपज और खरपतवार नियंत्रण दक्षता पाई गई, जो बुबाई से पूर्व 750 ग्राम/हे की दर से पेन्डीमेथालिन प्रयोग के बाद की हाथ से निराई और बुबाई के पूर्व में पेन्डीमेथालिन 30 ईसी के बाद बुबाई के 30–35 दिन पर क्विजालोफॉप–इथाइल 5% ईसी 40 ग्रा/हे के बराबर थी। सरसों पर बुबाई के 30–35 दिन पर 85 ग्रा/हे की दर से प्रोपेक्विजाफॉप 5%+ऑक्सीफ्लुफेन 12% डब्ल्यू/डब्ल्यू ईसी (रेडी–मिक्स) की फाइटोटॉक्सि– सिटी देखी गई।
- जोबनेर में जौ की फसल के अन्तर्गत, खरपतवार मुक्त उपचार में अधिकतम अनाज उपज और खरपतवार नियंत्रण दक्षता पाई गई, जो कि (127.5+4) ग्रा/हे की दर से पायरोक्सासल्फोन + मेटसल्फ्यूरॉन और 127.5 ग्रा/हे की दर से पायरोक्सासल्फोन के अनुप्रयोग के बराबर थी।
- कश्मीर में, गेहूं की फसल में, सल्फोसल्फ्यूरॉन 25 ग्रा/हे या क्लोडिनाफॉप 60 ग्रा/हे के बाद मेटसल्फ्यूरॉन 4.0 ग्रा/हे उपचार से अन्य की तुलना में उच्च खरपतवार नियंत्रण दक्षता दर्ज की गई।
- धारवाड़ में, सोयाबीन की फसल में, खरपतवारनाशक– सहिष्णु माइकोराइजल और पीपीएफएम कंसोर्टियम बुबाई के 15वें, 30वें और 45वें स्प्रे के साथ बुबाई के पूर्व में डाइक्लोसुलम 84% डब्ल्यूडीजी 26 ग्रा/हे के छिड़काव से पौधों की सबसे अधिक ऊंचाई दर्ज की गई और उन खेतों की तुलना में शारीरिक मापदंडों में सुधार हुआ, जिनमें केवल बुबाई के पूर्व में डाइक्लोसुलम 84% डब्ल्यूडीजी 26 ग्रा/हे का छिड़काव किया गया था।
- गन्ने की खेती में धारवाड़ में, यूएएस–डी एएमएफ ने अकेले ही स्ट्राइगा के अंकुरण को काफी हद तक कम कर दिया, जो कि उन खेतों से बेहतर है, जहां स्ट्राइगा के अंकुरण के समय 2. 4–डी. सोडियम 2.0 कि/हे+ मेट्रिब्यूजिन 1.0 कि/हे का प्रयोग किया था।

- In maize crop at Bengaluru, *Rottboellia cochinchinensis* was controlled more effectively by pyroxasulfone (127.5 g/ha) and isoxaflutole + thiencarbazone-methyl (90+36) g/ha as early post-emergence than other herbicides.
- Indaziflam 20 + Glyphosate IPA 540 SC (1.65 + 44.63) % w/w @ 1050 g/ha has been found to be a suitable option for controlling weeds as compared to glyphosate and paraquat in Mulberry at Bengaluru.
- Among the different tillage and weed control practices, conventional tillage with residue and atrazine 1.0 kg/ha at 2 DAS *fb* topramezone 25.2 g/ha at 20 DAS fb hand weeding at 40 DAS *fb* weed seed harvest has recorded the lowest weed density, dry weight, and highest grain yield in *Kharif* maize at Bengaluru.
- At Jobner, the maximum seed yield and WCE were found in the weed-free treatment, which was at par with the pre-emergence application of pendimethalin @ 750 g a.i./ha *fb* 1 hand weeding and pendimethalin 30 EC as pre-emergence @ 750 g a.i./ha *fb* quizalofop-ethyl 5% EC @ 40 g a.i./ha at 30-35 DAS. Phyotoxicity of propaquizafop 5% + oxyfluofen 12% w/w EC ready-mix @ 85 g a.i./ha at 30-35 DAS was observed on mustard.
- At Jobner, the maximum grain yield and WCE were found in the weed-free treatment, which was at par with the post-emergence tank mix application of pyroxasulfone + metsulfuron @ 127.5+4 g a.i./ha and the post-emergence application of pyroxasulfone @ 127.5 g a.i./ha in barley.
- At Kashmir, in the wheat crop, sulfosulfuron (25 g/ha) or clodinafop (60 g/ha) *fb* metsulfuron (4.0 g/ha) recorded higher weed control efficiency as compared to other treatments.
- At Dharwad, in the soybean crop, the herbicide-tolerant mycorrhizal and PPFM consortium spray (15th, 30th, and 45th DAS) along with diclosulum 84% WDG 26 g/ha as pre-emergence recorded the highest plant height and improved physiological parameters as compared to the plots that received diclosulum 84% WDG 26 g/ha as pre-emergence alone.
- At Dharwad in Sugarcane, the UAS-D AMF consortium alone reduced the *Striga* emergence to a tune, which is superior to the plots that received 2.4-D. Na 2.0 kg/ha + metribuzine 1.0 kg/ha at the time of *Striga* emergence.

डब्ल्यू पी 2. गैर–फसलीय और जलीय क्षेत्रों में खरपतवारों का प्रबंधन

- कोयम्बटूर में ग्लूफोसिनेट अमोनियम 13.5 एसएल 750 ग्रा/हे + 2, 4 डी सोडियम साल्ट 1.25 कि/हे के प्रयोग से *पार्थेनियम हिस्टेरोफोरस* के विरुद्ध अन्य खरपतवारनाशक संयोजन की तुलना में उच्च खरपतवार नियंत्रण दर्ज की गई।
- भुवनेश्वर में निचले/गहरे पानी वाले चावल के खेत में जलीय फर्न *साल्विनिया मोलेस्टा* के प्रबंधन में 2,4–डी सोडियम साल्ट 0.5 कि/हे और मेटसल्फ्यूरॉन मिथाइल+क्लोरोमुरॉन इथाइल 4 ग्रा/हे का प्रयोग सर्वोत्तम पाया गया।
- बेंगलुरु में, गैर–फसलीय क्षेत्र में, ग्लाइफोसेट और पैराक्वाट की तुलना में, इण्डाजीफ्लैम 20 + ग्लाइफोसेट आईपीए 540 एससी (1.65% डब्ल्यू/डब्ल्यू+44.63% डब्ल्यू/डब्ल्यू) 2100 मिली/हेक्टेयर और 1050 मिली/हेक्टेयर को खरपतवारनाशक के प्रयोग के 56 दिनों तक खरपतवारों को नियंत्रित करने में प्रभावी पाया गया।
- त्रिशूर में, 2.5–10% तक की सांद्रता वाले लैक्टिक एसिड के विपरीत जलीय परिस्थितियों में एसिटिक एसिड की 10% सांद्रता *पिस्टिया स्ट्रेटिओट्स* के पूर्ण विरंजन और क्षय का कारण बनती है।
- हिसार में, सबसे अधिक समस्याग्रस्त खरपतवार *फलारिस माइनर, साइपरस रोटंडस, इकाईनोक्लोआ कोलोना इकाएनो क्लोवा क्रैसगैली, रुमेक्स डेंटेटस, ओरोबैंकी* और *पार्थेनियम हिस्टेरोफोरस* पाए गए जिनकी आक्रामकता और प्रभाव मूल्य 24.0 और 32.6 थे।
- लुधियाना में राष्ट्रीय महत्व के खरपतवार के अंतर्गत 300 किसानों का एक यादृच्छिक सर्वेक्षण किया गया, जिसमें *फेलारिस माइनर* अन्य की तुलना में सबसे अधिक प्रभावशाली खरपतवार पाया गया।
- कोयंबटूर में, गैर–फसल क्षेत्र के तहत पार्थेनियम नियंत्रण में ग्लूफोसिनेट अमोनियम 13.5 एसएल 750 ग्रा/हे + 2,4 डी सोडियम साल्ट 1.25 कि/हे के प्रयोग से कम खरपतवार घनत्व, शुष्क भार और उच्च खरपतवार नियंत्रण दक्षता का संकेत दिया गया।
- पालमपुर में *लैंटाना कैमारा* को नियंत्रित करने के लिए फंगल कल्चर आधारित उत्पाद एजीएलसी 14 की प्रभावकारिता का परीक्षण करने के लिए एक क्षेत्र परीक्षण आयोजित किया गया। छिड़काव समाधान के पीएच के समायोजन के बाद दो बार छिड़काव किया गया था। इस प्रकार प्राप्त परिणामों से पता चला कि यह कवक कल्चर आधारित उत्पाद *लैंटाना कैमारा* के नियंत्रण के लिए प्रभावी नहीं था।
- पालमपुर में अगस्त में *लैंटाना* की झाड़ियों को काटें, फिर एक महीने तक उन्हें फिर से उगने दें और लैंटाना को प्रभावी ढंग से

W P 2. Management of weeds in non-cropped and aquatic areas

- The application of glufosinate ammonium 13.5 SL 750 g/ha + 2,4 D Na salt 1.25 kg/ha was recorded to have a higher WCE against *Parthenium hysterophorus* than another herbicide combination at Coimbatore.
- Application of 2,4-D Na salt 0.5 kg/ha and metsulfuron methyl + chloromuron ethyl 4 g/ha was found to be the best screened-out in managing *Salvinia molesta* the aquatic fern in the lowland/deep water rice field, in Bhubaneswar.
- At Bengaluru, in the non-cropped area, indaziflam 20 + glyphosate IPA 540 SC (1.65% w/w + 44.63 % w/w) @ 2100 ml/ha and 1050 ml/ha were found effective in controlling weeds up to 56 days after herbicide application as compared with glyphosate and paraquat.
- At Thrissur, a 10% concentration of acetic acid has been observed to cause complete bleaching, decay, and sinking of the *Pistia stratiotes* under aquatic conditions against lactic acids with concentrations ranging from 2.5% to 10 %.
- At Hisar under WoNI, the most problematic weeds were found to be *Phalaris minor*, *Cyperus rotundus*, *Echinochloa colona/crussgalli*, *Rumex dentatus*, *Orobanche* and *Parthenium hysterophorus* with an invasiveness and impact value of 24.0 and 32.6.
- At Ludhiana, the identification of WoNI (Weeds of National Importance) was conducted a random survey of 300 farmers, *Phalaris minor* has been the most dominant weed flora than other.
- At Coimbatore, the lesser total weed density and dry weight and higher WCE were indicated by the application of glufosinate ammonium 13.5 SL 750 g/ha + 2,4 D Na salt 1.25 kg/ha in Parthenium control under the non-cropped area.
- At Palampur a field trial was conducted to test the efficacy of fungal culture based product AGLC#14 for controlling *Lantana camara*. The culture (after the adjustment of the pH of the spray solution was sprayed twice. Results so obtained revealed that this fungal culture was not effective for the control of *Lantana camara*.
- In Palampur, cutting the *Lantana* bushes in August, then allowing to regenerate for one month and use

नियंत्रित करने के लिए ग्लाइफोसेट 1500 ग्रा/हे + मेटसल्फ्यूरॉन–मिथाइल 4 ग्रा/हे. के साथ या बिना सर्फेक्टेंट 1000 मिली/हे. का उपयोग करें। इस उपचार के परिणामस्वरूप शुरुआती छह महीनों के लिए *लैंटाना* की झाड़ियाँ पूरी तरह से नष्ट हो गईं और उसके बाद बहुत कम पुनर्जनन हुआ। इन शाकनाशियों का छिड़काव वसंत ऋतु में करने के बजाय शरद ऋतु में करें। ग्लाइफोसेट 2000 ग्रा/हे. मेटसल्फ्यूरॉन मिथाइल 8 ग्रा/हे. के उपयोग से *लैंटाना* पर बहुत कम पुनर्जनन के साथ प्रभावी और दीर्घकालिक नियंत्रण मिला।

डब्ल्यू पी 3. विभिन्न कृषि–पारिस्थितिकी तंत्रों में शाकनाशी अवशेष

- पंजाब में सरसों और मिट्टी में पेंडीमेथालिन और फेनोक्साप्रोप–प्रोपार्गिल के अवशेष (<0.01 माइक्रोग्राम/ग्राम) और कटाई के समय सरसों (<0.05 माइक्रोग्राम/ग्राम) पता लगाने योग्य सीमा से नीचे था।
- पंजाब में मूंग फसल के अंतर्गत कटाई के बाद मिट्टी में पेन्डीमेथालिन और इमेजेथापायर के अवशेष पता लगाने योग्य सीमा (<0.01 माइक्रोग्राम/ग्राम) से नीचे थे।
- पंजाब में, शुष्क सीधे बोए गए चावल के अंतर्गत प्रयोग किए गए पेन्डीमेथालिन और बिसपायरीबैक सोडियम के डीटी 50 की अवधि 35.90 से 44.19 और 8.65 से 11.39 दिनों के बीच थी, और फसल कटाई के समय मिट्टी (<0.01 माइक्रोग्राम/ ग्राम) और चावल (<0.05 माइक्रोग्राम/ग्राम) में इन खरपतवारनाशकों के अवशेष पता लगाने योग्य सीमा से नीचे थे।
- पंजाब में आलू की फसल में, मिट्टी में मेट्रिब्यूजिन की डीटी 50 18.98 दिन थी और कटाई के समय मिट्टी और आलू में इसके अवशेष पता लगाने योग्य सीमा (<0.01 माइक्रोग्राम/ग्राम) से नीचे थे, हालांकि, मेट्रिब्यूजिन ने मिट्टी की डिहाइड्रोजनेज और क्षारीय फॉस्फेट गतिविधि को अस्थायी रूप से प्रभावित किया।
- पंजाब में, सरसों में पेंडीमेथालिन और पाइरोक्सासल्फोन के अवशेष समय के साथ कम हो गए और कटाई के समय मिट्टी (<0.01 माइक्रोग्राम/ग्राम) और सरसों (<0.05 माइक्रोग्राम/ग्राम) दोनों में पता लगाने योग्य सीमा से नीचे थे।
- पंजाब में मक्का की कटाई के समय, टेम्बोट्रायोन, टोप्रामेजोन और हैलोसल्फ्यूरॉन–मिथाइल के प्रथम अवशेष 0.0132–0.33 से 0.0546–0.34 माइक्रोग्राम/ग्राम तक थे और मिट्टी और फसल उत्पाद दोनों में पता लगाने की सीमा (<0.01 माइक्रोग्राम/ग्राम) से नीचे थे।
- पंजाब में मक्का में, टोप्रामेजोन के अवशेष 20–60 सेमी में वितरित किए गए और मुख्य रूप से निचली मिट्टी की परतों (50–60 सेमी) और लीचेट (49.12–70.12%) में मौजूद (22.11–26.54%) थे। जब 300 मिमी के बराबर वर्षा की गई, तो टोप्रामेजोन तुलनात्मक रूप से अधिक मात्रा में निक्षालित हुआ।

glyphosate 1500 g/ha + metsulfuron-methyl 4 g/ha along with or without surfactant 1000 ml/ha for effectively controlling *Lantana*. This treatment resulted in complete kill of *Lantana* bushes for the initial six months with very little regeneration afterwards. Spray these herbicides in autumn season rather than their application in spring season. Application of glyphosate 2000 g/ha, metsulfuron methyl 8 g/ha gave effective and long term control of *Lantana* with very less regeneration.

WP 3. Fate of herbicide Residues in different agro-ecosystems

- In mustard, residues of pendimethalin and fenoxaprop-propargyl in soil (<0.01 μg/g) and mustard (<0.05 μg/g) at harvest were below the detectable limit at Panjab.
- In green gram, residues of pendimethalin and imazethapyr in soil were below the detectable limit (<0.01 μg/g) at harvest at Panjab.
- At Punjab, DT50 of pendimethalin and bispyribac sodium applied to DSR in soil in different treatments ranged from 35.90 to 44.19 and 8.65 to 11.39 days, and residues of these herbicides in soil (<0.01 μg/g) and rice (<0.05 μg/g) at harvest were below detectable limit.
- In potato crop at Punjab, DT50 of metribuzin in soil was 18.98 days and its residues in soil and potato at harvest were below detectable limit (<0.01 μg/g) however, metribuzin transiently affected dehydrogenase and alkaline phosphatase activity of soil.
- Metribuzin, pendimethalin, and clodinafop residues in the soil and in the second-picked peas at harvest were below the detection limits of less than 0.01 and less than 0.05 μg/g, respectively, in Punjab.
- At harvest in Punjab maize, the first residues of tembotrione, topramezone, and halosulfuron-methyl ranged from 0.0132-0.33 to 0.0546-0.34 μg/g and were below the detection limit (<0.01 μg/g) in both soil and crop produce.
- At Punjab in maize, residues of topramezone were distributed in 20-60 cm and predominantly present (22.11-26.54%) in the lower soil layers (50-60 cm) and leachate (49.12-70.12%). When rainfall equivalent to 300 mm was applied, topramezone leached comparatively more.

- पंजाब में किसानों के खेतों में, ग्रीष्मकालीन मूंग, खरीफ मूंग और उड़द की फसल में इमेजेथापायर के प्रयोग से 15 और 25 दिन बाद 75 ग्राम/हेक्टेयर की दर से प्रयोग किए जाने पर अवशेष <0.01 माइक्रोग्राम/ग्राम की पता लगाने योग्य सीमा से नीचे थे, जबकि उच्च प्रयोग दरों पर, कटाई के बाद भंडारण के दौरान अवशेष के स्तर में गिरावट आई और 18 दिनों के भीतर पता लगाने योग्य सीमा (<0.01 माइक्रोग्राम ग्राम) से नीचे थे।
- आनंद में, हल्दी के ताजे प्रकंद में एट्राजीन, पेंडीमेथालिन या मेट्रिब्यूजिन का कोई भी शाकनाशी अवशेष नहीं देखा गया।
- कोयम्बटूर में बेबी कॉर्न में खरपतवारों को नियंत्रित करने के लिए इस्तेमाल की गई जुताई और खरपतवार प्रबंधन प्रथाओं के बावजूद, विभिन्न भूखंडों से मिट्टी और बेबी कॉर्न में पेंडीमेथालिन, टोप्रामेजोन और एट्राजीन अवशेष मात्रात्मक स्तर से नीचे थे।
- कोयम्बटूर में, दो स्थानों पर कटाई के समय गोभी के फूल और मिट्टी के नमूनों में पेंडीमेथालिन अवशेष पता लगाने की सीमा <0.01 माइक्रोग्राम/ग्राम से नीचे थे।
- कोयंबटूर में, 10 वर्ष से अधिक समय से खरपतवारनाशकों का उपयोग कर रहे किसानों के खेतों से एकत्रित मिट्टी और भूजल के नमूनों के अवशेष विश्लेषण से पता चला कि मिट्टी और भूजल में कोई भी खरपतवारनाशक नहीं पाया गया।
- हैदराबाद में चने के दानों और मिट्टी के नमूनों में मिट्टी, अनाज और पौधों में पेंडीमेथालिन, इमेजेथापायर, फोमेसेफेन, फ्लूजिफॉप और टोप्रामेजोन के अवशेष पता लगाने की सीमा से नीचे थे।
- हैदराबाद में कटाई के समय सभी प्रारंभिक मृदा नमूनों, अंतिम मृदा नमूनों तथा मक्का के दाने/पौधे में एट्राजीन अवशेष 0.05 माइक्रोग्राम/ग्राम की पहचान सीमा से नीचे थे।
- हैदराबाद में कटाई के बाद चुकंदर की फसलों और मिट्टी के नमूनों से एकत्र किए गए सभी नमूनों में पेंडीमेथालिन अवशेष पता लगाने की सीमा (<0.05 मिलीग्राम/ग्राम) से नीचे थे।

डब्ल्यू पी 4. खरपतवार प्रबंधन प्रौद्योगिकियों का प्रदर्शन और प्रभाव मूल्यांकन

- आनंद द्वारा किए गए खेत पर अनुसंधान परीक्षणों से पता चला कि मूंगफली में 800 ग्रामध्हेक्टेयर पर पेंडीमेथालिन 30: . इमेजेथापायर 2: ईसी के अनुप्रयोग से किसानों की पद्धति (अंतर कृषि क्रियाएं के बाद बुवाई के 20 और 40 दिन पर हाथ से निराई) की तुलना में उच्च उपज और लाभ–लागत अनुपात दर्ज किया गया।
- आनंद में ग्रीष्मकालीन मूंगफली में आयोजित अग्रिम पंक्ति प्रदर्शन में, फ्लूजिफॉप–पी–ब्यूटाइल 11.1: डब्ल्यूध्डब्ल्यू

- At Punjab in the farmer field, residues of imazethapyr in summer moong, kharif moong, and urd bean applied at 75 g/ha at 15 and 25 DAS were below the detectable limit of <0.01 µg/g, while at higher application rates, residue levels declined during post-harvest storage and were below the detectable limit (<0.01 µg g^{-1}) within 18 days.
- At Anand, there was no herbicide residue of atrazine, pendimethalin, or metribuzin observed in fresh rhizome of turmeric.
- Pendimethalin, topramezone, and atrazine residues in soil and baby corn from various plots were below the quantification level, irrespective of the tillage and weed management practices used to control weeds in baby corn at Coimbatore.
- At Coimbatore, pendimethalin residues in cabbage head the soil samples of two locations at harvest were below the detection limit of <0.01(µg/g).
- Residue analysis of soil and groundwater samples, collected from farmers fields with more than 10 years of herbicide usage revealed that none of the applied herbicides were detected in the soil and groundwater at Coimbatore.
- The pendimethalin, imazethapyr, fomesafen, fluazifop and topramezone residues in soil, grain and plant were below the respective detection limits in chickpea grains and soil samples at Hyderabad.
- The atrazine residues were below the detection limit of 0.05 µg/g in all initial soil samples, final soil sample, and maize grain/plant at the time of harvest in Hyderabad.
- Pendimethalin residues were below the detection limit (0.05 mg/kg) in all the samples collected from post-harvest beet crops and soil samples in Hyderabad.

W P 4. Demonstration and Impact assessment of weed management technologies

- On-farm research trials conducted by Anand indicated that the application of pendimethalin 30% + imazethapyr 2% EC at 800 g a.i./ha (Ready-mix) recorded higher yield and benefit-cost ratio compared to farmers' practice (IC *fb* HW at 20 and 40 DAS) in groundnut.
- Frontline demonstration conducted at Anand, the application of fluazifop-p-butyl 11.1% w/w +

फोमेसेफेन 11.1: (तैयार मिश्रण) 250 ग्रामःहेक्टेयर का बुवाई के 10–15 दिन बाद प्रयोग, किसान की पद्धति (अंतर कृषि क्रियाएं के बाद बुवाई के 20 और 40 दिन पर हाथ से निराई) की तुलना में उच्च लाभ लागत अनुपात के साथ प्रभावी पाया गया।

- कल्याणी में, मक्का पर किए गए ओएफआर परीक्षण में, बुबाई के बाद, टोप्रामेजोन+एट्राजीन (25.2+500) ग्राम/हे. के बाद (अंतर कृषि क्रियाएं के बाद बुवाई के 40 दिन पर हाथ से निराई) का प्रयोग उच्चतम अनाज के साथ बेहतर था, इसके बाद किसानों की पद्धति (20 और 40 दिनों पर हाथ से निराई) का स्थान रहा।
- उदयपुर में गेहूं पर किए गए ऑन–फार्म अनुसंधान के तहत, क्लोडिनाफॉप प्रोपार्गिल 15%+मेटसल्फ्यूरॉन मिथाइल 1% डब्ल्यू पी 60+4 ग्राम/हेक्टेयर की दर से बुबाई के 30 दिन बाद प्रयोग किसान प्रौद्योगिकी की तुलना में उच्चतम अनाज उपज दर्ज किया गया।
- पंतनगर में रोपे गए चावल में ओएफआर आयोजित किया गया, जिसमें सबसे अधिक उपज और बीसी अनुपात पेनोक्सासुलम + साइहेलोफॉप–ब्यूटाइल 135 ग्रा/हे के साथ प्राप्त किया गया, जो किसान प्रौद्योगिकी (पेनोक्सासुलम+ब्यूटाक्लोर रोपाई के 7 दिन बाद) की तुलना में अधिक दर्ज किया गया।
- पंतनगर में, किए गए फार्म रिसर्च परीक्षण में, बुबाई से पूर्व मेसोट्रियोन 2.27% + एट्राजीन 22.7% एससी 875 ग्रा/हे के प्रयोग से उच्च गन्ना उपज दर्ज की गई है, जिसके बाद अमेट्रिन 80 डब्ल्यूडीजी 2.0 कि/हे का स्थान है, जो गन्ने में किसान प्रौद्योगिकी की तुलना में बेहतर है।
- पंतनगर में गन्ने के मामले में, अग्रिम पंक्ति प्रदर्शन के तहत, एमेट्रिन 80 डब्ल्यूडीजी 2.0 कि/हे अंकुरण के पूर्व प्रयोग किसान प्रौद्योगिकी से बेहतर पाया गया।
- छत्तीसगढ़ के रायपुर जिले में सीधे बुबाई वाले चावल पर पांच ओएफआर आयोजित किए गए, जिसमें अंकुरण से पूर्व पेनोक्सुलम + साइहेलोफॉप–ब्यूटाइल 135 ग्रा/हे के साथ, बुबाई के 25 दिन पर पाइराजोसल्फ्यूरॉन 20 ग्रा/हे के प्रयोग से सबसे अधिक औसत अनाज उपज प्राप्त हुई, इसके बाद पाइराजोसल्फ्यूरॉन 20 ग्रा/हे के साथ, बुबाई से 20 दिन में बिसपायरीबैक–सोडियम 25 ग्रा/हे का स्थान रहा है ,जो कि किसानों की पद्धति, (बुबाई के 20 दिन पर बिसपायरीबैक–सोडियम 25 ग्रा/हे की तुलना में क्रमशः 14.37% और 11.72% अधिक था।
- रायपुर में, सीधे बोए गए चावल में खरपतवार प्रबंधन पर 16 अग्रिम पंक्ति प्रदर्शन आयोजित किए गए, जिसमें बुवाई के 0–7 दिनों में पाइराजोसल्फ्यूरॉन 20 ग्रा/हे, उसके बाद बुवाई के 20 दिनों में बिसपायरीबैक–सोडियम 25 ग्रा/हे के प्रयोग से किसानों की पद्धति (बुवाई के 20 दिनों में बिसपायरीबैक–ना 25 ग्रा/हे) की तुलना में उच्चतम खरपतवार नियंत्रण दक्षता,

fomesafen 11.1% (Ready-mix) 250 g a.i./ha as an early post emergence at 10-15 DAS has been found effective with higher B:C as compared to the farmer's practice (IC+HW at 20 and 40 DAS) in summer groundnut.

- At Kalyani, in the OFR trial conducted on maize, the application of topramezone + atrazine (25.2 + 500) g/ha as early post-emergence *fb* (IC + HW at 40 days) was better with the highest grain and economics, followed by farmers practice (HW at 20 and 40 days).
- At Udaipur, under on-farm research conducted in wheat, clodinafop propargyl 15% + metsulfuron methyl 1% WP 60+4 g/ha at 30 DAS recorded as the highest grain yield over farmer's technology.
- OFR conducted in transplanted rice at Pantnagar, the highest yield and BC ratio were achieved with penoxasulam + cyhalofop-butyl 135 g/ha, followed by penoxasulam + butachlor (7 DAT) early post-emergence over farmer's technology.
- On Farm Research Trail conducted by Pantnagar, the application of mesotrione 2.27%+ atrazine 22.7% SC 875 g/ha as pre-emergence has recorded higher cane yield which was closely followed by ametrine 80 WDG 2.0 kg/ha as pre-emergence better than farmer's technology in sugarcane.
- In case of sugarcane, ametrine 80 WDG 2.0 kg/ha as pre-emergence performance better than farmer's technology under Front line Demonstration at Pantnagar.
- Five OFRs were conducted at District Raipur, Chhattisgarh, in direct-seeded rice, the highest average grain yield was obtained under the application of pyrazosulfuron 20 g/ha pre-emergence *fb* pre-emergence Penoxsulam + cyhalofop-butyl 135 g/ha at 25 DAS, followed by pyrazosulfuron 20 g/ha pre-emergence at 0-7 DAS *fb* bispyribac-Na 25 g/ha at 20 DAS, which was 14.37 % and 11.72 % more than the farmers practice, i.e., bispyribac-Na 25 g/ha at 20 DAS.
- At Raipur, 16 FLDs were conducted on weed management in DSR, The pyrazosulfuron 20 g/ha at 0-7 DAS *fb* bispyribac-Na g/ha at 20 DAS recorded highest benefit-cost ratio and WCE over the farmer's practice (bispyribac-Na 25 25g/ha at 20 DAS). However, the increased yield under the recommended practice over the farmer's practice

लाभ–लागत अनुपात और 17.50% की उपज वृद्धि हुई।

- त्रिशूर में, चार स्थानों पर रोपे गए चावल में ऑन–फार्म अनुसंधान आयोजित किये गये जिसमे फ्लोरापीरॉक्सिफेन बेंजिल एस्टर नामक शाकनाशी, किसानों की पद्धति (बिस्पायरिबैक सोडियम और संयुक्त शाकनाशी पेनोक्ससुलम + साइहेलोफॉप ब्यूटाइल) की तुलना में विविध खरपतवार वनस्पतियों को नियंत्रित करने में अधिक प्रभावी था।

- उदयपुर के वल्लभनगर तहसील के तारावत और नेतावाला गांवों में गेहूं में खरपतवार नियंत्रण पर दो खेत पर अनुसंधान आयोजित किए गए जिसमे बुबाई के 30 दिन पर कार्फेंट्राजोन + सल्फोसल्फ्यूरॉन 245 ग्रा/हे के प्रयोग से किसान की पद्धति की तुलना में 20.21% अधिक अनाज उपज दर्ज की गई।

- उदयपुर जिले के वल्लभनगर के तारावत, नवानिया और सिया खेड़ी में गेहूं में व्यापक–स्पेक्ट्रम खरपतवार नियंत्रण पर पांच अग्रिम पंक्ति प्रदर्शन आयोजित किए गए, जिसमें बुबाई के 35 दिन बाद मेसोसल्फ्यूरॉन + आइडोसल्फ्यूरॉन मिथाइल सोडियम 14.4 ग्रा/हे के छिड़काव से किसानों की पद्धति की तुलना में न्यूनतम खरपतवार घनत्व और अनाज की उपज में 16.97% वृद्धि दर्ज की गयी है।

- ओडिशा के जगतसिंहपुर, मोरादा और नुआगांव जिलों में रबी 2023–24 के दौरान मूंगफली पर दस अग्रिम पंक्ति प्रदर्शन आयोजित किए गए, जिसमें किसानों की पद्धति (बुबाई के 25 दिन पर हाथ से निराई) की तुलना में टेम्बोट्रियोन+एट्राजीन (120+500) ग्रा/हे के प्रयोग से 25% की उपज वृद्धि दर्ज हुई।

- खरीफ 2024 के दौरान ओडिशा राज्य के बागोई, कुजंगा, जगतसिंहपुर, मोरादा और नुआगांव जिलों में प्रत्यारोपित चावल पर किए गए दस अग्रिम पंक्ति प्रदर्शनों से पता चला है कि प्रत्यारोपित चावल के मामले में किसानों की पद्धति (25 दिन पर एक बार मैनुअल निराई) की तुलना में अंकुरण के पूर्व प्रीटिलाक्लोर के बाद बुबाई के 25 दिन पर बिस्पायरिबैक सोडियम 0.75 कि/हे प्रयोग से 25–32% की उपज में वृद्धि दर्ज हुई।

- पंजाब में तर–बतर में सीधी बुवाई वाले चावल के तहत खरपतवार प्रबंधन पर खेत पर तीन परीक्षण आयोजित किए गए जिसमें अंकुरण के पूर्व में 750 ग्रा/हे पेन्डीमेथालिन +25 ग्रा/हे पाइराजोसुलफ्यूरॉन इथाइल और फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/डब्ल्यू साईहैलोफॉप–ब्यूटाइल 10.64% डब्ल्यू/डब्ल्यू ईसी 150 ग्रा/हे का प्रयोग, कृषक पद्धतियों की तुलना में खरपतवारों पर अधिक प्रभावी नियंत्रण प्रदान करता पाया गया।

- हैदराबाद राज्य के नलगोंडा जिले के त्रिपुराराम मंडल के नीलाईगुड़ेम गांव में खरीफ 2024 के दौरान चावल में

was 17.50%.

- At Thrissur, on-farm research conducted at four locations in transplanted rice on herbicide florpyrauxifen benzyl ester was more effective in controlling diverse weed flora in comparison to farmers' practice (bispyribac sodium and combination herbicide penoxsulam + cyhalofop butyl).

- Two OFRs were conducted on broad-spectrum weed control in wheat; the application of carfentrazone + sulfosulfuron (245 g/ha) at 30 DAS recorded 20.21% higher grain yield than both farmers' practices. It was conducted at Tarawat and Netawala villages of Vallabhnagar tehsil, Udaipur.

- Five FLDs were conducted on broad-spectrum weed control in wheat at Tarawat, Navaniya, and Siya Khedi dist. Vallabhnagar in Uadipur district, the application of ready-mix herbicide mesosulfuron + idosulfuron methyl sodium 14.4 g/ha at 35 DAS recorded a minimum weed density and weed dry matter as compared to farmers practice, with an increased wheat grain yield of 16.97 percent over farmers practice.

- Ten frontline demonstrations were conducted on groundnut during *Rabi* 2023-24 in Jagatsinghpur, Morada, and Nuagaon districts, Odisha, with a yield increase of 25% with the early post-emergence application of tembotrione + atrazine (120 + 500 g/ha) at 14 DAS over farmers' practice of (1 HW at 25 DAS).

- Ten frontline demonstrations (FLDs) conducted on transplanted rice during *Kharif* 2024 in Bagoi, Kujanga, Jagatsinghpur, Morada & Nuagaon districts in Odisha state revealed the yield increase of 25-32% with the application of pre-emergence pretilachlor *fb* bispyribac Na. 0.75 kg/ha at 25 DAT over farmers' practice of (one manual weeding at 25 DAT) in the case of transplanted rice.

- Three OFTs on weed management in tar wattar DSR were conducted at Punjab; the application of pendimethalin @ 750 g/ha + pyrazosulfuron ethyl @ 25 g/ha as pre-emergence (Tank mix) and florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha post emergence provided more effective control of broad-spectrum weeds than farmer practices.

- Five Front Line Demonstrations were conducted in rice during *Kharif* 2024 at Neelaigudem village, Tripuraram Mandal in Nalgonda district at

पांच अग्रिम पंक्ति प्रदर्शन किए गए, जिसमे बुबाई के 40 दिन बाद हाथ से निराई के साथ, फ्लोरपाइरॉक्सिफेन–बेंजिल 2.13% डब्ल्यू/डब्ल्यू साइहैलोफॉप–ब्यूटाइल 10.64% डब्ल्यू/ डब्ल्यू ई सी का 150 ग्रा/हे की दर से प्रयोग करने से किसान पद्धति (40 दिन बाद हाथ से निराई के साथ ट्रायफामोन 20%, 44 ग्रा/हे + इथोक्सीसल्फ्यूरॉन 10%, 22.5 ग्रा/हे) की तुलना में अधिक उपज और लाभ–लागत अनुपात पाया गया।

- ग्वालियर में बाजरे पर दो कृषि अनुसंधान परीक्षणों में, सबसे अधिक उपज, शुद्ध लाभ और बीसी अनुपात एट्राजीन+ मेसोट्रियोन (रेडी–मिक्स) 656 ग्रा/हे में दर्ज किया गया, जो कि किसानों के अभ्यास (कोई शाकनाशी का प्रयोग नहीं) की तुलना में 24.20% अधिक था।
- जम्मू में मक्का फसल में खरपतवार प्रबंधन पर अग्रिम पंक्ति प्रदर्शनों में, टोप्रामेजोन + एट्राजीन (25.2+500) ग्रा/हे को बुबाई के 15–20 दिनों में प्रयोग करने से मक्का की औसत उपज में 19.08% की वृद्धि हुई, जो किसान पद्धति एट्राजीन 1 कि/हे की तुलना में अधिक थी।
- जम्मू में, गेहूं की फसल के अंतर्गत खरपतवार प्रबंधन के लिए एससीएसपी कार्यक्रम के तहत तीन विभिन्न स्थानों पर पचास अग्रिम पंक्ति प्रदर्शन आयोजित किए गए जिसमें क्लोडिनाफॉप–प्रोपार्गिल+मेटसल्फ्यूरॉन 60+4 ग्रा/हे का प्रयोग बुबाई के 30–35 दिन पर करने से संबंधित स्थानों पर गेहूं की उपज में 3–10% की वृद्धि हुई, जो किसान पद्धति बुबाई से 30–35 दिन पर मेट्रिब्यूजिन 200 ग्रा/हे की तुलना में अधिक था।
- कोयम्बटूर में कोदो और फॉक्सटेल में अग्रिम पंक्ति प्रदर्शन आयोजित किए गए जिसमें 4 ग्रा/हे की दर से मेटसल्फ्यूरॉन मिथाइल+क्लोरिम्यूरॉन मिथाइल 20% डब्ल्यूपी के प्रयोग को किसानों की पद्धति की तुलना में निराई लागत में बचत के रूप में दर्ज किया गया।

Hyderabad State, the post-emergence application of florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC at 150 g/ha as post emergence fb hand weeding at 40 DAT has been found to have a higher yield and benefit-cost ratio over farmer practice (triafamone 20% (44 g/ha) + ethoxysulfuron 10% WG (22.5 g/ha) as post emergence *fb* hand weeding at 40 DAT with).

- At Gwalior two on-farm research trials conducted in pearlmillet, the highest yield, net return and BC ratio were recorded in atrazine + mesotrione (Ready-mix) 656 g/ha as post-emergence, which was 24.20% higher over farmer's practice (no herbicide applied).
- In frontline demonstrations on weed management in maize at Jammu, the application of topramezone + atrazine 25.2 + 500 g/ha applied at 15-20 DAS resulted in a 19.08% increase in average yield of maize as compared to the farmer's standard practice of using atrazine at 1 kg/ha.
- At Jammu, fifty frontline demonstrations were conducted in three different locations under the SCSP program for weed management in wheat; the herbicidal combination of clodinafop-propargyl + metsulfuron 60+4 g/ha applied at 30-35 DAS resulted in wheat yield increases of 3% to 10 % at the respective locations as compared to the farmer's practice of using metribuzin 200 g/ha at 30-35 DAS.
- At Coimbatore, front line demonstrations were conducted in Kodo millet and Foxtail millet; the application of metsulfuron methyl + chlorimuron methyl 20% WP @ 4 g/ha was recorded as savings in weeding cost over farmers' practice.

1. ORGANIZATION AND FUNCTIONING

1.1 Introduction

The All India Coordinated Research Project on Weed Management was launched in April,1978 by the ICAR in collaboration with the United States Department of Agriculture (USDA) at six locations, Punjab Agricultural University, Ludhiana (Punjab); University of Agricultural Sciences, Bengaluru (Karnataka); Indian Institute of Technology, Kharagpur (West Bengal); Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.); Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (U.P.); and Himachal Pradesh Krishi Vishwa Vidyalaya, Palampur (H.P.). The initial financial outlay of Rs. 42.97 lakhs for five years. The tenure of the project was, however, extended for one more year till March, 1984 with the savings. Further work was continued at these centres with the AP Cess fund of ICAR till the implementation of VII Plan in April, 1986.

The activities of the project were extended covering 7 more cooperating centres, Assam Agricultural University, Jorhat (Assam); Marathwada Agricultural University, Parbhani (Maharashtra); Gujarat Agricultural University, Anand (Gujarat); Narendra Dev University of Agriculture and Technology, Faizabad (U.P.); Indian Institute of Horticultural Research, Bengaluru (Karnataka); Indian Grassland and Fodder Research Institute, Jhansi (U.P.) and Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) through a fresh negotiation between ICAR and FERRO, USDA with a sanctioned outlay of Rs 58.10 lakhs for five years. The work at these centres was effectively implemented from 1982-83 to 1986-87.

In the third phase, 9 more centres, Birsa Agricultural University, Ranchi (Bihar); Haryana Agricultural University, Hisar (Haryana); Vishwa Bharati, Sriniketan (W.B.); Rajendra Agricultural University, Pusa (Bihar); Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.); Kerala Agricultural University, Thrissur (Kerala); Orissa University of Agriculture and Technology, Bhubaneswar (Orissa); Acharya N.G. Ranga Agricultural University, Hyderabad (Andhra Pradesh) and ICAR Research Complex, Barapani (Meghalaya) were initiated at total outlay of Rs. 63.85 lakhs for four years (1985-86 to 1989-90) with the assistance of USDA under USIF funds. In the VIII Plan, 4 new centres, Rajasthan Agricultural University, Bikaner; Indira Gandhi Krishi Vishva Vidyalaya, Raipur; Konkan Krishi Vidhya Peeth, Dapoli and University of Agricultural Sciences, Dharwad were initiated with total outlay of 16.41 lakhs. Seventy five percent of the total budget required by each centre was provided by the ICAR and the remaining 25% was met from the state department of agriculture as a state share. There was however, 100% funding by the ICAR to Visva Bharati, Sriniketan.

During IX Plan (1997-2002), X Plan (2002-2007), XI plan (2007-2012) and XII plan (2012-17) the total expenditure incurred under AICRP-WM was Rs. 823.79, 1696.57, 3548.78 lakhs and 4007.26 lakhs, respectively. During XII Plan (2012-17), four AICRP on Weed Management centres, University of Agricultural Sciences, Dharwad; Chandra Shekhar Azad University of Agriculture & Technology, Kanpur; Swami Keshwanand Rajasthan Agricultural University, Bikaner, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani and Visva-Bharati, Sriniketan were closed and new centers at Maharana Pratap University of Agriculture and Technology, Udaipur; University of Agricultural Sciences, Raichur; Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola; Bidhan Chandra Krishi Viswavidyalaya, Kalyani; Sher-eKashmir University of Agricultural Sciences and Technology, Jammu and Central Agricultural University, Pasighat by redeployment of existing manpower were opened. As per the approval of SFC (2017-20), another six coordinating centres (NDUAT, Faizabad; CAU, Pasighat; RAU, Pusa; BAU, Ranchi; DBSKKV, Dapoli and UAS, Raichur) were closed w.e.f. 1.4.2018.

The coordinating unit of the project was located initially at Central Rice Research Institute, Cuttack, and shifted to National Research Centre for Weed Science in 1989. Later in 2009, NRC for

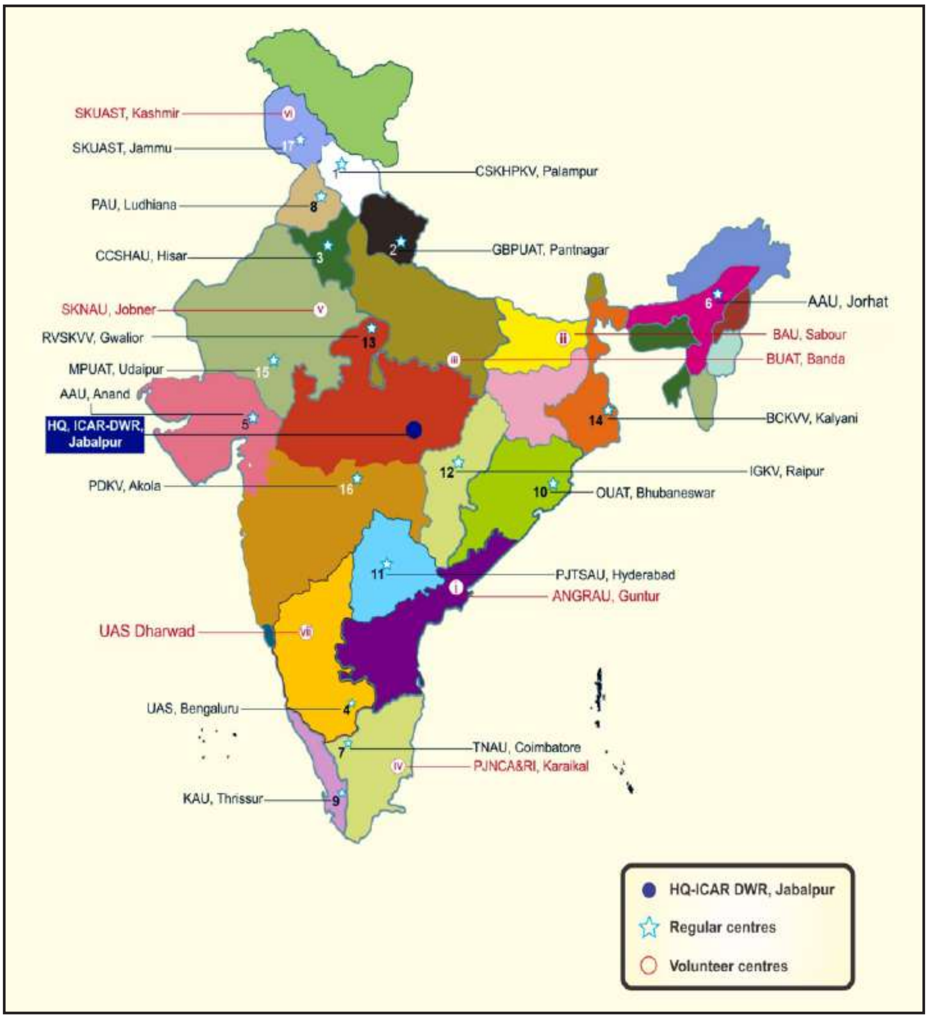
Weed Science was upgraded to Directorate of Weed Science Research. During XII Plan (2012-17), it has renamed as "Directorate of Weed Research" and "AICRP on Weed Control" was renamed as "AICRP on Weed Management"

1.2 Mandate

- To conduct location-specific research for developing appropriate weeds management technologies.
- To demonstrate the weed management technologies through on-farm adaptive trials.

1.3 Objectives

- To work out effective and economic weed management modules for field and horticultural crops, in non-crop and aquatic situations.
- To study the long-term residual and cumulative effect of herbicides, if any.
- To evaluate new herbicides and working out the residual effect on non-targeted organisms.
- To study biology and control of problem weeds including aquatic and parasitic weeds.
- To analyze herbicide residues in soil, water and food chain.
- To test available tools/ implements for weed management under various agro-ecosystems.
- To transfer weed management technologies on farmers' fields through OFT and FLDs, their impact assessment and training.



AICRP-WM Regular Centres

01	CSKHPKV, Palampur
02	GBPUAT, Pantnagar
03	CCSHAU, Hisar
04	UAS, Bengaluru
05	AAU, Anand
06	AAU, Jorhat
07	TNAU, Coimbatore
08	PAU, Ludhiana
09	KAU, Thrissur
10	OUAT, Bhubaneswar
11	PJTSAU, Hyderabad
12	IGKV, Raipur
13	RVSKVV, Gwalior
14	BCKVV, Kalyani
15	MPUAT, Udaipur
16	PDKV, Akola
17	SKUAST, Jammu

Volunteer Centres

i	ANGRAU, Guntur
ii	BAU, Sabour
iii	BUAT, Banda
iv	PJNCA&RI, Karaikal
v	SKNAU, Jobner
vi	SKUAST, Kashmir
vii	UAS, Dharwad

2. STAFF POSITION AND EXPENDITURE

AICRP on Weed Management is presently under operation in 17 State Agricultural Universities in 17 different states of the country and represent diverse agro-ecological regions. Altogether, 34 scientific posts comprising Agronomy, Residue Chemistry and Taxonomy have been sanctioned. Besides 17 regular centres, 07 volunteer centres are also in operation. The details of staff position and funds allocated in the financial year 2024-25 are given below:

Staff position at different coordinating centres during 2024-25

Centre	Scientific		Technical		Driver	
	Sanctioned	Filled	Sanctioned	Filled	Sanctioned	Filled
PAU, Ludhiana	2	2	1	1	-	-
UAS, Bengaluru	2	2	1	1	1	1
RVSKVV, Gwalior	2	2	1	1	-	-
GBPUAT, Pantnagar	2	2	1	1	-	-
CSKHPKV, Palampur	2	1	1	-	1	1
AAU, Jorhat	2	2	1	1	1	1
AAU, Anand	2	2	1	1	1	1
TNAU, Coimbatore	2	2	1	1	1	1
KAU, Thrissur	2	2	1	-	1	-
OUAT, Bhubaneshwar	2	2	1	1	1	1
PJTSAU, Hyderabad	2	2	1	-	1	1
CCSHAU, Hisar	2	2	1	-	-	-
IGKVV, Raipur	2	2	1	1	-	-
PDKV, Akola	2	1	1	1	-	-
MPUAT, Udaipur	2	1	1	-	-	-
SKUAST, Jammu	2	2	1	1	-	-
BCKV, Kalyani	2	2	1	1	-	-
Total	**34**	**31**	**17**	**12**	**08**	**07**

Funds released to the regular coordinating centres during the financial year 2024-25

Sl. No.	Centre Name	ICAR Share
1.	PAU, Ludhiana	47.68
2.	UAS, Bengaluru	66.79
3.	RVSKVV, Gwalior	53.82
4.	GBPUAT, Pantnagar	62.29
5.	CSKHPKV, Palampur	31.36
6.	AAU, Jorhat	69.05
7.	AAU, Anand	43.49
8.	TNAU, Coimbatore	60.25
9.	KAU, Thrissur	39.09
10.	OUAT, Bhubaneshwar	58.10
11.	PJTSAU, Hyderabad	69.15
12.	CCSHAU, Hisar	37.00
13.	IGKV, Raipur	44.25
14.	PDKV, Akola	36.68
15.	BCKV, Kalyani	28.06
16.	MPUAT, Udaipur	42.89
17.	SKUAST, Jammu	51.97
18.	PC Unit, Jabalpur	5.69
	Total	**847.61**

3. RESEARCH ACHIEVEMENTS

WP 1 Development of location-specific sustainable weed management practices

WP 1.1 Weed management in major crops and cropping systems

WP 1.1.1. Sustainable management of major weeds in dry direct-seeded rice (DSR)

Network Centres: CSKHPKV Palampur, CCSHAU Hisar, OUAT Bhubaneswar, UAS Bengaluru, BCKV Kalyani, GBPUAT Pantnagar, AAU Anand, PAJANCOA & RI Puducherry, BAU Sabour, ICAR-DWR and BUAT Banda

Objectives:

1. To study the weed dynamics and productivity of rice influenced by weed management practices in dry DSR.
2. To determine bio-efficacy of herbicide combinations for managing major weeds in dry DSR.
3. To monitor weed flora shift as influenced by weed management practices.

Treatments:

1. Pendimethalin 38.4% w/w + pyrazo-sulfuron ethyl 0.85% w/w ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (25 DAS).
2. Pretilachlor 30.0% w/w + pyrazosulfuron-ethyl 0.75% w/w WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (25 DAS).
3. Pyrazosulfuron-ethyl 10% w/w WP 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (25 DAS).
4. Pendimethalin 38.4% w/w + pyrazo-sulfuron ethyl 0.85% w/w ZC 785 g/ha as PE *fb* bispyribac-sodium 10% w/w SC 25 g/ha + [(metsulfuron methyl 10% w/w + chlorimuron ethyl 10% w/w) (RM) WP] 4 g/ha (TM) as PoE (25 DAS) / Bispyribac-sodium 38% + chlorimuron ethyl 2.5%+ metsulfuron Methyl 2.5% (w/w) WG 43 (15.63+25) g/ha (RM) PoE (25 DAS).
5. Penoxsulam 1.0% w/w + pendimethalin 24.0% w/w SE (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 6.7% w/w EC 67g/ha + ethoxysulfuron 15% w/w WDG 18 g/ha (Tank-mix) as PoE (25 DAS).
6. Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (18-20 DAS).
7. Bispyribac-sodium 38% w/w+chlorimuron-ethyl 2.5% w/w+metsulfuron-methyl 2.5% WG (RM) 43 g/ha as PoE (18-20 DAS).
8. Partially weedy check.

Experimental details:

Design: RBD, Replication: Three

CSKHPKV, Palampur

The major weeds that were found in this experiment on dry direct seeded rice included *Echinochloa colona* (23%), *Cyperus* spp. (19%), *Ageratum conyzoides* (12%), *Digitaria sanguinalis* (11%), *Panicum spp.* (11%), *Eleusine indica* (9%), *Aeschynomene indica* (6%) and *Commelina benghalensis* (9%).

Application of pendimethalin + pyrazosulfuron (RM) as PE followed by florpyrauxifen-benzyl + cyhalofop-butyl (RM) as PoE recorded significantly lower weed dry weight of most of the weeds and total dry weight. Significantly higher grain yield (3.25 t/ha) was recorded with the application of pendimethalin + pyrazosulfuron (RM) as PE followed by florpyrauxifen-benzyl + cyhalofop-butyl (RM) as PoE. This weed management treatment also recorded highest economic returns (Net returns of Rs 53,500/ha and BC ratio of 1.42) (**Table 1.1.1**).

The treratment pendimethalin + pyrazosulfuron (RM) as PE followed by florpyrauxifen-benzyl + cyhalofop-butyl (RM) as PoE was very much effective in controlling diverse weed flora resulted in highest grain yield and economic returns.

Table 1.1.1. Effect of weed management treatments on grain yield and economics of dry direct seeded rice.

Treatments	Dose (g /ha)	Grain yield (t/ha)	Net returns (Rs./ha)	BC ratio
Pendimethalin + pyrazosulfuron (RM) *fb* florpyrauxifen -benzyl + cyhalofop -butyl (RM)	785 *fb* 150	3.25	53,500	1.42
Pretilachlor + pyrazosulfuron ethyl (RM) *fb* florpyrauxifen -benzyl + cyhalofop -butyl (RM)	615 *fb* 150	2.96	45,100	1.17
Pyrazosulfuron ethyl *fb* florpyrauxifen -benzyl + cyhalofop -butyl (RM)	22.5 *fb* 150	2.50	34000	0.92
Pendimethalin + pyrazosulfuron (RM) *fb* bispyribac - sodium + [(metsulfuron methyl chlorimuron ethyl) (RM)]	785 *fb* 43	3.04	49,500	1.36
Penoxsulam + pendimethalin (RM)*fb* fenoxaprop + ethoxysulfuron (Tank -mix)	625 *fb* 67+18	3.12	46,900	1.15
Florpyrauxifen -benzyl + cyhalofop -butyl	150	2.28	29,000	0.82
Bispyribac Sodium + chlorimuron ethyl + metsulfuron methyl (RM)	43	2.36	32,700	0.95
Partially weedy check	-	1.36	7,600	0.24
SEm±	-	0.14		
LSD (P=0.05)	-	0.44		

CCSHAU, Hisar

Major weed flora recorded in the experiment were *Echinichloa crus-galli, E. colona, Leptochloa chinensis, Dactyloctenium aegyptium* and *Cyperus* spp.

Minimum dry weight of weeds was recorded in penoxsulam + pendimethalin (RM) as PE *fb* fenoxaprop-ethyl + ethoxysulfuron (Tank-mix) as PoE, which was statistically at par with pendimethalin + pyrazosulfuron-ethyl as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl as PoE. Significantly higher grain yield (5.14 t/ha) was recorded by the treatment penoxsulam + pendimethalin (RM) as PE *fb* fenoxaprop-ethyl + ethoxysulfuron (Tank-mix) as PoE, which was statistically at par with pendimethalin + pyrazosulfuron-ethyl as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl as PoE (5.03 t/ha).

The weed management treatments penoxsulam + pendimethalin (RM) as PE *fb* fenoxaprop-ethyl + ethoxysulfuron (Tank-mix) as PoE and pendimethalin + pyrazosulfuron ethyl (RM) as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl as PoE (5.03 t/ha) were found effective in controlling diverse weed flora in dry DSR.

OUAT, Bhubaneswar

The floristic composition of the experimental site was dominated with grasses like *Digitaria ciliaris, Cynodon dactylon, Echinochloa colona* and broadleaf weeds like *Ageratum conyzoides, Cleome viscosa, Celosia argentia Oldenlandia corymbosa, Ludwigia parviflora, Physalis minima* and *Amaranthus viridis*. The dominant sedges recorded were *Cyperus rotundus* and *Cyperus iria*. Other weeds recorded in lower density were *Panicum repens, Sporobolus diander, Alternanthera sessilis, Eclipta alba*.

Among the weed management treatments pyrazosulfuron-ethyl as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl as PoE recorded lowest total weed dry weight, weed index and highest grain yield (4.3 t/ha) closely followed by the treatment pendimethalin + pyrazo-sulfuron-ethyl as PE *fb* florpyrauxifen- benzyl + cyhalofop-butyl as PoE (3.9 t/ha)). Partially weedy check treatment recorded the lowest grain yield of 2.5 t/ha (**Table 1.1.2**).

The weed management treatments pyrazosulfuron-ethyl as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl as PoE and pendimethalin + pyrazosulfuron-ethyl as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl were found effective in managing diverse weed flora in dry DSR.

Table 1.1.2. Effect of weed management treatments on weed control efficiency, grain yield, weed index and economics of dry DSR.

Treatment	Weed control efficiency (%)		Grain yield (t/ha)	Weed Index (%)	Net returns (Rs./ha)	BC ratio
	40 DAS	60 DAS				
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE	85	59	3.9	5.11	33,870	2.65
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha as PE *fb* Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC @ 150 g/ha as PoE	65	48	3.4	13.58	30,019	2.38
Pyrazosulfuron ethyl 22.5 g/ha as PE *fb* Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE	87	62	4.3	0.00	35,276	2.76
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* Bispyribac Sodium 38% + chlorimuron ethyl 2.5%+ Metsulfuron methyl 2.5% (w/w) WG 15.63+25 g/ha (Ready-mix) as PoE	76	54	3.7	7.94	31,186	2.44
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* Fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS)	75	51	3.5	11.29	30,674	2.40
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (18-20 DAS).	49	41	2.7	25.40	21,712	2.09
Bispyribac sodium + chlorimuron ethyl + metsulfuron methyl (RM) 43 g/ha as PoE (18-20 DAS).	62	47	3.2	18.34	26,524	2.31
Partially weedy check	85	0.0	2.5	29.10	8,909	1.01
SEm±			0.3	-		
LSD (P=0.05)			0.82	-		

UAS, Bengaluru

The weed flora observed in the experimental plots were sedges – *Cyperus rotundus*, grasses – *Digitaria marginata* and *Eleusine indica*. In broadleaf weeds – *Borreria hispida, Ageratum conyzoides, Commelina benghalensis, Acyranthus aspera, Celosia argentea, Oldenlandia corymbosa* and *Argemone mexicana* were the dominant weed species. Among the total weed density broadleaf weeds dominated the weed flora followed by grasses and sedges.

Among the weed management treatments, penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67 g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE recorded weed control efficiency of

83.04, 86.39 and and 75.76% at 20, 40 and 60 DAS, respectively, which was comparable with pendimethalin + pyrazosulfuron ethyl (RM) 785 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE (25 DAS). The treatment pendimethalin + pyrazosulfuron ethyl (RM) 785 g/ha as PE fb florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE recrded highest grain yield of 4.21 t/ha and highest economic returns (Net returns of Rs 90,000/ha and BC ratio of 2.5) (**Table 1.1.3**)

The weed management treatment pendimethalin + pyrazosulfuron ethyl (RM) 785 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE (25 DAS) has been recorded as best treatment for controlling diverse weed flora and obtaining higher grain yield and net returns. This weed management treatment did not show phytotoxicity on the rice plants.

Table 1.1.3. Effect of weed management treatments on weed control efficiency, grain yield and economics of dry DSR.

Treatments	Weed control efficiency (%)		Grain yield (t/ha)	Net returns (Rs./ha)	B:C
	40 DAS	60 DAS			
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalof op-butyl 10.64% w/w EC 150 g/ha PoE (25 DAS)	86.15	76.96	4.21	90,000	2.5
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha PoE (25 DAS).	85.55	76.21	4.18	85,966	2.2
Pyrazosulfuron ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha PoE (25 DAS).	84.60	73.43	4.11	83,806	2.1
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* bispyribac-sodium 25 g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (TM) as PoE (25 DAS)	84.93	75.25	4.06	82,138	2.1
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS).	86.39	75.76	4.10	80,231	1.9
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha PoE (19 DAS).	69.54	58.80	3.69	71,866	1.9
Bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (TM) 43 g/ha as PoE (19 DAS).	70.64	55.51	3.76	77,100	2.2
Partially weedy check (Hand weeding at 60 DAS)	-	-	2.65	42,866	1.2
SEm +			0.31		
LSD (P=0.05)			0.93		

Pendimethalin 38.4% w/w+ pyrazosulfuron-ethyl 0.85% w/w ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (25 DAS)

Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (19 DAS)

Partially weedy check (Hand weeding at 60 DAS)

GBPUAT, Pantnagar

The experimental plots were dominated by *Eleusine indica, Digitaria sanguinalis, Dactyloctenium aegyptium, Phyllanthus niruri, Trianthema monogyna, Mollugo pentaphylla, Parthenium hysterophorus* and *Cyperus rotundus*.

Among the different weed management treatments, pretilachlor + pyrazosulfuron-ethyl (RM) 615 g/ha PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha PoE (25 DAS) and pyrazosulfuron-ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha PoE (25 DAS) completely controlled all the grasses & sedges. The highest grain yield (5.1 t/ha), highest net returns (Rs. 90904/ha) and benefit-cost ratio (3.0) were recorded with pretilachlor + pyrazosulfuron-ethyl (RM) 615 g/ha PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha PoE (25 DAS) closely followed by pyrazosulfuron-ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM)150 g/ha PoE (25 DAS) (Grain yield of 4.7 t/ha, net returns of Rs 83,069/ha and BC ratio of 2.86) (**Table 1.1.4**).

Among the weed management treatments, pretilachlor + pyrazosulfuron-ethyl (RM) 615 g/ha PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha PoE (25 DAS) and pyrazosulfuron-ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha PoE (25 DAS) have been found effective for controlling diverse weed flora in dry DSR without showing phytotoxicity on the rice plants.

Table 1.1.4. Effect of weed management treatments on weed control efficiency, grain yield and economics of dry DSR.

Treatments	Weed control efficiency (%)		Grain yield	Net returns	B:C
	40 DAS	60 DAS	(t/ha)	(Rs./ha)	
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS)	94.0	100.0	4.4	73,474	2.64
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	91.5	100.0	5.1	90,904	3.00
Pyrazosulfuron ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	85.0	78.2	4.7	83,069	2.86
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* bispyribac-sodium 25 g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (TM) as PoE (25 DAS)	87.2	73.5	3.7	59,806	2.43
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS).	98.6	99.3	3.4	46,455	2.04
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (18-20 DAS).	80.4	74.8	2.7	30,428	1.69
Bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (TM) 43 g/ha as PoE (18-20 DAS).	54.1	48.3	1.8	7,922	1.19
Weedy check	0.00	-	0.5	-24,925	0.36
SEm+			0.29		
LSD (P=0.05)			0.88		

Pretilachlor 30.0% w/w + pyrazosulfuron-ethyl 0.75% w/w WG 615 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).

Weedy check

AAU, Anand

From the experimentation, it was noticed that *Echinochloa crus-galli* (7.59%), *Digitaria sanguinalis* (6.33%), *Dactyloctenium aegyptium* (6.33%) and *Leptochloa chinensis* (3.80%) as monocot weed while *Phyllanthus niruri* (51.9%), *Digera arvensis* (13.9%), *Trianthema monogyna* (2.53%) and *Boerhavia erecta* (1.90%) as dicot weeds dominated in the field.

Among the weed management treatments, pendimethalin + pyrazosulfuron-ethyl (RM) 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (RM) 43 g/ha as PoE (25 DAS) recorded higher values of weed control efficiency and grain yield (4.63 t/ha) followed by pendimethalin + pyrazosulfuron-ethyl (RM) 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron- methyl (RM) 43 g/ha PoE (25 DAS) (4.53 t/ha) and florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE (18-20 DAS) (4.44 t/ha). Maximum net returns (Rs. 64,080/ha) was recorded under application of pendimethalin + pyrazosulfuron-ethyl (RM) 785 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE (25 DAS). However, higher benefit-cost ratio (2.17) was observed under florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE (18-20 DAS) followed by pendimethalin + pyrazosulfuron ethyl (RM) 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (RM) 43 g/ha as PoE (25 DAS) (2.13) (**Table 1.1.5**).

Among the weed management treatments, Pendimethalin + pyrazosulfuron ethyl (RM) 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (RM) 43 g/ha as PoE (25 DAS) and pendimethalin + pyrazosulfuron-ethyl (RM) 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (RM) 43 g/ha as PoE (25 DAS) has been found effective in controlling weeds. Only post-emergence application of florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (18-20 DAS) was equally effective in controlling weeds and obtaining higher economic returns.

Table 1.1.5. Effect of weed management treatments on weed control efficiency, grain yield, weed index and economics of dry DSR.

Treatments	Weed control efficiency (%)		Grain yield	Weed index (%)	Net returns	B:C
	40 DAS	60 DAS	(t/ha)		(Rs./ha)	
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS)	84.2	69.9	4.63	0.00	64,080	2.10
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	80.2	56.9	2.77	40.2	15,829	1.27
Pyrazo sulfuron ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	67.2	35.8	2.50	46.0	10,666	1.19
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC (RM) 785 g/ha as PE *fb* bispyribac-sodium 38% + chlorimuron ethyl 2.5%+ metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (25 DAS)	87.0	75.4	4.53	2.16	62,991	2.13
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS).	84.5	84.9	4.08	11.9	49,010	1.82

Table contd.

Florpyrauxifen-benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha as PoE (18 -20 DAS).	86.2	75.9	4.44	4.10	63,745	2.17
Bispyribac -sodium + chlorimuron-ethyl + metsulfuron-methyl (RM) 43 g/ha as PoE (18-20 DAS).	70.3	55.7	2.56	44.7	16,517	1.32
Partially weedy check	0.00	0.00	1.14	75.4	-16253	0.66
SEm +			**0.34**			
LSD (P=0.05)			**1.03**			

PAJANCOA & RI, Puducherry

Experimental field was completely dominated by grasses. Predominant weeds of the experimental field were *Echinochloa colona* Link. (84%), *Digitaria marginata* Stapf, *Panicum repens* L., *Digitaria ciliaris* (Retz.) Koeler and *Cyperus iria* L.

Major findings

Sequential application of penoxsulam + pendimethalin 625 g/ha as PE *fb* fenoxaprop-ethyl 67 g/ha + ethoxysulfuron 18 g/ha as PoE (25-30 DAS) recorded lower total weed density (34.0 no./m^2), resulted in higher grain yield (3.32 t/ha). Further, it was found on par with pendimethalin+ pyrazosulfuron-ethyl 785 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (3.22 t/ha). Unweeded control recorded higher total weed density (356 no./m^2) and resulted in lower rice yield (0.76 t/ha) with maximum yield loss of 77.2%.

Sequential application of penoxsulam + pendimethalin 625 g/ha as PE *fb* fenoxaprop-ethyl 67 g/ha + ethoxysulfuron 18 g/ha as PoE (25-30 DAS) and pendimethalin+ pyrazosulfuron-ethyl 785 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE recorded lower total weed density, resulted in higher grain yield in dry direct-seeded rice.

Pendimethalin + pyrazosulfuron-ethyl at 785 g/ha as PE *fb* florprauxifen-benzyl + cyhalofop-butyl at 150 g/ha as PoE

Pendimethalin + pyrazosulfuron-ethyl at 785 g/ha as PE *fb* florprauxifen-benzyl + cyhalofop-butyl at 150 g/ha as PoE

Weedy check

BAU, Sabour

During *kharif* 2024, the main weed flora recorded in the experimental plots were *Echinochloa colona, Echinochloa crusgalli, Eleusine indica, Cynodon dactylon, Digitaria sanguinalis* among grasses, *Cyperus rotundus, Cyperus iria, Cyperus difformis, Fimbristylis miliaceae* among sedges, *Alternanthera sessilis, Caesulia axillaris, Ludwigia parviflora, Eclipta alba, Phyllanthus niruri, Amaranthus viridis, Physalis minima, Commelina benghalensis* among broadleaf weeds.

Among the weed management treatments, highest weed control efficiency, highest grain yield (4.27 t/ha) and highest economic returns (highest net returns of Rs. 59344/ha and B:C of 1.53) were recorded by pretilachlor + pyrazosulfuron-ethyl 615 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 150 g/ha as PoE (25 DAS) (**Table 1.1.6**).

Pretilachlor + pyrazosulfuron-ethyl 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 150 g/ha PoE (25 DAS) has been recorded as best weed management treatment for controlling diverse weed flora and obtaining highest grain yield, and economic returns.

Table 1.1.6. Effect of weed management treatments on weed control efficiency, grain yield and economics of dry DSR.

Herbicides	Weed control efficiency (%)		Grain yield (t/ha)	Net returns (Rs./ha)	BC ratio
	40 DAS	60 DAS			
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* florpyrauxifenbenzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	80.6	77.4	4.13	57,229	1.52
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	91.9	90.1	4.27	59,344	1.53
Pyrazosulfuron ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	79.9	77.0	4.02	51,602	1.26
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* bispyribac -sodium 25 g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (TM) as PoE (25 DAS).	89.1	85.9	4.21	57,372	1.45
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS).	85.7	83.7	4.18	54,210	1.29
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (18-20 DAS).	68.7	66.8	3.53	42,462	1.10
Bispyribac-sodium + chlorimuron ethyl + metsulfuron methyl (RM) 43 g/ha as PoE (18-20 DAS).	62.4	61.4	3.49	40,326	1.01
Partially weedy check (1HW at 60 DAS)	0.0	0.0	2.18	11,844	0.31
SEm±			0.29		
LSD (P=0.05)			0.91		

BUAT, Banda

The experimental field was infested with several grasses, broadleaf and sedge weeds. The major weeds species were *Brachiaria reptans, Echinochloa crus-galli, Digera arvensis, Phyllanthus niruri, Cyperus rotundus.* etc. At 20 DAS only few grassy weeds, broadleaf and sedge weeds were recorded; however, at 40 DAS and 60 DAS a greater number of grassy as well as broadleaf weeds were registered. Weed population increased with advancement of crop stage.

At 40 DAS, higher weed control efficiency was recorded in the treatment pendimethalin + pyrazosulfuron-ethyl 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl 43 (15.63+25) g/ha (RM) as PoE (25 DAS). However, penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS) significantly reduced the weed dry weight at 60 DAS resulted in maximum weed control efficiency of 63.7%, maximum grain yield of 3.95 t/ha and highest CBR of 2.64.

Among the weed management treatments, penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS) has been recorded as effective weed management treatment for controlling weeds in dry DSR. Visual phytotoxic effect on crop was observed in the plots treated with florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE applied

ICAR-DWR, Jabalpur

Experimental plots in partially weedy control treatment were dominated by *Eleusine indica* (30.7%), *Dinebra retroflexa* (22.8%), *Alternanthera paronychioides* (18.0%), *Echinochloa colona* (14.0%) and *Cyperus iria* (10.0%) at 40 DAS. However, at 60 DAS, weeds were dominated by *Dinebra retroflexa* (30.2%) followed by *Eleusine indica* (24.8%), *Alternanthera paronychioides* (16.6%), *Echinochloa colona* (14.1%) and *Cyperus iria* (7.3%). The results revealed late emergence of *Dinebra retroflexa* and complete dominance of grasses in the experimental field. Percent contribution of the

Table 1.1.7. Effect of weed management treatments on weed control efficiency, grain yield, weed index and economics of dry DSR.

Treatment	Weed control efficiency (%)			Grain yield (t/ha)	Weed index (%)	Net returns (Rs./ha)	BC ratio
	20 DAS	40 DAS	60 DAS				
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* florpyrauxifen- benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS)	89.2	86.1	66.5	3.52	2.9	44274	1.85
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS)	83.7	84.0	62.7	3.42	5.8	43005	1.85
Pyrazosulfuron ethyl 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS)	82.4	79.8	59.7	3.07	15.3	35306	1.72

Table contd...

Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* bispyribac-sodium 25 g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (TM) as PoE (25 DAS)	89.7	79.0	55.5	2.77	23.6	28971	1.60
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS).	84.7	88.2	71.0	3.63	0.0	47232	1.93
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (18-20 DAS).	0.0	75.9	51.5	2.30	36.5	17420	1.37
Bispyribac-sodium 25 g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (TM) as PoE (18-20DAS)	0.0	66.2	45.9	2.18	39.8	17764	1.40
Partially weedy check	0.0	0.0	0.0	3.20	91.3	-30408	0.28
LSD (P=0.05)				1.983			

individual weed was measured on dry weight basis.

Among the weed management treatments, pre-emergence treatment of pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha recorded highest weed control efficiency values at 20 DAS. Among the post-emergence treatments, fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) applied at 25 DAS recorded highest weed control efficiency values at 60 DAS. This indicated that tank-mix application of fenoxaprop-ethyl + ethoxysulfuron effectively control the grasses and sedges. The maximum grain yield of 3.63 t/ha, net returns of Rs.47,232/ha and BC ratio of 1.93 were recorded by the treatment penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS). Highest weed index value of 91.3% recorded in partially weedy control treatment indicated aggressive growth of the diverse weed flora and that resulted in 91.3% yield reduction due to crop-weed competition (**Table 1.1.7**).

Sequential application of penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67 g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25 DAS) controlled the weeds effectively and recorded maximum grain yield (3.63 t/ha) and net returns (Rs. 47,232/ha).

Pendimethalin 38.4% w/w+ pyrazosulfuron-ethyl 0.85% w/w ZC 785 g/ha as PE *fb* florpyrauxifen- benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).

Penoxsulam 1.0% w/w + pendimethalin 24.0% w/w SE (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 6.7% w/w EC 67g/ha + ethoxysulfuron 15% w/w WDG 18 g/ha (Tank-mix) as PoE (25 DAS).

Bispyribac-sodium 10% w/w SC 25 g/ha + [(metsulfuron-methyl 10% w/w + chlorimuron- ethyl 10% w/w WP (RM)] 4 g/ha (Tank-mix) as PoE (18-20 DAS)

Partially weedy check

WP 1.1.2. Weed management in puddled wet direct-seeded rice (DSR)

Network Centres: IGKV Raipur, OUAT Bhubaneswar, AAU Jorhat, BCKV Kalyani, TNAU Coimbatore and BAU Sabour

Objectives:

1. To study the weed dynamics and productivity of rice influenced by weed management practices in puddled wet DSR.
2. To determine bio-efficacy of herbicide combinations for managing major weeds and to find out suitable weed management practices for puddled wet DSR.
3. To monitor weed flora shift as influenced by weed management practices.

Treatments:

1. Pendimethalin 38.4% w/w + pyrazosulfuron ethyl 0.85% w/w ZC 785 g/ha as PE *fb* bispyribac-sodium 10% w/w SC 25 g/ha + [(metsulfuron-methyl 10% w/w + chlorimuron-ethyl 10% w/w WP (RM)] 4 g/ha (TM) as PoE (25-30 DAS)/bispyribac-sodium 38% w/w + chlorimuron ethyl 2.5% w/w + metsulfuron methyl 2.5% w/w WG 43 g/ha (RM) PoE (25-30 DAS).
2. Penoxsulam 1.0% w/w + pendimethalin 24.0% w/w SE (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 6.7% w/w EC 67g/ha + ethoxysulfuron 15% w/w WDG 18 g/ha (Tank-mix) as PoE (25-30 DAS).
3. Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (25-30 DAS).
4. Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).
5. Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS) *fb* mechanical weeding through ambika weeder/low land weeder/brush cutter with rotary attachment at 40 DAS.
6. Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* mechanical weeding through ambika weeder/low land weeder/brush cutter with rotary attachment at 30-35 DAS.
7. Mechanical weeding through ambika weeder/low land weeder/brush cutter with rotary attachment at 20 and 40 DAS.
8. Partially weedy check.

Sowing through drum seeder (direct paddy seeder) machine to place the pre-germinated seeds in rows immediately after puddling.

Experimental details:

Design: RBD, Replication: Three

IGKV, Raipur

Weed flora of the experimental field was comprised by *Echinochloa colona* and *Cyanotis axillaris* among monocots, *Cyperus iria* among sedges and *Alternanthera sessilis* among broadleaf weeds. Broadleaf weeds and sedges dominated the weed flora at all the growth stages compared to grasses and other weeds. Other weeds like *Brachiaria ramosa*, *Sporobolus diander*, *Ludwigia parviflora* etc. were also recorded in the experiment. *Cyanotis axillaris* and *Sporobolus diander,* being late *kharif* weeds, dominated the weed flora during maturity of the crop.

Among all the weed management options, lowest values of *Cyperus iria*, and *Cyanotis axillaris* and total weed density were recorded under pretilachlor + pyrazosulfuron-ethyl 615 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25 DAS) followed by pendimethalin + pyrazosulfuron-ethyl 785 g/ha as PE *fb* bispyribac-sodium 25 g/ha + (metsulfuron-methyl + chlorimuron ethyl) 4 g/ha as PoE (25-30 DAS) at 60 DAS. While, at later stages, application of florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25 DAS) *fb* mechanical weeding through ambika paddy weeder at 40 DAS controlled *Echinochloa colona* effectively compared to the other treatments. Highest grain yield (6.06 t/ha), net returns (Rs. 98941/ha) and B:C (3.4) were recorded under the treatment pretilachlor + pyrazosulfuron-ethyl 615 g/ha PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25 DAS). It was closely followed by pendimethalin + pyrazosulfuron- ethyl 785 g/ha as PE *fb* bispyribac-sodium 25 g/ha + (metsulfuron-methyl + chlorimuron-ethyl) 4 g/ha as PoE (Tank-mix) (25-30 DAS).

Pretilachlor + pyrazosulfuron- ethyl 615 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25 DAS) has been recorded as best weed management treatment in puddled wet direct-seeded rice.

OUAT, Bhubaneswar

The floristic composition of the experimental site was dominated with grasses like *Digitaria ciliaris, Cynodon dactylon, Echinochloa colona* and broadleaf weeds like *Ageratum conyzoides, Cleome viscosa, Celosia argentea Oldenlandia corymbosa, Ludwigia parviflora, Physalis minima* and *Amaranthus viridis.* The dominant sedges, recorded in the experiment, were *Cyperus rotundus* and *Cyperus iria*. Other weeds, recorded in lower density, were *Panicum repens, Sporobolus diander, Alternanthera sessilis* and *Eclipta alba.*

Among different herbicide combinations, application of pendimethalin + pyrazosulfuron-ethyl 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl 43 g/ha (RM) PoE (25-30 DAS) recorded highest values of weed control efficiency closely followed by pretilachlor + pyrazosulfuron- ethyl 615 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25-30 DAS) and florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25 DAS). Significantly higher grain yield of 4.5 t/ha, highest net returns and benefit-cost ratio of 2.87 was obtained with the sequential application of pendimethalin + pyrazosulfuron-ethyl 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl 43 g/ha (RM) as PoE (25-30 DAS).

Sequential application of pendimethalin + pyrazosulfuron ethyl (RM) 785 g/ha as PE *fb* bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl 43 g/ha (RM) as PoE (25-30 DAS) has been found effective in controlling complex weed flora in puddled wet direct-seeded rice.

BCKV, Kalyani

The dominant weeds recorded in the experiment were *Echinochloa colona, Leersia hexandra, Cynodon dactylon* among grassy weeds; *Cyperus iria, Cyperus difformis, Fimbristylis dichotoma* among sedges, *Alternanthera philoxeroides*, *Ludwigia octovalvis*, *Ammannia baccifera* and *Eclipta alba* etc. among broadleaf weeds.

Among the weed management treatments, highest values of weed control efficiency were recorded in pendimethalin + pyrazosulfuron ethyl 785 g/ha as PE *fb* bispyribac-sodium 25g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (Tank-mix) as PoE (25

DAS), with 85.65% at 40 DAS and 80.32% at 60 DAS. This treatment also recorded the highest grain yield of 3.85 t/ha, net returns of Rs. 50,276/ha and BC ratio of 1.68.

The treatment pendimethalin + pyrazosulfuron ethyl 785 g/ha as PE *fb* bispyribac-sodium 25g/ha + [(metsul-furon methyl + chlorimuron ethyl) (RM)] 4 g/ha (Tank-mix) as PoE (25 DAS) has emerged as effective weed management treatment for controlling diverse weed flora in puddled wet direct-seeded rice **(Table 1.1.8)**.

Table 1.1.8. Effect of weed control treatments on weed control efficiency, weed index, grain yield and economics of puddled wet direct-seeded rice.

Treatments	Weed control efficiency (%)		Weed Index (%)	Grain yield (t/ha)	Net returns (Rs./ha)	B:C
	DAS	DAS				
Pendimethalin 38.4% + pyrazosulfuronethyl0.85% ZC 785g/ha as PE *fb* bispyribac-sodium 25g/ha + [(metsulfuronmethyl + chlorimuronethyl) (RM)] 4g/ha as PoE (25-30 DAS)	85.65	80.32	00.00	3.85	50,276	1.68
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25-30 DAS).	79.88	71.92	8.57	3.52	45,338	1.66
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25-30 DAS).	83.44	73.58	6.23	3.61	44,850	1.62
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	21.29	21.38	22.86	2.97	21,915	1.29
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS) *fb* mechanical weeding through low land weeder with rotary attachment at 40 DAS.	29.75	64.03	11.95	3.39	32,198	1.40
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* mechanical weeding through low land weeder with rotary attachment at 30-35 DAS	37.25	68.87	15.58	3.25	24,786	1.30
Mechanical weeding through low land weeder with rotary attachment at 20 and 40 DAS.	27.42	52.07	17.66	3.17	27,294	1.36
Partially weedy check (1HW at 60 DAS).	0.00	0.00	33.00	2.58	23,468	1.37
SEm±				0.08		
LSD (P=0.05)				0.24		

BAU, Sabour

The major weeds recorded at the experimental site were *Echinochloa colona, Eleusine indica, Cynodon dactylon* among grasses, *Cyperus rotundus, Cyperus iria, Cyperus difformis, Fimbristylis miliaceae* among sedges, *Alternanthera sessilis, Caesulia axillaris, Ludwigia parviflora, Commelina benghalensis* among broadleaf weeds.

Among different weed management treatments, the highest weed control efficiency at 60 DAS (91.37%), highest grain yield (4.39 t/ha), and highest net returns (Rs.59,112/ha) were recorded under pretilachlor + pyrazosulfuron-ethyl 615 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25-30 DAS). However, highest B:C was recorded in pendimethalin + pyrazosulfuron-ethyl 785 g/ha as PE *fb* bispyribac-sodium 25g/ha + [(metsulfuronmethyl + chlorimuronethyl) (RM)] 4g/ha (TM) as PoE (25 DAS) (**Table 1.1.9**).

Among different weed management treatments, sequential application of pretilachlor + pyrazosulfuron- ethyl 615 g/ha as PE *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha as PoE (25-30 DAS) has been recorded as best treatment for controlling diverse weed flora and obtaining highest grain yield and net returns.

Table 1.1.9. Effect of weed control treatments on weed control efficiency, weed index, grain yield and economics of puddled wet DSR.

Treatments	Weed control efficiency(%)		Weed Index (%)	Grain yield (t/ha)	Net returns (Rs./ha)	B:C
	40 DAS	60 DAS				
Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* bispyribac-sodium 25 g/ha + [(metsulfuron methyl + chlorimuron ethyl) (RM)] 4 g/ha (TM) as PoE (25-30 DAS).	67.07	66.63	4.56	4.19	57609	1.49
Penoxsulam + pendimethalin (RM) 625 g/ha as PE *fb* fenoxaprop-ethyl 67g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25-30 DAS).	82.16	79.82	6.61	4.10	54434	1.37
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop -butyl 10.64% w/w EC 150 g/ha as PoE (25-30 DAS).	91.79	91.37	0.00	4.39	59112	1.41
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS).	66.04	62.95	9.79	3.96	50622	1.25
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as Po E (25 DAS) *fb* mechanical weeding through cono weeder at 40 DAS.	85.65	73.86	1.59	4.32	56430	1.31
Pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha as PE *fb* mechanical weeding through cono weeder at 30-35 DAS.	69.69	71.32	6.15	4.12	55032	1.39
Mechanical weeding through cono weeder at 20 and 40 DAS.	87.04	86.76	1.37	4.33	58646	1.43
Partially weedy check (1HW at 60 DAS).	0.00	0.00	47.38	2.31	13834	0.35
SEm±				0.30		
LSD (P=0.05)				0.92		

WP 1.1.3. Effect of irrigation timing after application of pre-emergence herbicide and weed management in dry direct-seeded rice

Network Centres: IGKV Raipur and OUAT, Bhubaneswar.

Objectives:

1. To study the weed dynamics and productivity of rice influenced by weed management practices in dry DSR.
2. To determine bio-efficacy of herbicide combinations for managing major weeds and to find out suitable weed management practices for dry DSR.
3. To monitor weed flora shift as influenced by combination of irrigation timing and weed management practices.

Treatments:

Main plot: Timing of irrigation after herbicide (Pretilachlor 30.0% w/w + pyrazosulfuron ethyl 0.75% w/w WG 615 g/ha as PE) application

1. IR 1: 1 day after application (DAA)
2. IR 2: 3 DAA
3. IR 3: 5 DAA
4. IR 4: Application of irrigation immediately after sowing *fb* immediate application of herbicide within 1 day after sowing

Sub-plot: Weed management with the application of post-emergence herbicides (PoE)

1. Fenoxaprop-ethyl 67 g/ha + ethoxysulfuron 18 g/ha (Tank-mix) as PoE (25-30 DAS) DAS).
2. Bispyribac-sodium + chlorimuron-ethyl + metsulfuron-methyl (RM) 43 g/ha as PoE

(25-30 DAS).

3. Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha PoE (25-30 DAS).
4. Partially weedy check.

Experimental details:

Design: Split-plot, Replications: Three

IGKV, Raipur

Weed flora of the experimental field were comprised by *Echinochloa colona* among grasses, *Cyperus iria* among sedges and *Alternanthera triandra* among broadleaf weeds. Broadleaf weeds and sedges dominated the weed flora at all the growth stages compared to grasses and other weeds. Other weeds like *Brachiaria ramosa, Sporobolus diander, Cyanotis axillaris, Commelina benghalensis, Ludwigia parviflora* etc. were also recorded less in number. *Cyanotis axillaris* and *Sporobolus diander,* being late *kharif* weeds, dominated the weed flora during maturity of crop.

Among the irrigation timings, weed control efficiency at 20, 30, 60 DAS, grain yield (5.69 t/ha) and net returns were significantly higher when irrigation was applied immediately after sowing *fb* immediate application of herbicide within 1 day after sowing. Irrigation 1 day after application (DAA) of herbicide was also found effective as compared to Irrigation at 3 and 4 DAA of herbicide. Whereas, among the weed management treatments with application of post-emergence herbicides, florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha as PoE (25-30 DAS) recorded significantly highest grain yield (6.27 t/ha), net returns (Rs. 97,865/ha) and benefit-cost ratio (**Table 1.1.10**).

Application of irrigation immediately after sowing *fb* immediate application of pretilachlor + pyrazosulfuron ethyl (RM) 615 g/ha within 1 day after sowing of rice (IR 4) followed by application of florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha as PoE (25-30 DAS) has been found as effective weed management practice for controlling diverse weed flora and obtaining highest grain yield and economic returns in dry DSR.

Table 1.1.10. Effect of timing of irrigation after pre-emergence herbicide application followed by post-emergence application of herbicide on weed control efficiency, grain yield and economics of dry DSR.

Treatments	Weed control efficiency (%)		Grain yield (t/ha)	Net returns (Rs./ha)	B:C
	30 DAS	60DAS			
(A) Main plot: Timing of irrigation after herbicide (Pretilachlor 30.0% + pyrazosulfuron- ethyl 0.75% WG 615 g/ha as PE) application					
IR1- Irrigation 1 Day after application (DAA) of herbicide (Pretilachlor 30.0%+pyrazosulfuron ethyl 0.75% WG 61 5 g/ha)	80.23	62.06	5.06	73,713	2.69
IR2-Irrigation 3 DAA of herbicide	55.60	50.22	4.59	62,851	2.44
IR3-Irrigation 5 DAA of herbicide	34.92	34.06	3.97	48,386	2.11
IR4-Application of irrigation immediately after sowing *fb* immediate application of herbicide within 1 day after sowing	85.90	70.13	5.69	88,429	3.02
SEm±			**0.12**		
LSD (P=0.05)			**0.41**		

Table contd....

(B) **Sub-plot: Weed management with the application of post-emergence herbicides (PoE)**					
W1-Fenoxaprop-ethyl 67 g/ha + ethoxysulfuron 18 g/ha (tank-mix) as PoE (25-30 DAS)	78.74	65.94	5.43	79,726	2.72
W2-Bispyribac sodium + chlorimuron ethyl + metsulfuron methyl (RM) 43 g/ha as PoE (25 -30 DAS)	85.59	71.75	5.52	81,810	2.77
W3-Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha as PoE (25 -30 DAS)	92.33	78.78	6.27	97,865	3.06
W4-Partially weedy check	-	-	2.09	4,821	1.11
SEm+			**0.15**		
LSD (P=0.05)			**0.44**		
Interaction			**S**		

WP 1.1.4. Drone based application of herbicides Comparative assessment of bio-efficacy of herbicides applied through drone and knapsack sprayer/power sprayer in different crops.

Network Centres: PJTSAU Hyderabad, IGKV Raipur, GBPUAT Pantnagar, PDKV Akola, TNAU Coimbatore, MPUAT Udaipur, RVSKVV Gwalior, SKUAST Jammu and ANGRAU Guntur

Objectives:

1. To study the bio-efficacy of herbicides applied through drone and knapsack sprayer in crops.
2. To study the effect of treatments on weeds and productivity of crops.

Note: In drone experiment the spay volume was 25 lit/ha for drone, and in knapsack sprayer 500 lit/ha (PE), 375 lit/ha (PoE/EPoE) and 250 lit/ha (Power sprayer). Spray height with drone was 2 m above the crop canopy. Drone experiment has been conducted in RBD with three replications.

PJTSAU, Hyderabad

Drone based application of herbicides in transplanted rice

Treatments:

Treatment	Dose	Time of application
Bispyribac sodium 10% SC applied with drone	25 g/ha	PoE (20-25 DAT)
Penoxsulam 1.02 % + cyhalofop-butyl 5.1% OD applied with drone	135 g/ha	PoE (20-25 DAT)
Triafamone 20% + ethoxysulfuron l0% WG applied with drone	66.5 g/ha	PoE (20-25 DAT)
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC applied with drone	150 g/ha	PoE (20-25 DAT)
Bispyribac sodium 10% SC applied with knapsack sprayer	25 g/ha	PoE (20-25 DAT)
Penoxsulam 1.02 % + cyhalofop-butyl 5.1% OD applied with knapsack sprayer	135 g/ha	PoE (20-25 DAT)
Triafamone 20% + ethoxysulfuron l0% WG applied with knapsack sprayer	66.5 g/ha	PoE (20-25 DAT)

Table contd....

Florpyrauxifen-benzyl 2.13% w/w + Cyhalofop-butyl10.64% w/w EC applied with knapsack sprayer	150 g/ha	PoE (20-25 DAT)
Weed free (2 HW at 20 and 40 DAS)		
Weedy check		

The experimental field was dominated by *Echinochloa colona, Ammannia baccifera, Paspalum scrobiculatum, Chloris barbata, Scirpus supinus.*

The weed control efficiency observed at 40 DAT ranged between 83.9% (bispyribac sodium with knapsack sprayer) to 98.2% (weed-free). Among the herbicides, highest weed control efficiency was recorded with triafamone + ethoxyslfuron followed by florpyrauxifen-benzyl + cyhalofop-butyl. Highest grain yield was recorded in weed-free treatment (6.5 t/ha) followed by triafamone + ethoxysulfuron with drone (6.1 t/ha) (Table 1.1.11).

Drone based application of triafamone + ethoxyslfuron (RM) 66.5 g/ha as PoE (20-25 DAT) has been found effective in controlling weeds and obtaining higher grain yield. The values of weed control efficiency were comparable between drone and knapsack spraying.

Table 1.1.11. Effect of herbicides applied through drone & knapsack sprayer on weed control efficiency and grain yield of transplanted rice

Treatment	Dose	Weed control efficiency (%)		Grain yield (t/ha)
		40 DAT	60 DAT	
Bispyribac sodium10% SC applied with drone	25 g/ha	76.9	93.3	5.84
Penoxsulam1.02% + cyhalofop-butyl 5.1% OD applied with drone	135 g/ha	79.7	92.6	5.90
Triafamone 20% + ethoxysulfuron l0%WG applied with drone	66.5 g/ha	95.3	93.3	6.07
Florpyrauxifen- benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC applied with drone	150 g/ha	91.7	91.9	5.67
Bispyribac sodium 10% SC applied with knapsack sprayer	25 g/ha	80.7	93.3	5.67
Penoxsulam1.02% + cyhalofop-butyl 5.1% OD applied with knapsack sprayer	135 g/ha	88.6	91.9	5.62
Triafamone 20%+ethoxysulfuron l0%WG applied with knapsack sprayer	66.5 g/ha	92.0	93.3	5.91
Florpyrauxifen-benzyl 2.13% w/w+cyhalofop-butyl 10.64% w/w EC applied with knapsack sprayer	150 g/ha	91.1	93.3	5.35
Weed-free (2 HW at 20 and 40 DAS)		97.4	98.7	6.53
Weedy check				2.39
SEm±				**0.17**
LSD (P=0.05)				**0.52**

Drone based application of herbicides in dry direct-seeded rice (DSR).
Treatments (Revised):

	Treatments
T_1	Penoxsulam 1.2% + cyhalofop-butyl 5.1% 135 g/ha with drone
T_2	Bispyribac sodium 38%+ chlorimuron ethyl 2.5%+ Metsulfuron methyl 2.5% (RM) 40 g/ha with drone
T_3	Florpyrauxifen-benzyl 1.31%+ penoxsulam 2.1% 40.63 g/ha with drone
T_4	Bispyribac sodium 10% 25g/ha with drone
T_5	Penoxsulam 1.2% + cyhalofop-butyl 5.1% 135g/ha spray with knapsack sprayer
T_6	Bispyribac sodium 38%+ chlorimuron ethyl 2.5%+ metsulfuron methyl 2.5% (RM) 40 g/hawith knapsack sprayer
T_7	Florpyrauxifen-benzyl 1.31%+penoxsulam 2.1% 40.63g/ha with knapsack sprayer
T_8	Bispyribac sodium 10% 25 g/ha with knapsack sprayer
T_9	Weed_free 2 HW at 20 and 40 DAS
T_{10}	Weedy check

There was no significant difference between drone and knapsack spray of four herbicide combinations tested for total weed density and total weed biomass at 25, 50, 75 and 100 DAS. However, weed control efficiency of drone-based application was higher over knapsack spray irrespective of herbicide used. On the other hand, efficacy of florpyrauxifen-benzyl 1.31% + penoxsulam 2.1% spray to reduce the total weed density and weed biomass was found better than other three herbicides. Florpyrauxifen-benzyl + penoxsulam (RM) sprayed either through drone or knapsack recorded comparable grain yield of 4.82 and 4.77 t/ha, respectively, and net returns over the others. Bispyribac- sodium 38%+ chlorimuron-ethyl 2.5%+ metsulfuron-methyl 2.5% with drone also recorded substantial grain yield (4.50 t/ha) over the knapsack sprayer. Bispyribac-sodium with knapsack sprayer produced the lowest yield and net returns among the herbicides.

Florpyrauxifen-benzyl 1.31% + penoxsulam 2.1% (RM) applied either through drone or knapsack sprayer recorded the comparable grain yield and economics.

GBPUAT, Pantnagar
Drone based application of herbicides in transplanted rice

Treatments	Dose (g/ha)	Time of application
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha drone spraying 25 lit/ha	150	PoE
Bispyribac-sodium 10% w/w SC 25 g/ha drone spraying 25 lit/ha	25	PoE
Penoxsulam 1.02 % w/w + cyhalofop-butyl 5.1% w/w OD (RM) 135 g/ha drone spraying 25 lit/ha	135	PoE
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/wEC (RM) 150 g/ha knapsack spraying 375 lit/ha	150	PoE

Table contd....

Bispyribac-sodium 10% SC 25 g/ha knapsack spraying 375 lit/ha	25	PoE
Penoxsulam 1.02 % w/w + cyhalofop-butyl 5.1% w/w OD (RM) 135 g/ha knapsack spraying 375 lit/ha	135	PoE
Weedy check	-	-

The major weed flora in the experiment was *Panicum maximum, Ammannia baccifera, Alternanthera sessilis, Cyperus iria* and *Eleocharis quinqueflora,*

At 20 DAT, among different weed management treatments, weed density of different weeds did not differ significantly except *Cyperus iria* and *Eleocharis quinqueflora*. However, weed dry weight at 20 DAT was found significantly influenced by different weed management treatments except *Caesulia axillaris* and *Eleocharis quinqueflora*.

Through drone application, at 40 DAT, florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha completely controlled all the weed species except *Panicum maximum* and *Ammannia baccifera* followed by bispyribac-sodium 25 g/ha and penoxsulam + cyhalofop-butyl (RM) 135 g/ha. Through knapsack sprayer, florpyrauxifen-benzyl + cyhalofop-butyl EC (RM) 150 g/ha performed better against rest of the treatments. At 60 DAT, florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha was completely controlled all the weed species except *Panicum maximum* and *Cyperus difformis*. Penoxsulam + cyhalofop-butyl (RM) 135 g/ha at 60 DAT also controlled all the weed species except *Panicum maximum*, *Alternanthera sessilis* and *Ammannia baccifera*. Similar pattern was also recorded in herbicides applied through knapsack sprayer. The highest grain yield of rice (5.3 t /ha) and net returns (Rs. 95,472/ha) were recorded under florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha through drone application followed by penoxsulam + cyhalofop-butyl (RM) 135 g/ha through drone application (**Table 1.1.12**).

Application of florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha through drone has been recorded as an effective weed management treatment for controlling weeds, and obtaining higher grain yield and net returns.

Table 1.1.12. Effect of ready-mix herbicides applied through drone and knapsack sprayer on weed control efficiency, grain yield and net returns in transplanted rice.

Treatments	Dose (g/ha)	Time of application	Weed control efficiency (%)		Grain yield (t/ha)	Net returns (Rs./ha)
			40 DAT	60 DAT		
Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha drone spraying 25 lit/ha	150	PoE	95.8	81.3	5.3	95472
Bispyribac-sodium 10% w/w SC 25 g/ha drone spraying 25 lit/ha	25	PoE	76.9	65.7	4.8	84196
Penoxsulam 1.02 % w/w + cyhalofop-butyl 5.1% w/w OD (RM) 135 g/ha drone spraying 25 lit/ha	135	PoE	87.5	85.5	5.2	94103

Table contd....

Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/wEC (RM) 150 g/ha knapsack spraying 375 lit/ha	150	PoE	83.0	63.8	4.8	80459
Bispyribac-sodium 10% w/w SC 25 g/ha knapsack spraying 375 lit/ha	25	PoE	40.3	79.5	4.7	82827
Penoxsulam 1.02 % w/w + cyhalofop-butyl 5.1% w/w OD (RM) 135 g/ha knapsack spraying 375 lit/ha	135	PoE	64.3	88.8	4.8	83512
Weedy check	-	-	0.0	0.0	2.9	36462
SEm±					0.19	
LSD (P=0.05)					0.58	

PDKV, Akola

Drone based application of herbicides in soybean

Treatments:

S.No.	Treatment
1.	Diclosulam 84% w/w WDG 26 g/ha as PE (0-3 DAS) through drone
2.	Diclosulam 84% w/w WDG 26 g/ha as PE (0-3 DAS) through power sprayer
3.	Propaquizafop 2.5% w/w + imazethapyr 3.75% w/w ME 125 g/ha as POE (15-20 DAS) through drone
4.	Propaquizafop 2.5% w/w + imazethapyr 3.75% w/w ME 125 g/ha as POE (15-20 DAS) through powersprayer
5.	Farmers practice (1 Hoeing and 1 HW)
6.	Weedy check

Design: RBD Replications: Three

The major weeds during *kharif* season in soybean crop in the selected area were comprised by *Cynodon dactylon, Cyperus rotundus, Commelina benghalensis, Commelina communis, Digiterea sanguinalis, Dinebra retroflexa,* were dominant in monocot. Among dicot the weed density of *Euphorbia geniculata, Parthenium hysterophorus, Portulaca oleracea, Amaranthus viridis, Acalypha indica*, *Argemone mexicana* were predominant in the experimental plots.

At 20, 40 and 60 DAS, application of pre-emergence herbicide diclosulam 84% WDG 26 g/ha applied through drone recorded minimum total weed dry weight over power sprayer; however, difference between them was found at par. The results revealed that at 20, 40 and 60 DAS application of diclosulam 84% WDG 26 g/ha as pre-emergence applied through drone recorded maximum weed control efficiency over its power sprayer application. After that at 40 and 60 DAS, post-emergence herbicide propaquizafop 2.5% + imazethapyr 3.75% ME 125 g/ha applied through power sprayer recorded higher weed control efficiency over drone application. Application of diclosulam 26 g/ha through drone recorded lowest weed index over its power sprayer application. However, in case of post-emergence treatments, application of propaquizafop 2.5% + imazethapyr 3.75% ME 125 g/ha through power sprayer recorded lower weed index. Among the treatments involved in application of herbicides through done and power sprayer, maximum seed yield (1.77 t/ha), net returns (Rs. 44787/ha) and BC ratio (2.07) were recorded by application diclosulam 84% WDG 26 g/ha as PE (0-3 DAS) through drone (**Table 1.1.13**).

The efficiency of a drone sprayer proves superior over power sprayer. Pre-emergence application of herbicides through drones and post-emergence spraying with power sprayer recorded higher weed control efficiency across the treatment in soybean.

Table 1.1.13. Effect of herbicide and ready-mix herbicides applied through drone and power sprayer on weed control efficiency, seed yield and economics of soybean.

Treatment	Weed control efficiency (%)			Weed index (%)	Seed yield (t/ha)	Net returns (Rs./ha)	BC ratio
	20 DAS	40 DAS	60 DAS				
Diclosulam 84% WDG 26 g/ha as PE (0 -3 DAS) through drone	59.20	61.87	58.75	12.81	1.77	44787	2.07
Diclosulam 84% WDG 26 g/ha as PE (0 -3 DAS) through power sprayer	56.97	58.82	56.40	21.76	1.62	38125	1.92
Propaquizafop 2.5%+ imazethapyr 3.75% ME 125 g/ha as PoE (15 -20 DAS) through drone	48.16	73.86	63.65	21.63	1.62	36742	1.86
Propaquizafop 2.5% + imazethapyr 3.75% ME 125 g/ha as PoE (15 -20 DAS) through power sprayer	53.38	77.32	65.23	16.87	1.70	41249	1.98
Farmers practice (1 Hoeing and 1 HW)	76.99	86.49	76.73	0	1.97	52016	2.16
Weedy check	0.00	0.00	0.00	33.08	1.44	32654	1.86
SEm±					50		
LSD (P=0.05)					105		

TNAU, Coimbatore

Drone based application of herbicides in transplanted rice

No.	Treatments
1.	Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha as PoE, drone spraying 25 lit/ha
2.	Bispyribac-sodium 10% w/w SC25 g/ha as PoE, drone spraying 25 lit/ha
3.	Penoxsulam 1.02 % w/w+ cyhalofop-butyl 5.1% w/w OD (RM) 135 g/ha as PoE drone spraying 25 lit/ha
4.	Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha as PoE, knapsack spraying 375 lit/ha
5.	Bispyribac-sodium 10% w/w SC25 g/ha (Farmers' practice) as PoE, knapsack spraying 375 lit/ha

Table contd...

6.	Penoxsulam 1.02 % w/w + cyhalofop-butyl 5.1% w/w OD (RM) 135 g/ha as PoE, knapsack spraying 375 lit/ha
7.	Weedy check

Design: RBD Replications:Three

Major weeds present in the experimental field were *Echinochloa crusgalli, Echinochloa colona, Panicum repens* and *Leptochloa chinensis* among grasses, *Cyperus difformis* and *Cyperus iria* among sedges, *Bergia capensis, Eclipta alba, Ammannia baccifera* and *Monochoria vaginalis* among broadleaf weeds.

Among the different treatments, at 40 DAT, application of different herbicides through drone or knapsack sprayer recorded comparable results with regard to total weed density and dry weight. Above 95% weed control efficiency was recorded with the treatments irrespective of application of herbicides through drone and knapsack sprayer at 40 DAT.

MPUAT, Udaipur

Drone based application of herbicides in maize

Treatments

S. No.	Maize
1.	Atrazine + tembotrione (TM) (500 +120) g/ha as EPoE (15 DAS) with drone
2.	Atrazine + topramezone (TM) (500 + 25.2) g/ha as EPoE (15 DAS) with drone
3.	Atrazine + mesotrione (RM) 875 g/ha as PoE (20 DAS) with drone
4.	Atrazine 750 g/ha (PE) with drone *fb* mechanical weeding at 35-40 DAS
5.	Atrazine + tembotrione (TM) (500 +120) g/ha as EPoE (15 DAS) with knapsack sprayer
6.	Atrazine + topramezone (TM) (500 + 25.2) g/ha as EPoE (15 DAS) with knapsack sprayer
7.	Atrazine + mesotrione (RM) 875 g/ha as PoE (20 DAS) with knapsack sprayer
8.	Atrazine 750 g/ha (PE) with knapsack sprayer *fb* mechanical weeding at 35-40 DAS
9.	Weedy check

Design: RBD; Replication: Three

The major broadleaf weeds in the experimental field at 40 DAS were *Digera arvensis* (10.52 %), *Amaranthus viridis* (6.41%), *Trianthema portulacastrum* (10.42%), *Physalis minima* (6.93%) and *Commelina benghalensis* (6.27%). The grassy weeds were *Echinochloa colona* (15.81%), *Eleusine indica* (10.12 %), *Dinebra retroflexa* (22.76 %) and *Cynodon dactlyon* (10.76 %).

Maximum weed control efficiency at 30 DAS was observed with the treatment atrazine + mesotrione (RM) 875 g/ha as PoE (20 DAS) with knapsack sprayer followed by atrazine + tembotrione (Tank-mix) (500 +120) g/ha as EPoE (15 DAS) applied through drone. Likewise, at 60 DAS, maximum weed control efficiency was recorded in atrazine + tembotrione (Tank-mix) (500 +120) g/ha as EPoE (15 DAS) applied through drone. Maximum grain yield (4.73 t/ha) and stover yield (6.90 t/ha) was recorded by the treatment atrazine + topramezone (500 + 25.2) g/ha (Tank-mix) as EPoE (15 DAS) with knapsack sprayer, which was followed by atrazine + topramezone (500 + 25.2) g/ha (Tank-mix) as EPoE (15 DAS) applied through drone. The highest net returns (Rs 1,05,243/ha) and BC ratio (3.49) was obtained with atrazine + topramezone (500 + 25.2) g/ha (Tank-mix) as EPoE (15 DAS) applied through knapsack sprayer.

Application of atrazine + topramezone (500 + 25.2) g/ha (Tank-mix) as EPoE (15 DAS) through drone and knapsack sprayer was equally effective for controlling weeds and producing grain yield in maize.

RVSKVV, Gwalior

Drone based application of herbicides in sorghum

S. No.	Treatments
1.	Atrazine 750 g/ha (PE) *fb* 2,4-D Ethyl ester 500 g/ha as PoE (20 DAS) application with drone
2.	Atrazine 750 g/ha (PE) *fb* 2,4-D Ethyl ester 500 g/ha as PoE (20 DAS) application with knapsack sprayer
3.	Atrazine 750 g/ha (PE) *fb* 2,4-D dimethylamine salt 750 g/ha as PoE (20 DAS) application with drone
4.	Atrazine 750 g/ha (PE) *fb* 2,4-D dimethylamine salt 750 g/ha as PoE (20 DAS) application with knapsack sprayer
5.	Atrazine + topramezone (TM) (500 +18.9) g/ha EPoE (15 DAS) application with drone
6.	Atrazine + topramezone (TM) (500 +18.9) g/ha EPoE (15 DAS) application with knapsack sprayer
7.	Atrazine 500 g/ha PE application with drone *fb* mechanical weeding at 30 DAS
8.	Atrazine 500 g/ha PE application with knapsack sprayer *fb* mechanical weeding at 30 DAS
9.	Weedy check

Design: RBD, Replications: Three

During the experimentation, the weeds recorded in the experimental site were *Echinochloa crus-galli, Cynodon dactylon, Dactyloctenium aegyptium* and *Eragrostis ciliaris* as narrow leaved weeds, *Alternanthera sessilis*, *Commelina benghalensis* and *Digera arvensis* as broadleaf weeds and *Cyperus rotundus* as sedge.

Among the application of different herbicides, at 20 DAS, the maximum weed control efficiency (60.73%) was recorded with drone application of atrazine + topramezone (500+18.9 g/ha) (Tank-mix) at 15 DAS, it was closely followed by knapsack sprayer application of atrazine (500 g/ha) + topramezone (18.9 g/ha) (Tank-mix) (57.77%) at 15 DAS, whereas, at 40, 60 DAS and at harvest, the maximum weed control efficiency (78.68, 70.97 and 71.12%, respectively) was recorded by the treatment atrazine as pre-emergence (500 g/ha) was applied through drone *fb* mechanical weeding at 30 DAS. Comparatively higher grain yield was recorded in the treatments where herbicides were applied through drone compared to knapsack sprayer (**Table 1.1.14**).

Herbicide application through drone was more effective in terms of weed control, higher productivity and profitability of sorghum cultivation.

Table 1.1.14. Effect of herbicides applied through drone and knapsack sprayer on weed control efficiency, grain yield and economics of sorghum.

Treatments	Weed control efficiency (%)			Grain yield (t/ha)	Net returns (Rs./ha)	BC ratio
	20 DAS	40 DAS	60 DAS			
Atrazine 750 g/ha as PE *fb* 2,4-D Ethyl ester 500 g/ha as PoE (20 DAS) application with drone	42.70	50.83	53.19	2.32	61223	3.20
Atrazine 750 g/ha as PE *fb* 2,4-D Ethyl ester 500 g/ha as PoE (20 DAS) application with knapsack sprayer	40.58	45.20	49.27	2.19	55155	2.92
Atrazine 750 g/ha as PE *fb* 2,4-D dimethylamine salt 750 g/ha as PoE (20 DAS) application with drone	47.84	39.10	52.48	2.30	59999	3.14

Table contd...

Atrazine 750 g/ha as PE *fb* 2,4-D dimethylamine salt 750 g/ha as PoE (20 DAS) application with knapsack sprayer	45.57	35.01	51.48	2.28	58213	3.00
Atrazine + topramezone (TM) (500 +18.9) g/ha as EPoE (15 DAS) application with drone	60.73	69.79	59.74	2.50	66705	3.29
Atrazine + topramezone (TM) (500 +18.9) g/ha as EPoE (15 DAS) application with knapsack sprayer	57.77	66.96	56.35	2.33	59780	3.02
Atrazine 500 g/ha as PE application with drone *fb* mechanical weeding at 30 DAS	30.59	78.68	70.97	2.76	76605	3.63
Atrazine 500 g/ha PE application with knapsack sprayer *fb* mechanical weeding at 30 DAS	27.57	75.82	67.44	2.54	67615	3.29
Weedy check	0.0	0.0	0.0	1.67	39784	2.65
SEm (±)				0.14		
LSD (P=0.05)				0.42		

Effect of atrazine 500 g/ha as PE application with drone *fb* mechanical weeding at 30 DAS in sorghum

Effect of atrazine + topramezone (Tank-mix) (500 +18.9) g/ha as EPoE (15 DAS) application with drone in sorghum

Station trials

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

Centre: CCSHAU, Hisar (PAU Ludhiana will assist in executing the technology)

Objectives:

1. To determine the bio-efficacy of herbicides for managing major weeds in *tar-vattar* DSR
2. To study the weed dynamics and productivity of *tar-vattar* DSR.
3. To monitor weed flora shift as influenced by weed management practices.

Treatments:

Main plot: Timing of first irrigation

1. IR 1- 7 days after sowing
2. IR 2 -14 days after sowing
3. IR 3 -21 days after sowing

Sub-plot: Weed management treatments:

1. Pendimethalin 38.4% w/w + pyrazosulfuron ethyl 0.85% w/w ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (20-25 DAS)
2. Pretilachlor 30.0% w/w + pyrazosulfuron ethyl 0.75% w/w WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w

EC 150 g/ha as PoE (20-25 DAS)

3. Pyrazosulfuron ethyl 10% w/w WP 22.5 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (20-25 DAS)
4. Pendimethalin 38.4% w/w + pyrazosulfuron ethyl 0.85% w/w ZC 785 g/ha as PE *fb* bispyribac sodium 10% w/w SC 25 g/ha + [(metsulfuron-methyl 10% w/w + chlorimuron-ethyl 10% WP w/w) (RM)] 4 g/ha (TM) as PoE (20-25 DAS)/ Bispyribac Sodium 38% w/w + chlorimuron ethyl 2.5% w/w + metsulfuron methyl 2.5% w/w WG 15.63+25 g/ha (RM) PoE (20-25 DAS)
5. Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (20-25 DAS)
6. Partially weedy check

Experimental details:

Design: Split-plot, Replication: Three

At 20 DAS, delay in first irrigation significantly reduced the density of grasses like *Echinochloa crus-galli*, *Dactyloctenium. aegyptium* and *Leptochloa chinensis* with irrigation at 21 days after sowing compared to irrigation at 7 days after sowing. Among the pre-emergence herbicides, pendimethalin + pyrazosulfuron-ethyl 785 g/ha resulted in lower density of the grasses compared to pretilachlor + pyrazosulfuron-ethyl 615 g/ha and alone application of pyrazosulfuron-ethyl 22.5 g/ha. Sequential application of pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (20-25 DAS) recorded minimum and significantly lower density of the weeds and highest grain yield of 5.21 t/ha.

Lower grain yield of 4.18 t/ha was recorded with irrigation at 21 DAS compared to 14 DAS (4.23 t/ha) and 7 DAS (4.31 t/ha). Sequential application of pendimethalin 38.4% w/w + pyrazosulfuron ethyl 0.85% w/w ZC 785 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (20-25 DAS) has been recorded as effective weed management treatment for controlling grasses and obtaining higher grain yield.

ST 1.1.2. Weed management in pearl millet and residual effect on succeeding mustard crop

Centre: CCSHAU, Hisar

Application of tembotrione and tembotrione + atrazine had some phyto-toxicity on the crop plants; however, crop plants recovered at 30 days after application, whereas topramezone (25.2 g/ha) recorded phytotoxicity on pearl millet (65-70%) resulting in lower seed yield. Weed-free treatment recorded highest seed yield of pearlmillet (3794 kg/ha) followed by tembotrione 100 g/ha as PoE (3492 kg/ha) and tembotrione + atrazine 80 + 500 g/ha (Tank-mix) as PoE (3215 kg/ha). Application of topramezone 25.2 g/ha as PoE recorded lowest seed yield (731 kg/ha), which was lower than weedy check (1932 kg/ha).

Tembotrione 100 g/ha

Tembotrione + atrazine 80 + 500 g/ha

Weed free

Weedy check

ST 1.1.3. Weed management in cluster bean and residual effect on succeeding mustard crop

Centre: CCSHAU, Hisar

Among the weed management treatments, application of propaquizafop + imazethapyr (RM) 125 g/ha at 2-3 leaf stage of weeds and imazethapyr + imazamox (RM) 70 g/ha at 2-3 leaf stage of weeds have been recorded as effective weed management treatments for controlling weeds without showing phytotoxicity on cluster bean and obtaining higher seed yield. Flauzifop + fomasefen (RM) 250 g/ha and sodium acifluorfen + clodinafop-propargyl 245 g/ha recorded phytotoxicity on the crop plants and that resulted in lower seed yield.

ST 1.1.4. Bio-efficacy of herbicides against complex weed flora in *kharif* blackgram

Centre: AAU, Anand

Among the herbicidal treatments, propaquizafop 2.5% + imazethapyr 3.75% w/w ME 125 g/ha as PoE recorded maximum weed control efficiency of 94.2% at 60 DAS, maximum seed yield of 7.04 q/ha, net returns of Rs. 16,575/ha and benefit-cost ratio of 1.45 in blackgram.

ST 1.1.5. Bio-efficacy of herbicide against complex weed flora in rice nursery

Centre: AAU, Anand

Higher transplantable seedlings (1014/m^2) were recorded under application of pretilachlor 30.0% + pyrazosulfuron-ethyl 0.75% WG (RM) 615 g/ha as PE. Maximum net returns of Rs. 23998/ha and benefit- cost ratio of 4.74 was observed under application of pretilachlor 30.0% + pyrazosulfuron-ethyl 0.75% WG (RM) 615 g/ha as PE. Application of pendimethalin 38.7% CS 750 g/ha as PPI showed the highest phytotoxicity (10 score) even at 20 days after herbicide application (DAHA). Whereas, application of oxyfluorfen 23.5% EC 150 g/ha PE (4 score), oxadiargyl 80% WP 90 g/ha PE (3 score), pendimethalin 30% EC 750 g/ha PE (2 score), pyrazosulfuron-ethyl 10% WP 10 g/ha PE (2 score), pretilachlor 30.0% + pyrazosulfuron-ethyl 0.75% WG (RM) 615 g/ha PE (1 score) showed phytotoxicity at 10 DAHA; however, rice seedlings recovered at 20 DAHA.

ST 1.1.7. Weed management in pigeonpea + soybean (1:4) intercropping system

Centre: PDKV, Akola

At 20 DAS, quizalofop-ethyl + imazethapyr 98.435 g/ha at 15 DAS recorded highest weed control efficiency followed by imazethapyr + imazamox 70 g/ha at 15 DAS and these treatments showed almost similar values of weed control efficiency because of early post-emergence application as ready-mix herbicides, which controlled the weed at early growth stage. Lowest weed control efficiency was recorded with imazethapyr 75 g/ha as EPoE (15 DAS). By and large highest weed control efficiency was recorded with integration of pendimethalin 678 g/ha as PE *fb* hoeing at 30 DAS over remaining herbicidal treatments except at 20 DAS. Among different weed management treatments, the highest seed yield of soybean was obtained with the application of pendimethalin 678 g/ha *fb* hoeing at 30 DAS, which was at par with pendimethalin + imazethapyr (RM) 960 g/ha, quizalofop ethyl + imazethapyr 98.435 g/ha, imazethapyr+imazamox 70 g/ha. For effective weed management and higher seed yield of soybean + pigeonpea intercropping system, application of pendimethalin 678 g/ha *fb* HW at 30 DAS was found effective **(Table 1)**.

Table 1. **Weed control efficiency, soybean equivalent yield and economics of soybean + pigeonpea intercropping system as influenced by different weed management treatments.**

Treatment	Weed control efficiency (%)			Soybean equivalent yield (t/ha)	Net returns (Rs./ha)	B:C
	20 DAS	40 DAS	60 DAS			
Pendimethalin 38.7% CS 678 g/ha PE *fb* Hoeing at 30 DAS	59.80	72.76	62.57	3.52	110470	2.79
Pendimethalin 30% + imazethapyr 2% EC (RM) 960 g/ha PE	72.79	69.03	60.73	3.40	102169	2.59
Diclosulam 84 WDG 26 g/ha PE	71.05	66.12	58.20	3.27	98856	2.61
Imazethapyr 10% SL 75 g/ha at 15-20 DAS	64.48	55.03	42.89	2.93	82462	2.35
Imazethapyr 35%+ imazamox35% WG (RM) 70 g/ha PoE at 15-20 DAS	81.34	60.75	47.70	3.32	100025	2.61
Propaquizafop 2.5% + imazethapyr 3.75% ME (RM) 50 +75 g/ha at 15-20 DAS	76.17	56.29	44.80	3.16	92894	2.50
Quizalofop-ethyl 7.5% + imazethapyr 15% EC (RM) 98.435 g/ha 15-20 DAS	83.68	61.51	49.92	3.35	103542	2.71
Farmers' practice (2 Hoeing 15 & 30 DAS and 1 HW)	92.78	93.55	81.49	3.97	125863	2.85
Weedy check	0.00	0.00	0.00	2.45	61138	2.04
SEm±				70		
LSD (P=0.05)				213		

ST 1.1.9. Weed Management in direct-seeded/drill sown finger millet

Centre: MPUAT Udaipur and GBPUAT Pantnagar

MPUAT, Udaipur

Maximum grain yield of 2.68 t/ha and highest net return of Rs 87012/ha were recorded with the treatment oxadiargyl 80% WP 80 g/ha at 0-3 DAS+ HW at 30 DAS. However, maximum benefit-cost ratio of 2.90 was registered by pyrazosulfuron-ethyl 15 g/ha as PE.

ST 1.1.10. Weed management in transplanted finger millet.

Centres: AAU Jorhat and OUAT Bhubaneswar

OUAT, Bhubaneswar

Among the weed management treatments, application of pyrazosulfuron-ethyl as PE 15 g/ha *fb* one hand weeding (30 DAT) or application of bensulfuron methyl + pretilachlor 660 g/ha *fb* hand weeding at 30 DAT recoded higher grain yield of 2.13 and 2.04 t/ha, respectively.

ST 1.1.13. Weed management in maize through tank mixture of halosulfuron methyl with other herbicides and their residual effect on succeeding vegetable crops

Centre: PAU, Ludhiana

Highest yield of maize (6.49 t/ha) was recorded in tembotrione 110.0 g/ha as PoE and this was statistically at par with topramezone 33.6 g/ha as PoE. Halosulfuron-methyl + tembotrione, halosulfuron-methyl + topramezone and halosulfuron-methyl alone were equally effective in controlling sedges only.

ST 1.1.14. Evaluation of pre-and post-emergence herbicides in blackgram and its residual effect on succeeding barley crop under rainfed conditions (Collaboration with pulse Research Station, Samba, SKUAST Jammu)

Centre: SKUAST, Jammu

The combination of pendimethalin + imazethapyr (RM) 1000 g/ha as PE recorded highest seed yield of 997 kg/ha closely followed by imazethapyr 60 g/ha as PoE (9.43 q/ha) and imazethapyr + imazamox 70 g/ha as PoE (9.37 q/ha). Highest net returns of Rs. 69452/ha and benefit-cost ratio of 2.00 was recorded by pendimethalin + imazethapyr (RM) 1000 g/ha as PE. Imazethapyr + Imazamox 80 g/ha as PoE showed phytotoxicity on blackgram plants.

ST 1.1.15. Weed management in sunflower

Centres: PJTSAU Hyderabad and BCKV Kalyani

PJTSAU Hyderabad

Among the pre-emergence herbicides, chlorimuron-ethyl 25% WP at 9 g/ha resulted in poor germination of sunflower (19.5%) (Scale 8). Among the post-emergence herbicides bentazone 480 SL 960 g/ha caused severe phytotoxicity (Scale 8) on sunflower plants and that led to a loss of 50% population within 30 DAS. Among the herbicidal treatments, highest seed yield was recorded in quizalofop-ethyl 4% + oxyfluorfen 6% EC (RM) and it was comparable with pyroxasulfone 85% WG, oxyfluorfen 23.5% EC and pendimethalin 38.7% CS. The lowest yield was recorded in bentazone treatment, which was also lesser than weedy check, due to loss of population (**Table 2**).

Table 2. Effect of weed management treatments on germination of sunflower seeds, weed control efficiency and seed yield of sunflower.

Treatment		Dose	Time of application	Weed control efficiency (%)		Germination (%)	Seed yield (kg/ha)
				20 DAS	40 DAS		
T1	Pendimethalin 38.7 % CS	677.25 g/ha	PE	69.9	51.8	91.2	1258
T2	Oxyfluorfen 23.5% EC	100 g/ha	PE	74.0	66.7	82.0	1165
T3	Pyroxasulfone 85% w/w WG	127.5 g/ha	PE	75.3	72.3	80.1	1265
T4	Metolachlor 50% EC	1000 g/ha	PE	69.9	61.4	82.0	1050
T5	Chlorimuron-ethyl 25% WP	9 g/ha	PE	83.6	85.1	19.5	857
T6	Bentazone 480 SL	960 g/ha	PoE (20 DAS)	4.1	24.9	85.1	607
T7	Quizalofop-ethyl 4% + Oxyfluorfen 6% EC (RM)	100 g/ha	PoE (20 DAS)	6.8	74.3	90.5	1283
T8	Fluazifop-p-butyl 11.1% w/w + Fomesafen 11.1% w/w SL (RM)	250 g/ha	PoE (20 DAS)	5.5	52.6	92.0	1087
T9	Sodium acifluorfen 16.5% + clodinafop propargyl 8% EC (RM)	245 g/ha	PoE (20 DAS)	8.2	36.5	88.9	1138
T10	Weed free (2 HW at 20 and 40 DAS)			4.1	94.8	87.0	1515
T11	Weedy check					83.5	728
	SEm±						45.0
	LSD (P=0.05)						133.7

Chlorimuron-ethy l 25% WP 9 g/ha as PE

Bentazone 480 SL 960 g/ha as PoE (20 DAS)

Pyroxasulfone 85% w/w WG 127.5 g/ha as PE

Weedy check

ST 1.1.18. Efficacy of tank mix application of herbicides with Sampoorna KAU multi-mix in rice

Centre: KAU, Thrissur

Phytotoxicity to rice was recorded with tank-mix application of 2,4- D+ Sampoorna. In the case of metsulfuron methyl+chlorimuron ethyl + Sampoorna, though visual phytotoxicity symptoms were not present, reduction in plant height was recorded. Reduction in plant height in 2, 4-D+ Sampoorna was 17 % and 10 % at 30 and 60 days after transplanting (DAT), respectively, compared to its sole application. While metsulfuron-methyl+chlorimuron-ethyl+ Sampoorna resulted in 13 % and 6 % reduction at 30 and 60 DAT, respectively. With respect to the effect of Sampoorna application on grain yield of rice, the effect was not very much conspicuous as the soils of the experimental field were not deficient with respect to micronutrient status. It can be concluded that a few post emergence herbicides for rice weed control *ie;* bispyribac-sodium, cyhalofop-butyl and premix of cyhalofop-butyl + penoxsulam can be recommended for tank mix application with KAU Sampoorna as foliar spray at 15-20 days after sowing or transplanting. 2,4-D and metsulfuron-methyl+chlorimuron-ethyl are not compatible with Sampoorna and hence are not suitable for tank-mix application.

ST 1.1.19. Soil residue analysis of pre-emergent herbicides in various soil types

Centre: KAU, Thrissur

Two hours after herbicide spray (0 DAS) only cyhalofop-butyl was detected in sandy clay loam soil type (Kozhukully). As the sampling interval increased to 10 days and beyond, herbicide degradation occurred.

ST 1.1.21. Long-term herbicide trial in transplanted lowland rice-blackgram cropping system

Centre: TNAU, Coimbatore

Among the weed management treatments, application of bensulfuron-methyl 0.6% + pretilachlor 6% GR 660 g/ha as PE *fb* bispyribac-sodium 10 SC 25 g/ha as PoE recorded significantly higher grain yield of 6.53 t/ha, net returns of Rs.77,244/ha and benefit-cost ratio of 2.29 in transplanted rice.

ST 1.1.23. Weed management practices for controlling *Rottboellia cochinchinensis* in maize

Centre: UAS, Bengaluru

Pyroxasulfone 127.5 g/ha as PE *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE recorded the highest weed control efficiency at 20 and 60 DAS (79.66% and 84.73%, respectively) and stale seedbed *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE and pyroxasulfone 127.5 g/ha (PE) *fb* Isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE recorded the highest weed control efficiency at 40 DAS (86.70% and 86.49%, respectively). Application of pyroxasulfone 127.5 g/ha as PE *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE recorded the highest grain yield of 6.10 t/ha followed by stale seedbed *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE (6.05 t/ha). Pyroxasulfone 127.5 g/ha as PE *fb* Isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE also recorded highest net returns of Rs.110875/ha and benefit-cost ratio of 3.66. Application of pyroxasulfone 127.5g/ha as PE *fb* isoxaflutole + thiencarbazone-methyl 90 + 36 g/ha as EPoE and stale seedbed *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE showed best control over *Rottboellia cochinchinensis* and other weed species emerged in the experimental plot at all the stages.

Pyroxasulfone 127.5 g/ha as PE *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE

Stale seedbed *fb* isoxaflutole + thiencarbazone-methyl 90+36 g/ha as EPoE

Atrazine 750 g/ha as PE *fb* topramezone 25.2 g/ha as PoE (25 DAS)

Weedy check

ST 1.1.24. Integrated weed management in mulberry crop – A holistic approach

Centre: UAS, Bengaluru

Among the different weed management practices, non-chemical weed management practices were found effective in controlling weeds. Hand weeding immediately after pruning and plastic mulching at 4 days after pruning (DAP), hand weeding twice [one immediately after pruning and the second on 25 DAP] and hand weeding immediately after pruning and intercropping with fodder cowpea were found effective. However, with respect to the chemical weed management treatments, post-emergence application of indaziflam 20 + glyphosate IPA 540 SC (1.65 % w/w + 44.63 % w/w) (Alion plus) 1050 g/ha at 4 DAP was recorded as best treatment.

ST 1.1.28. Integrated weed management in greengram.

Centre: SKNAU, Jobner

Among the weed management treatments, post-emergence application of sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC 245 g/ha applied at 15-20 DAS recorded maximum weed control efficiency and seed yield of greengram.

ST 1.1.31. Validation of herbicide tolerant inoculum consortia on growth and yield parameters of soybean under the influence of herbicides.

Centre: UAS, Dharwad

Application of microbial consortia of AM fungi and methylobacteria with all the three herbicidal treatments *viz.*, Diclosulam 84 % WDG 26 g/ha (PE), Imazethapyr 10 % SL 100 g/ha (PoE) and Diclosulam 84 % WDG 26 g/ha (PE) + Imazethapyr 10 % SL 100 g/ha (PoE) recorded higher plant height. Among the herbicide tolerant microbial consortium, the highest grain yield was recorded with the treatments that received herbicide tolerant mycorrhizal and PPFM consortium spray (15th, 30th and 45th DAS) (1155 kg/ha), followed by herbicide tolerant mycorrhizal consortium (1082 kg/ha). The interaction studies between herbicide tolerant mycorrhizal and PPFM consortium spray (15th, 30th and 45th DAS) along with Diclosulam 84 % WDG 26 g/ha (PE) recorded the highest seed yield (1230 kg/ha) compared to Diclosulam 84 % WDG 26 g/ha (PE) alone (980 kg/ha).

Diclosulam 84% WDG 26 g/ha (PE) and herbicide tolerant mycorrhizal consortium

Diclosulam 84% WDG 26 g/ha (PE) and herbicide tolerant PPFM consortium spray (15th, 30th and 45th DAS)

Diclosulam 84% WDG 26 g/ha (PE) and uninoculated control

Diclosulam 84% WDG 26 g/ha (PE) + Imazethepyr 10% SL @ 100 g/ha (PoE)) and Herbicide tolerant PPFM consortium spray (15th, 30th and 45th DAS)

WP 1.2 Weed management under conservation tillage-based cropping systems

Objectives

- To monitor weed and pest dynamics, crop-cum-energy productivity, resource use efficiency, profitability under long-term conservation tillage and weed management practices
- Study on weed seed dynamics
- To study change in physico-chemical and biological properties of soil

Technical programme

1. Duration: 2022-2028 (six years)
2. Design: Split-plot
3. Replications: not less than three

Treatments

Main plot:

1. Conventional tillage (CT): CT-CT-CT
   CT+R-CT+R-CT+R
2. Resource conservation technology (RCT):
   ZT-ZT-ZT
   ZT+R-ZT+R-ZT+R

Subplot:

1. HR: Herbicide rotation
2. IWM: Integrated weed management (herbicides *fb* hand weeding) *fb* weed seed harvest
3. Partially weedy (removal of weeds after critical competition period)

Observations to be recorded

1. Species-wise and total weed density at 30 & 60 DAS and biomass at 60 DAS
2. Monitoring of weed shifts over base year
3. Phyto-sociological parameters: relative frequency, abundance, importance value index and other diversity indices
4. Weed seed bank study at 0-10 and10-20 cm depths
5. Monitoring of herbicide residues (wherever facilities are available)
6. Monitoring of periodical incidence of insect-pest, disease, nematode rodents etc. in crops and cropping system
7. Crop growth and yield attributes
8. Energy and economic parameters
9. Soil health-related parameters (Bulk density and Soil organic carbon) and other parameters (in collaboration with soil science department)

It has been suggested to conduct a bioassay after 3 years to know the herbicide resistance and weed flora shift.

WP 1.2.1 Weed management in rice-wheat-legume cropping system under conservation tillage

Network centers: GBPUAT Pantnagar, SKUAST Jammu, CCSHAU Hisar and PAU Ludhiana

Treatment	Rice (DSR)	Wheat	Greengram/green manure
Main plot	**Tillage**		
	CT CT+R ZT ZT+R	CT CT+R ZT ZT+R	CT CT+R ZT ZT+R
Sub plot	**Weed management**		
Herbicide rotation	1st year: Pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) 2nd year: Pretilachlor + pyrazosulfuron 615 g/ha (2 DAS) *fb* cyhalofop+	1st year: Clodinafop + metsulfuron 64 g/ha (30 DAS) 2nd year: Mesosulfuron + iodosulfuron 14.4 g/ha (30 DAS)	1st year: Pendimethalin + imazethapyr 1.0 kg/ha (2 DAS) 2nd year: Imazethapyr

Table contd.

	penoxsulam 135 g/ha (20 DAS) 3rd year: Pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20 DAS)	3rd year: Pinoxaden + carfentrazone 40 + 20 g/ha or Sulfosulfuron + metsulfuron 32 g/ha (30 DAS)	100 g/ha (20 DAS) 3rd year: Pendimethalin 678 g/ha (2 DAS)
IWM	Pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest	Clodinafop+ metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS)	Pendimethalin 678 g/ha (2 DAS) *fb* hand weeding (30 DAS)
Unweeded check	Partially weedy (weeds removed after critical period)	Weedy check	Weedy check

DSR: direct-seeded rice; CT- Conventional tillage, ZT- Zero tillage, R- previous crop residue, *fb*- followed by

GBPUAT, Pantnagar

Rabi 2023-24

In *rabi* 2023-24, major weeds under weedy situation were recorded as *Phalaris minor, Medicago denticulata, Melilotus indica, Chenopodium album, Solanum nigrum, Coronopus didymus* and *Polygonum plebeium* at 30 DAS. Density and biomass accumulation of all the weeds at 60 DAS were comparable among different tillage systems. In contrast, weed management practices had a significant effect on weed density of all the weeds except *Polygonum plebeium* (**Table 1.2.1**). At 60 DAS, tillage method, DSR (CT+R)-wheat (CT+R)-GM (CT+R) recorded the lowest total weed density, total biomass and the highest weed control efficiency (72.0%). However, wheat yield and yield attributes did not differ significantly due to different tillage methods. The net returns (Rs 126284/ha) and benefit-cost ratio (3.91) were recorded the highest under DSR (CT+R)-wheat (CT+R)-GM (CT+R).

Among weed management treatments, clodinafop+ metsulfuron methyl 64 g/ha (30 DAS) *fb* HW (45 DAS) recorded the lowest total weed density and biomass accumulation of the weeds with the highest weed control efficiency (96.3%). Application of clodinafop+ metsulfuron methyl 64 g/ha (30 DAS) *fb* HW (45 DAS) recorded significantly highest yield attributes and yield (5.3 t/ha) these resulted in the highest net returns (Rs. 134572/ha) but benefit-cost ratio (4.27) was recorded higher with mesosulfuron + iodosulfuron 14.4 g/ha (30 DAS).

Table 1.2.1. Effect of establishment methods and weed management practices on weed control, growth, yield, and economics of wheat in rice-wheat-legume cropping system

Treatments	Total weed density (no./m²)	Total weed biomass (g/m²)	WCE (%)	Plant height (cm)	Spikes (no./m²)	Grain yield (t/ha)	Straw yield (t/ha)	Net returns (Rs. /ha)	B:C
Main plot - Tillage									
DSR(CT)-wheat (CT)-GM(CT)	11.2 (178.9)	4.3 (23.4)	52.2	101.2	371.0	4.7	7.8	119873	3.44
DSR(CT+R)-wheat (CT+R)-GM(CT+R)	8.7 (99.3)	3.4 (13.7)	72.0	101.6	429.1	4.9	8.2	126284	3.59
DSR(ZT)-wheat (ZT)-GM(ZT)	10.9 (185.3)	4.3 (27.5)	43.9	96.8	341.6	4.6	7.8	118153	3.77
DSR(ZT+R)-wheat (ZT+R)-GM(ZT+R)	10.7 (158.4)	4.5 (24.6)	49.8	101.4	377.7	4.7	7.9	120551	3.79
SEm±	0.52	0.32	-	3.00	11.6	0.09	0.14		
LSD(p=0.5)	NS	NS	-	NS	41.0	NS	NS		

Table contd....

Sub plot- Weed management									
Clodinafop + metsulfuron 64 g/ha (30 DAS)	9.5 (100.3)	3.9 (16.1)	67.1	103.1	381.8	5.1	8.2	132494	3.82
Clodinafop+ metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS)	3.1 (12.7)	1.6 (1.8)	96.3	101.8	433.3	5.3	8.3	134572	4.06
Partially weedy (weeds removed after 60 DAS)	18.5 (353.5)	6.9 (49.0)	0.0	95.9	324.4	3.8	7.4	96580	3.07
SEm±	0.80	0.31	-	1.68	13.2	0.06	0.11		
LSD(p=0.5)	2.42	0.94	-	5.07	39.8	0.18	0.33		

DSR(ZT)-Wheat (ZT)- legume ZT

DSR(CT)-Wheat (CT)- legume (CT)

Kharif 2024

During *kharif* 2024, the major weed flora recorded under weedy situations are *Echinochloa colona, Echinochloa crusgalli, Panicum maximum, Alternanthera sessilis, Ammannia baccifera, Caesulia axillaris, Eclipta alba, Cyperus iria* and *Cyperus difformis* at 60 DAS. At 60 DAS, the establishment method did not significantly affect the biomass and weed density of all the weed species except *Echinochloa colona* and *Alternanthera sessilis* (**Table 1.2.2**). Weed management treatment significantly influences weed density and biomass of all the weed spp. The lowest weed density and biomass of all the weed species were significant except density of *Caesulia axillaris* and biomass of *Alternanthera sessilis* were recorded with the application of pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest. At 60 DAS, establishment methods, DSR (CT+R)-wheat (CT+R)-GM(CT+R) recorded lowest total weed density, dry matter accumulation and highest weed control efficiency (71.4%). Under weed management treatments lowest total weed density, dry matter accumulation and highest weed control efficiency (93.4%) were recorded under Integrated weed management (IWM) i.e., pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest (**Table 1.2.2**).

All yield attributing characters and yield were significantly not affected by the different establishment methods (except tillers). Among the establishment methods highest yield and yield attributes were recorded with DSR (CT+R)-wheat (CT+R)-GM(CT+R). Among weed management treatments, yield attributing characters and yield were significantly not affected by the different establishment methods except, grain yield & straw yield, pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest recorded highest yield attributes (**Table 1.2.2**).

Among establishment methods, the highest net returns (Rs 49069/ha) were recorded with DSR (CT+R)-

wheat (CT+R)-GM(CT+R) while the highest benefit-cost ratio (2.11) was found with DSR(ZT)-wheat (ZT)-GM (ZT) and among different weed management methods, the highest net returns and benefit-cost ratio of Rs. 63000/ha and 2.49 were recorded under pendimethalin + pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone + ethoxysulfuron 66.5 g/ha (20 DAS) (**Table 1.2.2**).

Table 1.2.2. Effect of establishment methods and weed management on weed control, yield and economics of rice under rice-wheat-legume cropping system

Treatments	Total weed density (no./m^2)	Total weed biomass (g/m^2)	WCE (%)	Grain yield (t/ha)	Straw yield (t/ha)	Net returns (Rs /ha)	B: C
Tillage and residue management							
DSR(CT)-wheat (CT)-GM (CT)	6.3 (72.9)	7.5 (111.2)	48.4	3.6	4.8	47785	2.03
DSR(CT+R)- wheat(CT+R)-GM(CT+R)	4.8 (31.1)	6.4 (61.6)	71.4	3.7	4.9	49087	2.06
DSR(ZT)- wheat(ZT)-GM(ZT)	6.7 (52.0)	9.1 (109.0)	49.4	3.5	4.6	47138	2.11
DSR(ZT+R)-wheat(ZT+R) -GM(ZT+R)	5.7 (40.4)	8.2 (84.7)	60.7	3.0	4.2	36391	1.85
SEm±	0.61	1.13	-	0.16	0.19	-	-
LSD(p=0.5)	NS	NS	-	NS	NS	-	-
Weed management practices							
Pendimethalin 678 g/ha (2 DAS*) fb* bispyribac-sodium 25 g/ha (20 DAS)	4.8 (27.0)	6.5 (45.2)	79.0	4.1	5.6	63000	2.49
Pendimethalin 678 g/ha (2 DAS) *fb* bispyribac-sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest	2.3 (9.3)	3.2 (14.3)	93.4	4.1	5.5	59285	2.26
Partially weedy (weeds removed after critical period)	10.1 (111.0)	13.8 (215.4)	-	2.1	2.9	13016	1.32
SEm±	**0.62**	**1.03**	**-**	**0.13**	**0.18**	**-**	**-**
LSD(p=0.5)	**1.89**	**3.14**	**-**	**0.40**	**0.53**	**-**	**-**

DAS: days after sowing; HW- hand weeding; DSR: direct-seeded rice; ZT- zero tillage; GM- green manure; CT-conventional tillage; NS: non-significant

DSR (CTR+R)- wheat (CTR+R)-green manure (CTR+R) Pendimethalin 678g/ha PE *fb* bispyribac sodium 25g/ha (20 DAS) PoE *fb* HW at 40DAS *fb* weed seed harvest

DSR (CTR+R)- wheat (CTR+R)-green manure (CTR+R) weedy check

SKUAST, Jammu

***Rabi* 2023-24 (Wheat)**

In wheat during 2023-24, the study area comprised *Phalaris minor, Rumex* spp., *Anagallis arvensis, Medicago denticulata*, and *Ranunculus arvensis*. Also, some minor weeds such as *Melilotus indica* and *Vicia sativa* were observed. Among the establishment methods, at 60 DAS, the lowest total weed density and biomass were recorded in ZT+R followed by CT+R. The CT+R and ZT+R obtained almost similar yield attributes and yields of wheat. However, the highest net returns and B: C were observed in ZT+R followed by CT+R (**Table 1.2.3**).

At 60 DAS, among weed management practices, all weed management treatments recorded significantly lower weed density and biomass than the weedy check. The lowest weed density and biomass were recorded with IWM [clodinafop + metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS)] in comparison to mesosulfuron + iodosulfuron 14.4 g/ha (30 DAS) and weedy check. All the weed management treatments recorded significantly higher growth, yield attributes and yields of wheat as compared to weedy check. The combination of mesosulfuron+ iodosulfuron 14.4 g/ha (30 DAS) followed by hand weeding (45 DAS) produced the highest grain yield, though it was similar to the yield from clodinafop + metsulfuron 14.4 g/ha (30 DAS). However, B:C was higher in mesosulfuron+ iodosulfuron 14.4 g/ha (30 DAS).

Table 1.2.3. Effect of tillage and weed management practices on weed parameters at 60 DAS, yield and economics of wheat (*Rabi* 2023-24)

Treatments	Weed parameters at 60 DAS		Grain yield (t/ha)	Straw yield (t/ha)	Net returns (Rs./ha)	B:C
	Weed density	Weed biomass				
Tillage and residue management						
CT	6.47(40.88)	9.34(86.42)	4.09	5.40	61783	2.01
CT+R	5.89(33.73)	8.36 (69.96)	4.19	5.49	65924	2.30
ZT	6.39(39.87)	8.98(79.68)	3.90	5.18	61284	2.29
ZT+R	5.33(27.45)	8.18(65.92)	4.08	5.38	64576	2.34
SEm ±	0.05	0.04	1.02	2.37	-	-
LSD (p=0.05)	0.14	0.11	NS	NS	-	-
Weed management						
HR: Clodinafop + metsulfuron 64 g/ha (30 DAS)	4.33(17.77)	6.51 (41.43)	4.36	5.99	71065	2.58
IWM: Clodinafop + metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS)	2.31(4.37)	3.71 (12.80)	4.58	6.30	72981	2.37
Unweeded check	9.41(87.69)	12.82 (163.56)	3.18	3.72	45406	1.75
SEm ±	0.07	0.05	1.02	1.25	-	-
LSD (p=0.05)	0.21	0.15	3.05	3.78	-	-

CT + R with IWM

ZT + R with unweedy check

Kharif 2024 (Rice)

During _Kharif_ 2024 in rice, the study area comprised of _Echinochloa_ spp. and _Digitaria sanguinalis_ among grassy weeds, _Caesulia axillaris_ and _Physalis minima_ among broad-leaved weeds, and _Cyperus rotundus_ as a sedge. While, other minor weeds are _Commelina benghalensis, Alternanthera philoxeroides, Phyllanthus niruri_ and _Cucumis_ spp.

At 60 DAS, total weed density and biomass were significantly ($p<0.05$) influenced by tillage and residue management practices. The lowest total weed density and biomass were recorded in CT+R than other treatments. Growth parameters and yield attributes along with yield were non-significant, but a better response was recorded with CT+R followed by ZT+R. However, economic parameters like B: C were more with CT+R followed by ZT+R.

Among weed management practices, lower weed density and biomass were observed in IWM [pendimethalin 678 g/ha _fb_ bispyribac sodium 25 g/ha (20 DAS) _fb_ hand weeding (40 DAS) _fb_ weed seed harvest] than herbicide alone and weedy check. Adoption of weed management practices enhances the growth parameters and yield attributes of rice resulting in higher grain and straw yield and economic returns. Imposition of IWM was recorded with the highest growth, yield and economic parameters followed by herbicides alone and the lowest with a weedy check (**Table 1.2.4**).

Table 1.2.4. Effect of crop establishment methods and weed management on weeds, yield and economics on DSR (_Kharif_ 2024)

Treatments	Total weed density at 60 DAS (no./m^2)	Total weed dry weight at 60 DAS (g/m^2)	No. panicles/m^2	Grain yield (t/ha)	Straw yield (t/ha)	B:C
Tillage and residue management						
CT	8.49 (71.23)	7.14(51.26)	232.00	3.24	4.21	3.14
CT+R	7.23 (51.36)	6.00(35.80)	240.14	3.41	4.82	2.82
ZT	9.33 (86.17)	9.75(95.19)	213.00	2.70	3.24	2.37
ZT+R	7.64 (57.51)	6.86(47.32)	238.00	3.32	4.00	3.07
SEm ±	0.18	0.34	18.00	0.42	0.60	
L.S.D (p=0.05)	0.32	0.49	NS	NS	NS	
Weed management practices						
HR: Pendimethalin 678 g/ha _fb_ bispyribac-sodium 25 g/ha at 20 DAS	7.12 (50.80)	7.65(58.30)	236.56	3.43	4.54	2.98

Table contd....

IWM: Pendimethalin 678 g/ha *fb* bispyribac-sodium 25 g/ha at 20 DAS *fb* HW at 40 DAS *fb* weed seed harvest	5.05 (26.54)	3.89(14.50)	264.43	3.79	4.99	3.25
Unweeded check	11.10(123.86)	9.97(99.35)	195.27	2.20	2.59	2.08
SEm ±	0.15	0.24	9.92	0.37	0.36	
L.S.D (p=0.05)	0.44	0.70	29.29	1.05	1.05	

ZT (DSR)-ZT (Wheat)-ZT (Greengram) in Rice Pendimethalin +pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone + ethoxysulfuron 66.5 g/ha (20 DAS) (Herbicide rotation)

ZT (DSR)+R - ZT (Wheat)+R - GM in Rice Pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20 DAS) *fb* hand weeding (40 DAS) (IWM)

CCSHAU, Hisar

***Rabi* 2023-24 (Wheat)**

In wheat during 2023-24, significantly higher density of *P. minor* (21.6) was recorded under CT condition, while density of *R. dentatus* (41.6), *M. denticulata* (8.7) were recorded higher under ZT conditions. Results showed that tillage and residue management failed to influence weed density and biomass of *P. minor*, *R. dentatus* and *M. denticulata*.

However, numerically higher density and biomass of *P. minor* were observed under ZT conditions. However, significantly higher grain yield was recorded under ZT+R (5.33 t/ha) as compared to conventional tillage (5.21 t/ha) and conventional tillage with residue incorporation (4.88 t/ha) (**Table 1.2.5**).

Among weed management, taller plants were recorded in FP (87.8 cm) as compared to IWM and herbicide rotation. FP (farmer practice) recorded the highest grain yield (5.29 t/ha) followed by HR and IWM.

Table 1.2.5. Effect of tillage, residue management on weed infestation (density) in wheat before spray, at 60 DAS and crop yield

Treatment	Weed density before PoE			*P. minor at* 60 DAS		Tillers/mrl	Plant height (cm)	Grain yield (t/ha)
	P. minor	*R. dentatus*	*M. denticulata*	(no./m^2)	(g/m^2)			
Tillage and residue management								
CT	21.6	7.1	2.7	3.7	2.6	79.9	87.0	5.21
CT+R	16.4	3.3	8.2	3.6	2.1	80.1	85.8	4.88
ZT+R	5.8	16.9	2.4	6.2	2.9	84.2	88.1	5.33
ZT	14.4	41.6	8.7	9.3	6.8	74.8	86.2	4.63
LSD (p=0.05)	7.1	6.6	2.4	1.9	1.5	4.9	NS	269

Table contd....

Weed management								
IWM	13.8	14.5	5.8	3.5	1.2	78.9	87.1	4.81
HR	13.7	18.7	5.7	7.8	5.7	76.1	85.4	4.93
FP	16.2	18.5	5.0	5.8	3.9	84.2	87.8	5.30
LSD (p=0.05)	NS	NS	NS	2.0	1.5	4.7	1.4	178

***Kharif* 2024**

In rice during *kharif* 2024, at 60 DAS, *E. crusgalli* density at 20 days after sowing was found significantly lower under ZT wheat + R scenario, which was significantly higher to rest of the tillage system. Whereas, *C. rotundus* density was found maximum under CT + R (41.3/m^2) (**Table 1.2.6**) as compared to ZT + R. While at 60 DAS, minimum and significantly lower density was recorded under ZT +R (5.8) as compared to CT and ZT but was statistically at par with CT+R (8.4). Whereas, minimum density of *D. aegyptium* was recorded under ZT + R (3.3) as compared to CT + R. *C. dactylon* density was found significantly higher under ZT and ZT + RR system as compared to CT and CT +RI. Whereas density of *L. chinensis* remain unaffected with the different tillage and residue management system.

Regarding weed management at 20 DAS, minimum density of *E. crusgalli* was recorded in FP treatments, which was significantly lower to the rest of treatments. While, C. *rotundus* density was recorded for HR (15.5), which was significantly lower to rest of the treatments (**Table 1.2.6**). At 60 DAS, minimum *E. crusgalli* density was recorded for IWM (5.0), which was significantly lower to the rest of treatments. Similar observations were recorded for *D. aegyptium* and *L. chinensis.* Higher grain yield was recorded under CT (4.71 t/ha) which was statistically at par with CT+RI (4.67 t/ha), but significantly higher as compared to ZT+RR (3.14 t/ha) and ZT (2.95 t/ha). Among weed management practices, significantly higher grain yield was recorded for IWM (4.79 t/ha) as compared to rest of the treatments.

Table 1.2.6. Effect of tillage and weed control treatments on weed infestation, rice grain yield and yield attributes (*Kharif* 2024)

Treatment	Weed density (no./m^2) 20 DAS		Weed density (no./m^2) 60 DAS				Grain yield (kg/ha)
	E. crusgalli	*C. rotundus*	*E. crusgalli*	*D. aegyptium*	*L. chinensis*	*C. dactylon*	
Main plot (tillage and residue management)							
CT	3.15 (9.6)	4.93 (24.7)	3.41 (12.0)	2.04 (3.6)	2.24 (4.7)	1.00 (0.0)	4.71
CT+R	3.15 (10.0)	6.31 (41.3)	2.90 (8.4)	3.03 (8.4)	2.24 (4.7)	1.44 (1.3)	4.67
ZT+R	2.34 (5.1)	5.20 (28.7)	2.41 (5.8)	1.93 (3.3)	2.24 (5.3)	3.40 (11.8)	3.14
ZT	3.30 (10.7)	5.74 (33.8)	3.53 (12.2)	2.28 (4.7)	2.46 (5.5)	4.01 (15.3)	2.95
LSD (p=0.05)	0.55	0.74	0.62	0.43	NS	0.53	190
Sub plot (weed management)							
IWM	4.01 (15.5)	6.54 (43.0)	2.21 (5.0)	1.62 (2.0)	1.38 (1.2)	1.86 (3.5)	4.79
HR	2.78 (7.0)	4.00 (15.5)	3.57 (12.5)	2.33 (4.7)	2.95 (7.8)	2.73 (8.8)	3.27
FP	2.15 (4.0)	6.10 (37.8)	3.41 (11.3)	3.01 (8.3)	2.65 (6.2)	2.80 (9.0)	3.53
LSD (p=0.05)	0.42	0.97	0.50	0.32	0.43	0.37	166

PAU, Ludhiana

This trial was initiated from *Kharif* 2024, where rice crop was established by DSR *tar-wattar* technique, owing to first year and season, residue management and tillage treatments scenarios remained similar in main plots, the density and biomass of weed flora was statistically at par amongst all main plot treatments. But sub-plot treatments differed significantly amongst themselves with respect to weed density and biomass, as density of aerobic weeds and *Cyprus rotundus* was highest in untreated- control plots followed by the plots where the sequential application of pendimethalin as PE followed by bispyribac-Na 25 g/ha as PoE was sprayed and lowest weed density and biomass was recorded in plots where integration of hand weeding was done in addition to sequential application of pendimethalin as PE followed by bispyribac-Na 25 g/ha as PoE (**Table 1.2.7 to 1.2.8**). IWM treatment performed better as bispyribac-Na doesn't have good control of aerobic weeds, thus these left-over weeds were destroyed with the execution of IWM treatment, thus crop-weed competition was minimized in these plots.

Table 1.2.7: Weed density at 60 DAS in DSR during *Kharif* 2024

Treatments	**Weed density (No./m^2)**					
	Sedge	**Grasses**				**Broad leaved**
	Cyperus rotundus	*Digitaria sanguinalis*	*Dactyloctenium aegyptium*	*Eragrostis tenella*	*Eleusine indica*	*Phyllanthus niruri*
Ret (CT)	3.22 (10.22)	3.15 (9.88)	2.83 (8.00)	2.72 (7.55)	2.72 (7.33)	2.70 (7.11)
Ret (ZT)	2.96 (8.33)	2.94 (8.77)	2.64 (6.55)	2.68 (7.11)	2.59 (6.55)	2.51 (6.00)
Rem (CT)	3.23 (10.55)	3.26 (10.55)	2.95 (8.55)	2.87 (8.88)	2.81 (7.88)	2.67 (7.44)
Rem (ZT)	3.05 (8.88)	2.97 (9.00)	2.80 (7.44)	2.63 (7.00)	2.65 (6.89)	2.65 (6.89)
LSD (p=0.05)	NS	NS	NS	NS	NS	NS
IWM	1.92 (2.75)	1.72 (2.08)	1.66 (1.83)	1.26 (0.66)	1.44 (1.16)	1.36 (0.91)
Herbicide	3.61 (12.08)	3.52 (11.41)	3.18 (9.16)	3.17 (9.08)	3.01 (8.16)	2.96 (7.83)
Control	3.82 (13.66)	4.01 (15.16)	3.58 (11.91)	3.75 (13.16)	3.62(12.16)	3.57 (11.83)
LSD (p=0.05)	0.23	0.286	0.286	0.292	0.262	0.256

*Original values are given in parenthesis, which were transformed to $\sqrt{x+1}$

Table 1.2.8: Weed biomass at 60 DAS in DSR during *Kharif* 2024

Treatments	**Weed biomass (g/m^2)**					
	Sedge	**Grasses**				**Broad leaved**
	Cyperus rotundus	*Digitaria sanguinalis*	*Dactyloctenium aegyptium*	*Eragrostis tenella*	*Eleusine indica*	*Phyllanthus niruri*
Ret (CT)	3.81 (13.66)	3.30 (10.22)	2.98 (8.11)	3.12 (9.00)	3.16 (9.22)	2.54 (6.00)
Ret (ZT)	3.71 (13.00)	3.10 (8.77)	2.75 (6.66)	2.80 (7.22)	2.91 (7.66)	2.19 (4.33)
Rem (CT)	4.06 (15.55)	3.43 (11.00)	3.05 (8.55)	3.57 (12.00)	3.29 (10.00)	2.48 (5.88)
Rem (ZT)	3.90 (14.44)	3.24 (9.77)	2.82 (7.11)	2.99 (8.22)	3.03 (8.23)	2.28 (4.88)
LSD (p=0.05)	NS	NS	NS	NS	NS	NS
IWM	3.78 (13.33)	2.83 (7.08)	2.62 (5.91)	2.85 (7.33)	2.96 (7.91)	1.92 (2.75)
Herbicide	3.81 (13.75)	3.14 (8.91)	2.69 (6.33)	2.92 (7.91)	2.83 (7.08)	1.76 (2.25)
Control	4.02 (15.41)	3.83 (13.83)	3.39 (10.58)	3.59 (12.08)	3.51 (11.41)	3.43 (10.83)
LSD (p=0.05)	0.325	0.375	0.241	0.389	0.320	0.259

*Original values are given in parenthesis, which were transformed to $\sqrt{x+1}$

WP 1.2.2. Weed management in rice- maize-legume cropping system under conservation tillage

Network Centres: IGKVV, Raipur and OUAT, Bhubaneshwar

Treatment	Rice (DSR)	Maize	Cowpea/greengram/green manure
Main plot	**Tillage and residue management**		
	CT	CT	CT
	CT+R	CT+R	CT+R
	ZT	ZT	ZT
	ZT+R	ZT+R	ZT+R
Sub plot	**Weed management**		
Herbicide rotation	1st year: Pendimethalin 678 g/ha (2 DAS) *fb* bispyribac-sodium 25 g/ha (20 DAS) 2nd year: Pretilachlor + pyrazosulfuron 615 g/ha (2 DAS) *fb* cyhalofop+ penoxsulam 135 g/ha (20 DAS) 3rd year: Pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20 DAS)	1styear: Atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) 2nd year: Pyroxasulfone 127.5 g/ha (2 DAS) *fb* tembotrione 120 g/ha (20 DAS) 3rd year: Atrazine + mesotrione 875 g/ha (20 DAS)	1styear: Pendimethalin + imazethapyr 1.0 kg/ha (2 DAS) 2nd year: Imazethapyr 100 g/ha (20 DAS) 3rd year: Pendimethalin 678 g/ha (2 DAS)
IWM	Pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest	Atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS)) *fb* hand weeding (40 DAS) *fb* weed seed harvest	Pendimethalin 678 g/ha (2 DAS) *fb* hand weeding (30 DAS)
Unweeded check	Partially weedy (weeds removed after critical period)	Weedy check	Weedy check

IGKV, Raipur

Rabi **2023-24 (Maize)**

In maize during 2023-24, the experimental field was heavily infested with *Medicago denticulata, Echinochloa colona, Chenopodium album* and *Convolvulus arvensis* with a dominance of *M. denticulata* having almost 33% of total population. At 60 DAS, a lesser number of weeds were observed under ZT+R-ZT+R-ZT+R followed by CT+R-CT+R-CT+R as compared to the same tillage practice without residue incorporation. Growth and yield attributes were recorded higher in ZT+R. Significantly higher grain yield (4.66 t/ha) with maximum net returns of Rs. 58315/ha and B: C (2.44) was recorded under the ZT+ R- ZT+R- ZT+ R. However, CT+R-CT+R-CT+R also produced a comparable grain yield (4.51 t/ha) to that of ZT+R.

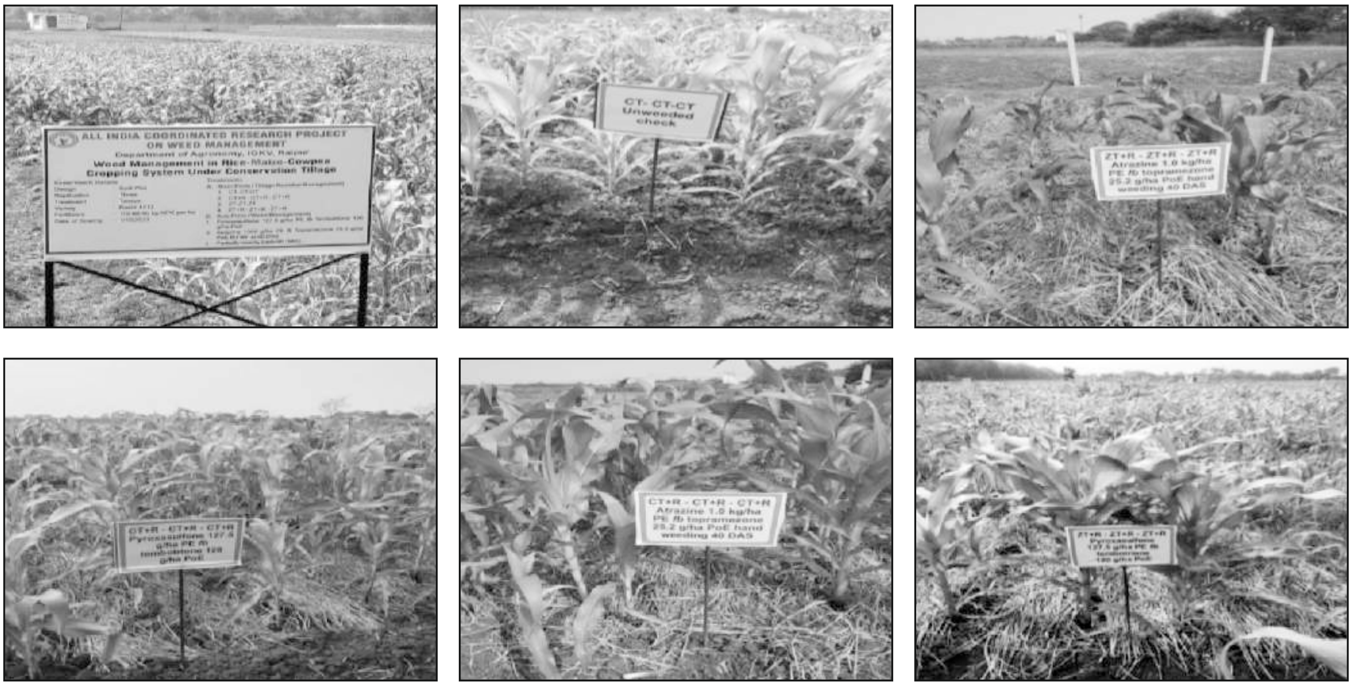
Among weed management options, a lesser number of weeds were recorded under the integrated weed management option i.e. atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest at all the observational stages. Almost similar findings were recorded in the case of weed biomass at all stages. Almost similar findings were recorded in the case of weed biomass at all stages. Significantly higher values of yield attributes, grain yield (5.89 t/ha) and net returns (Rs. 61990/ha) were recorded in the IWM option as compared to recommended and partially weedy (weeds removed after critical period) treatment. (**Table 1.2.9**).

Table 1.2.9. Weed biomass, grain yield and economics as influenced by crop establishment methods and weed management practices in maize in rabi 2023-24.

Treatments	Weed biomass (g/m^2)	Grain yield (t/ha)	Net returns (Rs./ha)	B:C
Tillage and residue management				
CT-CT-CT	7.23(51.80)	3.84	38355	1.84
CT-R-CT+R-CT+R	5.50(29.74)	4.51	50681	2.12

Table contd....

ZT-ZT-ZT	6.92(47.37)	4.22	50820	2.30
ZT-R-ZT+R-ZT+R	5.14(25.97)	4.66	58316	2.44
SEm±	0.37	0.05	-	-
LSD(p=0.05)	1.29	0.17	-	-
Weed management practices				
Recommended (atrazine 1.0 kg/ha *fb* topramezone 25.2 g/ha)	6.06(36.18)	4.79	47575	2.47
Integrated (atrazine 1.0 kg/ha *fb* topramezone 25.2 g/ha *fb* hand weeding 40 DAS)	4.03(15.77)	5.89	61990	2.70
Partially weedy (weeds removed after critical period)	8.04(64.22)	2.25	9337	1.34
SEm±	0.18	0.05	-	-
LSD(p=0.05)	0.55	0.16	-	-



Field view of weed management in rice-maize-legume cropping system *Rabi* 2023-24

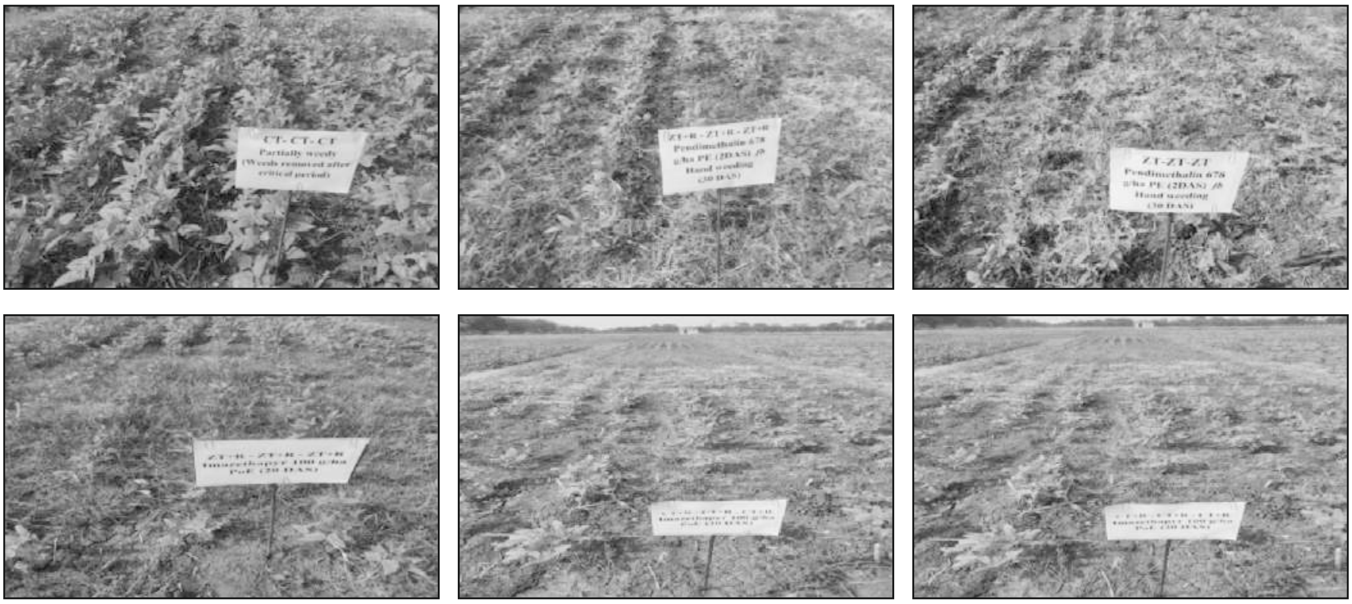
Summer 2024 (Cowpea)

In cowpea during summer 2024, the experimental field was dominated by *Echinochloa colona*, *Alternanthera triandra, Cynodon dactylon* with a dominance of *Echinochloa colona* having 48% of total population in partially weedy (weeds removed after critical period) check. At 40 DAS, a smaller number of weeds were observed under those plots with residue incorporation under ZT+R- ZT+R- ZT+R and followed by CT+R-CT+R-CT+R as compared to the same tillage practice with residue incorporation. ZT+R produced the tallest plant, highest green fodder yield (26.76 t/ha), net returns (Rs.35766/ha) and B: C (2.76) as compared to the conventional (CT)/zero tillage without residue. However, CT+R-CT+R-CT+R also produced a comparable green fodder yield (26.78 t/ha) to that of zero tillage with residue incorporation (**Table 1.2.10**).

Among weed management practices, a lesser number of weeds were recorded under integrated weed management option i.e. pendimethalin 678 g/ha *fb* hand weeding. Almost similar findings were recorded in the case of weed biomass. Significantly the highest GFY (30.46 t/ha) and net return (Rs.40933 Rs/ha) was recorded under pendimethalin 678 g/ha *fb* hand weeding as compared to the recommended IWM and partially weedy check.

Table 1.2.10. Weed biomass, plant height at 40 DAS, green fodder yield, net returns and B: C of cowpea influenced by crop establishment methods and weed management during summer 2024

Treatments	Weed biomass (g/m^2)	Plant height (cm)	Green fodder yield (t/ha)	Net returns (Rs./ha)	B: C
Tillage and residue management					
CT-CT-CT	6.53 (42.19)	42.50	22.80	16855	1.68
CT+R-CT+R-CT+R	5.34 (28.07)	45.55	25.60	33655	2.67
ZT-ZT-ZT	6.49 (41.57)	43.88	18.99	27411	2.34
ZT+ R- ZT+ R- ZT+ R	5.11 (25.63)	46.73	26.76	35767	2.76
SEm±	0.13	1.10	0.96	-	-
LSD(p=0.05)	0.43	3.82	3.33	-	-
Weed management practices					
Pendimethalin +imazethapyr 1.0 kg/ha	5.78 (32.95)	44.11	27.68	26550	2.38
Pendimethalin 678 g/ha *fb* hand weeding	3.70 (13.21)	49.52	30.46	40933	2.70
Unweeded check	7.58 (56.93)	40.73	12.48	17783	2.01
SEm±	0.10	0.78	0.74	-	-
LSD(p=0.05)	0.31	2.33	2.22	-	-



Field view of weed management in rice-maize-legume cropping system summer 2024

***Kharif* 2024 (Rice)**

In rice during 2024, the experimental field was comprised of *Echinochloa colona* among grasses, *Cyperus iria* among sedges and *Alternanthera triandra* among broad-leaf weeds. Broadleaved weeds and sedges dominated the weed flora at all the growth stages as compared to grasses and other weeds. Other weeds like *Brachiaria ramosa*, *Sporobolus diander*, *Cyanotis axillaris, Commelina benghalensis, Ludwigia parviflora,* etc. were also found in irregular and fewer numbers. *Cyanotis axillaris* and *Sporobolus diander* being late *kharif* weeds dominated the weed flora during the maturity of crop.

Weed density recorded at 60 DAS revealed that tillage practices caused remarkable variation in weed density at all the stages of crop growth. The lowest weed density was found under CT+R-CT+R-CT+R over CT without residue incorporation, ZT-ZT-ZT and ZT+R at all the stages. However, weed density and biomass were lower in ZT(DSR)+R as compared to ZT alone, this might be due to the presence of crop residues. Conventional tillage added with residue produced the highest yield of 5.26 t/ha with higher net returns (Rs. 87238/ha) over non-residue treatment with lesser net returns. On the other hand, ZT+ R-ZT+ R- ZT+ R produced higher yield and net returns (4.64 t/ha and Rs. 75803/ha, respectively) over non-residue (ZT-ZT-ZT) (**Table 1.2.11**).

As regards of weed management, the lower density of total weeds and biomass was less under IWM followed by RH over control. Integration of pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20DAS) with hand weeding (40 DAS) *fb* weed seed harvest produced the highest grain yield (6.09 t/ha) but it was at par to that of pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20 DAS). Partially weeded plots produced the lowest yield of rice. IWM also generated the highest net returns (Rs 108086/ha) and fetched the highest B: C (4.38) over the rest of the two practices.

Table 1.2.11. Effect of tillage and weed control treatments on weed infestation, rice grain yield and yield attributes (*Kharif* 2024)

Treatments	**Weed biomass (g/m^2) at 60 DAS**	**Test weight (g)**	**Grain yield (t/ha)**	**Net returns (Rs/ha)**	**B: C**
Main plot (Tillage)					
CT-CT-CT	6.62 (46.54)	27.00	4.73	76222	3.31
CT+R-CT+R-CT+R	5.96 (37.07)	27.44	5.26	87238	3.46
ZT-ZT-ZT	7.47 (57.44)	26.56	4.15	67573	3.38
ZT+R-ZT+ R- ZT+R	7.03 (50.76)	26.89	4.64	75803	3.40
SEm±	0.08	0.25	0.06	-	-
LSD(p=0.05)	0.28	0.83	0.21	-	-
Sub-plot (weed management)					
Pendimethalin+pyrazosulfuron 920 g/ha (2DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20DAS)	5.98 (35.98)	26.17	5.84	101269	4.05
Integrated weed management (Pendimethalin 678 g/ha (2DAS) *fb* bispyribac-sodium 25 g/ha (20DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest	5.25 (27.45)	27.92	6.09	108086	4.38
Partially weedy (weeds removed after critical period)	8.76 (76.68)	26.83	2.16	20771	1.73
SEm±	0.12	0.29	0.06	-	-
LSD(p=0.05)	0.35	0.85	0.18	-	-

OUAT, Bhubaneswar

Blackgram 2023-24

In blackgram during 2023-24, the floristic composition of the experimental site was dominated with grasses like *Digitaria ciliaris, Cynodon dactylon, Eleusine indica, Echinochloa colona* and broadleaf weeds like *Phyllanthus niruri, Ageratum conyzoides, Cleome viscosa, Celosia argentia, Ludwigia parviflora, Physalis minima* and *Amaranthus viridis.* The dominant sedge observed was *Cyperus iria*. The CT method of tillage recorded significantly lower weed density than the ZT method. At 20 and 40 DAS, CT+R had the substantially lowest weed density among the various tillage techniques, followed by ZT+R, CT, and ZT. Conventional tillage with residue resulted in the highest grain yield (1055.57 kg/ha), followed by zero tillage with residue (818.3 kg/ha) which was statistically similar to conventional tillage (786.05 kg/ha). Similarly, the economics was followed in a similar trend by obtaining the highest B: C (1.98) with the lowest (1.78) (**Table 1.2.12**).

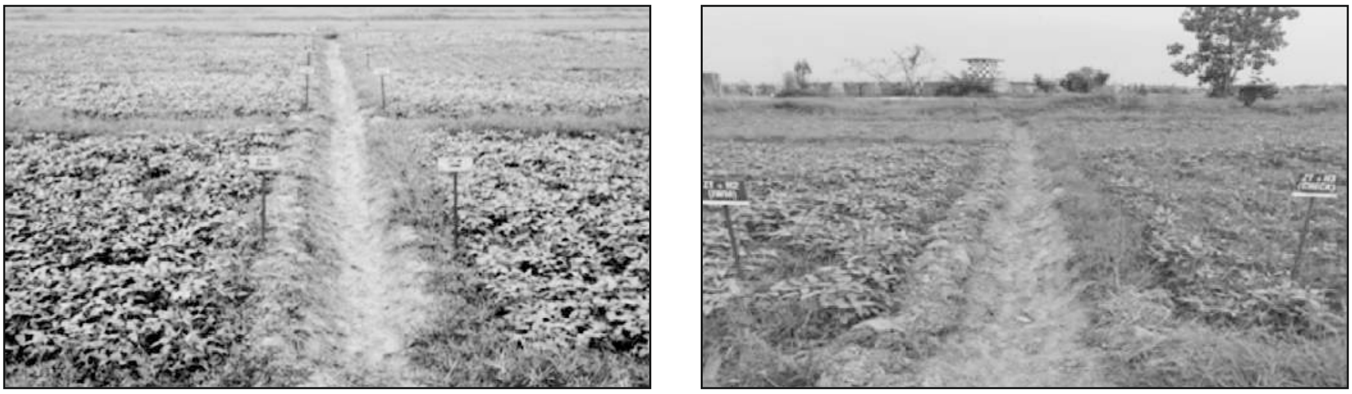
The lowest weed biomass (41.50 g/m^2) at 20 DAS was observed by pendimethalin + imazethapyr (RM) 1 kg/ha at 2 DAS *fb* one hand weeding at 30 DAS, followed by pendimethalin + imazethapyr (RM) 1 kg/ha at 2 DAS (35.86 g/m^2). The weedy check plot had the highest weed biomass (75.50 g/m^2). The highest grain yield was achieved with the application of pendimethalin + imazethapyr (RM) 1 kg/ha at 2 DAS *fb* one hand weeding at 30 DAS, (959.72 kg/ha), which was significantly higher than pendimethalin + imazethapyr (RM) 1 kg/ha at 2 DAS (930.19 kg/ha). Similarly, the application of pendimethalin + imazethapyr (RM) 1 kg/ha at 2 DAS alone achieved the highest B: C (2.54) compared to the application of pendimethalin + imazethapyr (RM) 1 kg/ha at 2 DAS followed by one hand weeding at 30 DAS (2.23). The lowest B: C was observed in the weedy check treatment (1.18).

Table 1.2.12. Effect of tillage and weed management practices on weed density, weed biomass, yield, weed index and B:C in black gram under conservation agriculture

Treatments	Total weed density (no./m^2)	Total weed biomass (g/m^2)	Yield (kg/ha)		Test weight (g)	B: C
	40 DAS	40 DAS	Seed yield	Stover yield		
Tillage and residue management						
CT-CT-CT	8.78(78.00)	3.92(14.89)	786.05	2597.43	35.37	1.98
CT+R-CT+R-CT+R	7.84(62.00)	3.14(9.37)	1055.57	3601.13	35.71	2.20

Table contd....

ZT-ZT-ZT	9.23(86.33)	3.48(11.65)	746.42	2263.02	31.97	1.78
ZT+R-ZT+R-ZT+R	8.31(69.67)	4.29(17.91)	818.31	3137.57	35.34	2.11
SEm±	0.06	0.04	10.31	96.64	0.77	_
LSD (p=0.05)	0.22	0.16	35.68	334.39	2.68	–
Weed management practices						
Recommended herbicides with rotation	8.82(77.75)	3.76(13.69)	930.19	3220.18	35.48	2.54
IWM	7.08(49.75)	3.16(9.51)	959.72	3568.65	35.98	2.23
Partial weed check	9.72(94.50)	4.69(21.54)	664.54	1910.52	32.33	1.18
SEm±	0.11	0.02	8.98	68.60	0.90	_
LSD (p=0.05)	0.31	0.05	26.18	200.21	2.63	_



EXPERIMENTAL SITE VIEW OF BLACK GRAM UNDER CONSERVATION AGRICULTURE

WP 1.2.3. Weed management under conservation tillage system in maize-based cropping *system*

Network Centres: UAS Bengaluru, CCSHAU Hisar, RVSKVV Gwalior and PJTSAU Hyderabad

Treatment	Maize	Mustard	Greengram	Green manure
Main plot	Tillage and residue management			
	CT	CT	CT	CT
	CT+R	CT+R	CT+R	CT+R
	ZT	ZT	ZT	ZT
	ZT+R	ZT+R	ZT+R	ZT+R
Sub plot	Weed management			
Herbicide rotation	1st year: Atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) 2nd year: Pyroxasulfone 127.5 g/ha (2 DAS)*fb* tembotrione 120 g/ha (20 DAS) 3rd year: Atrazine + mesotrione 875 g/ha (20 DAS)	1st year: Pendimethalin 339 g/ha (2 DAS) *fb* pinoxaden 50 g/ha (after first irrigation) 2nd year: Pendimethalin 339 g/ha (2 DAS) *fb* fenoxaprop 100 g/ha (after first irrigation) 3rd year: Oxadiargyl 90 g/ha (2 DAS) *fb* clodinafop 60 g/ha (after first irrigation)	1st year: Pendimethalin + imazethapyr 1.0 kg/ha (2 DAS) 2nd year: Imazethapyr 100 g/ha (20 DAS) 3rd year: Pendimethalin 678 g/ha (2 DAS)	-
IWM	Atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest	Pendimethalin 339 g/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* WSH	Pendimethalin 678 g/ha (2 DAS) *fb* hand weeding (30 DAS)	-
Unweeded check	Weedy check	Weedy check	Weedy check	-

UAS, Bengaluru

Second cycle - Second Crop- *Rabi* Greengram (2023-2024)

In *rabi* greengram (2023-24), the major weed flora observed in the experimental plots were *Cyperus rotundus* (not so prominent - among sedges), *Eleusine indica* and *Digitaria marginata* (among grasses). Whereas, among broad-leaved weeds, major weeds were, *Borreria hispida, Ageratum conyzoides, Commelina benghalensis, Acanthospermum hispidum, Argemone mexicana* and *Celosia argentea*.

At 60 DAS, CT+R obtained the lowest density and biomass (43.56 no./m^2) followed by CT (50.67 no./m^2). Between the ZT and CT practices, ZT recorded the lowest weed density at all stages of crop growth. The lowest weed biomass was obtained with CT+R (8.85 g/m^2) followed by CT (10.29 g/m^2) over ZT and ZT+R. Contrarily, adopting CT+R practices recorded significantly higher yields (1.02 t/ha) followed by CT (0.92 t/ha). Gross returns were higher with CT+R (Rs. 86700/ha), while net returns and B: C were also higher with CT+R (Rs. 57,600/ha and 2.97, respectively) (**Table 1.2.13**).

Among the weed management practices, at 60 DAS, pendimethalin 678 g/ha (2 DAS) *fb* HW (30 DAS) recorded lower weed density and biomass (27.83 no./m^2 and 5.56 g/m^2 respectively) followed by use of post-emergence herbicide alone *i.e.,* Imazethapyr 100 g/ha (20 DAS) (46.50 no./m^2 and 11.33 g/m^2, respectively) lowered the density of weeds compared to partially weedy check. The plots treated with integrated weed management practices (pendimethalin 678 g/ha (2 DAS) *fb* HW (30 DAS) recorded the highest yield (1.04 t/ha) as compared to imazethapyr 100 g/ha (20 DAS) (0.97 t/ha) and partially weedy treatment (0.74 t/ha) due to effective control of weeds.

Table 1.2.13. Effect of crop establishment methods and weed management practices on weed parameters, yield, and economics in greengram, *Rabi* 2023-24

Treatments	Total weed density (no./m^2)	Total weed biomass (g/m^2)	Greengram yield and economics (Rs/ha)					
			Seed yield (t/ha)	Weed index (%)	CoC (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B: C
Tillage and residue management								
CT	7.03 (50.67)	3.30 (10.29)	0.92	--	26,300	78,200	51,900	2.973
CT + R	6.46 (43.56)	3.05 (8.85)	1.02	--	29,100	86,700	57,600	2.979
ZT	7.97 (65.56)	3.72 (13.43)	0.83	--	23,900	70,550	46,650	2.952
ZT+ R	7.66 (61.11)	3.55 (12.22)	0.89	--	26,700	75,650	48,950	2.833
SEm±	0.15	0.07	0.02	NA	NA	NA	NA	NA
LSD (p=0.05)	0.53	0.24	0.09					
Weed management practices								
Imazethapyr 100 g/ha (20 DAS)	7.54 (56.33)	3.50 (11.33)	0.97	9.04	28,199	82,450	54,251	2.924
Pendimethalin 678 g/ha (2 DAS) *fb* HW (30 DAS)	5.53 (27.33)	2.52 (5.56)	1.04	0.00	34,694	88,400	53,706	2.548
Partially weedy (weeds removed after critical period)	9.08 (82.00)	4.19 (16.70)	0.74	30.58	33,300	62,900	29,600	1.889
SEm±	0.22	0.10	0.04	NA	NA	NA	NA	NA
LSD (p=0.05)	0.67	0.30	0.08					

NS – Non-Significant. * Data in the parenthesis are Square root transformed value of (X+0.5) was used for statistical analysis.

Third cycle – First Crop- *Kharif* Maize (2024-2025)

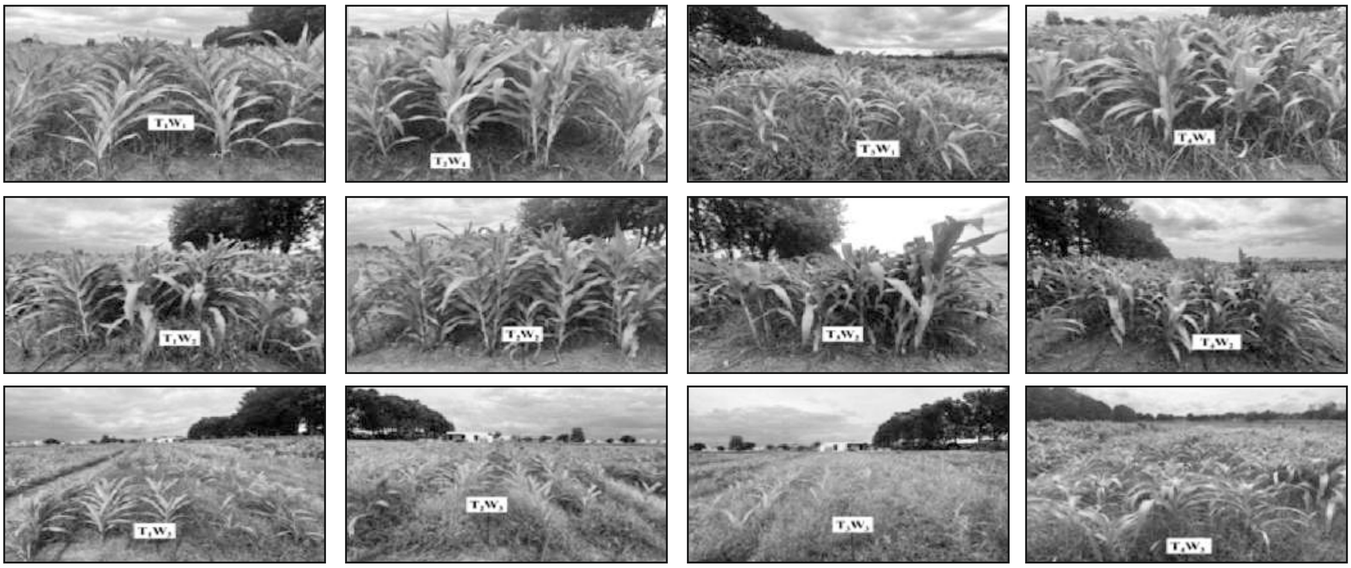
In maize during *kharif* 2024-25, major weed flora observed in the experimental plots were *Cyperus rotundus* (Sedge), *Eleusine indica, Echinochloa colona, Dactyloctenium aegyptium* and *Digitaria marginata* (Grasses) *Borreria hispida, Ageratum conyzoides, Acanthospermum hispidium* and *Celosia argentea* (Broad leaved weeds). Among the weed species, the density of *Dactyloctenium aegyptium* and *Ageratum conyzoides* was higher than other weed species, indicating their dominance.

Among tillage practices, at 60 DAS, the CT+R recorded the lowest weed density and biomass of 42.67 no./m^2 and 6.03 g/m^2 respectively followed by CT alone (54.56 no./m^2 and 7.33 g/m^2, respectively)**.** The CT + R numerically recorded the highest grain yield (6.02 t/ha) followed by CT and ZT + R practices. CT+R plots recorded the highest gross returns, net returns and B: C (Rs. 1,68,560/ha, Rs. 1,25,110/ha and 3.87, respectively) while CT recorded the comparable B:C (3.85).

Among the weed management practices, at 60 DAS, atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest (30.67 no./m^{2}and 6.26 g/m^2 respectively) recorded significantly lower total weed density and biomass compared to two other treatments (**Table 1.2.14**). the plots treated with atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest recorded highest grain yield (5.95 t/ha) compared to use of only post-emergence herbicide (5.66 t/ha). Partially weedy check treatment recorded lowest seed yield (4.85 t/ha) due to less effective control of weeds throughout crop growth period. IWM [atrazine 1.0 kg/ha (2 DAS) *fb* topramezone 25.2 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest] recorded the higher net returns of Rs. 1,16,203/ha, however, the highest B:C of 3.39 was recorded in atrazine + mesotrione 875 g/ha (20 DAS) treatment due to increased cost of cultivation in integrated weed management practices.

Table 1.2.14. Effect of Crop establishment methodsand weed management practices influences on weed parameters, yield, and economics in maize during *Kharif*, 2024-25

Treatments	Total weed density (no./m^2)	Total weed biomass (g/m^2)	Maize yield and economics (Rs. /ha)					
			Grain yield (t/ha)	Weed index (%)	CoC (Rs./ha)	Gross returns (Rs. /ha)	Net returns (Rs. /ha)	B:C
Crop establishment methods								
CT	7.74 (61.89)	3.38(11.02)	5.60	-	40,650	1,56,676	1,16,026	3.854
CT + R	6.91 (50.67)	3.09 (9.12)	6.02	-	43,450	1,68,560	1,25,110	3.879
ZT	9.09 (83.67)	3.90 (14.84)	4.95	-	38,250	1,39,160	1,00,910	3.638
ZT+ R	8.58 (74.67)	3.67 (12.83)	5.35	-	41,050	1,49,800	1,08,750	3.649
SEm±	0.18	0.13	0.19	NA	NA	NA	NA	NA
LSD (p=0.05)	0.63	0.45	0.67					
Weed management practices								
W_1	8.11 (65.58)	3.66 (12.60)	5.66	4.07	46,749	1,58,480	1,11,731	3.390
W_2	6.14 (38.25)	2.65 (6.26)	5.95	0.00	50,397	1,66,600	1,16,203	3.306
W_3	9.99 (99.33)	4.22 (17.00)	4.85	17.87	51,850	1,35,800	83,950	2.619
SEm±	0.19	0.11	0.17	NA	NA	NA	NA	NA
LSD (p=0.05)	0.59	0.32	0.52					



Effect of tillage practices and weed management practices on maize at 40 DAS

CCSHAU, Hisar

Rabi 2023-24 (Mustard)

Different tillage and residue management treatments in main plots significantly influenced the density of *M. denticulata* and *R. dentatus,* however, density of *P. minor, C. album, A. arvensis* and *C. didymus* not varied significantly. Significantly lower density of *M. denticulata* was recorded in CT as compared to other treatments. Density of *R. dentatus* was significantly lower in CT as compared to ZT and ZT+R.

Application of pendimethalin *fb* fenoxaprop (339 g/ha, PE *fb* 100 g/ha, PoE) and pendimethalin (339 g/ha) *fb* hand weeding significantly reduced the density and biomass accumulation by weeds as compared to weedy check (**Table 1.2.15**). Plant height and primary branches/plant were at par among different tillage and residue management practices, however, siliqua/plant were significantly higher in CT as compared to ZT, resulting in significantly higher seed yield in CT (1520 kg/ha) as compared to ZT (1354 kg/ha). Application of pendimethalin *fb* hand weeding resulted in significantly higher primary branches per plant (4.0), number of siliqua per plant (262.0) and seed yield (1674 kg/ha) as compared to pendimethalin *fb* fenoxaprop (1413 kg/ha) and weedy check treatment (1188 kg/ha).

Table 1.2.15. Effect of crop establishment methods and weed management on yield parameters and yield of mustard 2023-24

Treatments	Plant height at harvest (cm)	Primary branches/plant	No. of siliqua/ plant	Seed yield (kg/ha)
Tillage and residue management				
CT	203.4	3.9	244.9	1520
CT + R	204.6	3.7	239.8	1495
ZT	198.8	3.6	224.2	1354
ZT + R	198.3	3.6	224.0	1331
SEm±	2.4	0.1	4.8	41
LSD (p=0.05)	NS	NS	17.0	144
Weed management				
Pendimethalin *fb* fenoxaprop (339 fb 100 g/ha)	204.2	3.8	242.6	1413

Table contd....

Pendimethalin *fb* HW (339 g/ha)	207.8	4.0	262.0	1674
WC	191.7	3.4	195.2	1188
SEm±	1.9	0.1	4.4	41
LSD (p=0.05)	5.9	0.4	13.5	123

Summer 2024 (Greengram)

C. rotundus, E. colona, D. aegyptium and *C. arvensis* are the major weeds infested the summer greengram in the maize-mustard-mungbean cropping system after the harvest of mustard crop. At 60 DAS, density of *C. rotundus* was significantly higher under CT and CT + R as compared to ZT and ZT +R, respectively.

Among the weed management, application of imazethapyr 100 g/ha as PoE and pendimethalin *fb* hand weeding resulted in significantly lower density of all weeds as compared to weedy check. *C. rotundus* density was lower with application of imazethapyr as compared to pendimethalin *fb* hand weeding. The yield attributes i.e. plant height, primary branches/plant, pod length and yield was not significantly differed due to main plots treatments. However, application of imazethapyr (100 g/ha) and pendimethalin 678 g/ha *fb* hand weeding were at par with each other in terms of yield attributes and yield. Application of imazethapyr and pendimethalin *fb* hand weeding resulted in 56.9% and 58.5% higher seed yield as compared to weedy check, respectively (**Table 1.2.16**).

Table 1.2.16. Effect of crop establishment methods and weed management on weed density (no./m^2) at 60 DAS, yields attributes and yield of green gram

Treatments	*C. rotundus*	*E. colona*	*D. aegyptium*	*C. arvensis*	Plant height (cm)	Seed yield (kg/ha)
Tillage and residue management						
CT	7.7 (59.6)	3.4 (12.9)	3.0 (10.0)	1.3 (1.1)	37.1	610.6
CT + R	9.2 (86.7)	3.6 (14.7)	2.8 (8.2)	1.1 (0.2)	38.8	620.7
ZT	7.0 (53.1)	4.0 (17.8)	3.4 (13.1)	1.2 (0.7)	37.0	644.8
ZT + R	8.3 (69.8)	3.6 (14.9)	3.4 (12.4)	1.2 (0.4)	39.4	663.0
SEm±	0.2	0.1	0.2	0.1	1.0	36.6
LSD (p=0.05)	0.6	0.4	NS	NS	NS	NS
Weed management						
Pendimethalin + imazethapyr 1000 g/ga	6.3 (39.2)	3.4 (11.0)	3.3 (10.5)	1.1 (0.2)	39.6	770.8
Pendimethalin 678 g/ha *fb* HW	7.6 (58.7)	1.8 (2.2)	1.6 (1.7)	1.2 (0.5)	40.3	801.3
Weedy check	10.2 (104.0)	5.7 (32.0)	4.6 (20.7)	1.4 (1.2)	34.4	332.2
SEm±	0.18	0.1	0.2	0.1	0.8	31.7
LSD (p=0.05)	0.5	0.3	0.6	NS	2.5	93.6

*Original data in parenthesis were subjected to square root transformation

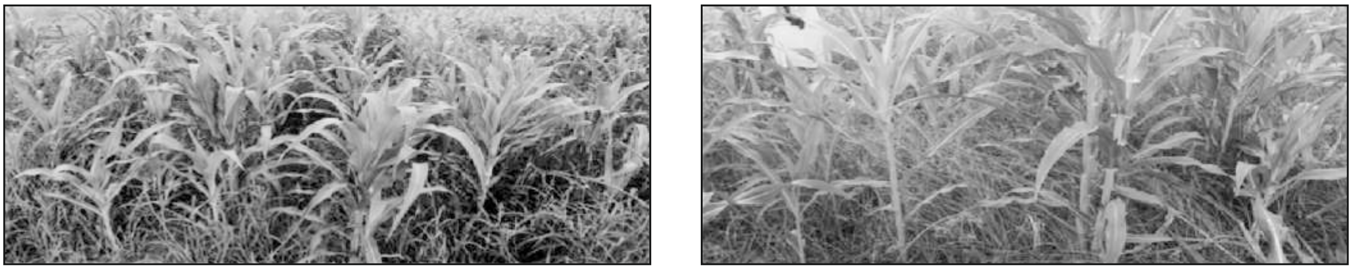
***Kharif* 2024 (Maize)**

In maize during *kharif* 2024, main plot treatments (tillage and residue management) significantly influence the density of *C. rotundus* and *D. aegyptium* while the density of *E. colona* did not differ significantly at 60 DAS. The density of *C. rotundus* was significantly higher under CT and CT+R as compared to ZT and ZT+R, while the *D. aegyptium* density was higher under ZT+R as compared to other CT and CT+R. Tillage and residue management had no significant influence on the yield attributes and yield.

Among weed management practices, total biomass accumulation by weeds was not influenced significantly by different tillage and residue management practices in main plot treatments. Weedy check resulted in significantly higher dry matter accumulation as compared to herbicide rotation (mesotrione + atrazine) and IWM. Application of mesotrione + atrazine (875 g/ha, PoE) also resulted in higher dry matter accumulation as compared to IWM (atrazine *fb* topramezone *fb* HW). Atrazine (1000 g/ha, PRE) *fb* topramezone (25.2 g/ha, PoE) *fb* hand weeding resulted in higher maize yield (4144.2 kg/ha) as compared to mesotrione + atrazine (875 g/ha, PoE) but significantly higher than weedy check (**Table 1.2.17**).

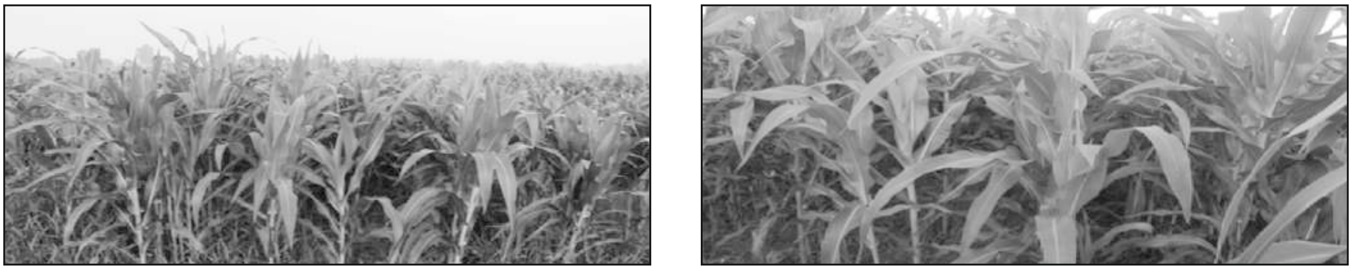
Table 1.2.17. Effect of crop establishment methods and weed management on yield parameters and yield of maize

Treatments	*C. rotundus* (no./m^2)	*E. colona* (no./m^2)	*D. aegyptium* (no./m^2)	Plant height at harvest (cm)	Dry weight/plant (g)	Cob length (cm)	Yield (kg/ha)
Main plots							
CT	7.6 (62.0)	2.4 (6.0)	2.1 (4.2)	200.8	179.6	15.6	3207.5
CT + R	7.1 (51.1)	2.3 (5.5)	2.1 (4.4)	201.4	181.2	16.1	3270.2
ZT	6.0 (37.8)	2.3 (5.3)	2.3 (5.3)	206.6	184.4	16.2	3329.7
ZT + R	6.1 (41.6)	2.2 (4.9)	2.5 (6.4)	209.8	185.8	16.5	3468.4
SEm±	0.2	0.1	0.6	3.0	3.3	0.4	64.9
LSD (p=0.05)	0.6	NS	0.2	NS	NS	NS	NS
Sub plots	**Maize growth and weed density under different tillage treatments**						
Mesotrione + atrazine 875 g/ha	4.7 (22.2)	2.4 (4.7)	2.5 (5.2)	211.9	197.6	16.3	3891.9
Atrazine 1.0 kg/ha *fb* topramezone 25.2 g/ha *fb* HW	6.4 (41.3)	1.0 (0.0)	1.0 (0.0)	216.1	202.4	16.8	4074.3
Weedy check	9.0 (80.8)	3.5 (11.3)	3.3 (10.2)	185.9	148.2	15.2	1990.6
SEm±	0.2	0.06	0.07	2.0	2.9	0.13	60.9
LSD (p=0.05)	0.5	0.2	0.2	6.0	8.5	0.4	184.3



CT-mesotrione + atrazine

CT- atrazine *fb* topramezone



ZT- mesotrione + atrazine

ZT- atrazine *fb* topramezone

Maize growth and weed density under different tillage treatments

RVSKVV, Gwalior

***Rabi* 2023-24 (Mustard)**

In mustard during *rabi* 2023-24, the experimental field comprised were *Phalaris minor, Spergula arvensis,* and *Cynodon dactylon* as grasses and *Chenopodium album, Anagallis arvensis, Convolvulus arvensis, Rumex dentatus, Chichorium intibus* and *Medicago hispida* as major broad-leaved weeds *Cyperus rotundus* as sedges. The *Cyperus rotundus* was most dominating sedges among all the weeds. The lowest weed population and respective biomass of weeds at 60 DAS were observed where ZT was done with crop residue. the highest number of siliqua/plant (153.2) and seed yield (1.84 t/ha) was recorded in ZT+R–ZT+R–ZT+R. The maximum net returns (Rs 63441/ha) and B: C (3.88) was obtained in ZT+R–ZT+R–ZT+R followed by CT+R-CT+R-CT+R (**Table 1.2.18**).

All the weed management practices significantly influenced the density and biomass of weeds. The highest weed population and biomass was recorded in weedy check while the lowest was recorded where pendimethalin 339 g/ha at 2 DAS *fb* one hand weeding at 30 DAS + WSH were applied. The maximum growth parameters, yield attributes, seed yield (1.98 t/ha), net returns (Rs. 76484/ha) and B:C (3.50) was obtained with the application of pendimethalin 339 g/ha at 2 DAS *fb* one hand weeding at 30 DAS *fb* weed seed harvest.

Table 1.2.18. Crop establishment methods and weed management practices influence weeds, yield and economics in mustard under maize- based cropping system

Treatments	Weed density (no./m²)	Weed biomass (g/m²)	No. of branches / plant	Grain yield (t/ha)	Net returns (Rs./ha)	B: C
Tillage and residue management						
CT-CT-CT	24.82 (2171.7)	10.27	3.89	1.70	53496	2.58
CT+R-CT+R-CT+R	18.04 (1086.0)	7.12	3.98	1.85	59612	2.70
ZT-ZT-ZT	21.53 (1616.7)	8.46	3.87	1.52	56249	3.58
ZT+R-ZT+R-ZT+R	17.24 (914.7)	6.11	4.07	1.93	75151	4.25
SEm±	1.59	1.47	0.16	0.03	-	-
LSD (p=0.05)	5.17	4.80	0.53	0.10	-	-
Weed management						
Pendimethalin 339 g/ha (2 DAS) *fb* pinoxaden 50 g/ha (after first irrigation)	22.46 (2186.7)	10.63	3.98	1.71	62611	3.50
Pendimethalin 339 g/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* WSH	13.06 (708.0)	1.69	4.02	2.10	76484	3.50
Partially weedy (weeds removed after critical period)	25.70 (2894.3)	11.65	3.85	1.44	49841	3.06
SEm±	2.04	1.18	0.18	0.01	-	-
LSD (p=0.05)	6.66	3.84	0.59	0.04	-	-

Pendimethalin 339 g/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* WSH

Pendimethalin 339 g/ha (2 DAS) *fb* pinoxaden 50 g/ha (after first irrigation)

***Kharif* 2024 (Maize)**

In maize (Hybrid GK-3101) during *kharif* 2024, weeds observed in the experimental site were *Setaria glauca*, *Echinochloa colona, Acrachne racemosa, Brachiaria reptans* and *Cynodon dactylon* as narrow leaved weeds, *Celosia argentea, Commelina benghalensis, Trianthema monogyna, Phyllanthus niruri* and *Digera arvensis,* as broad-leaved weeds and *Cyperus rotundus* as sedges (**Table 1.2.19**).

Among these, the density of *Cyperus rotundus* was very high. At 60 DAS, different tillage practices did not have any significant effect on population and biomass of total weeds. However, all the tillage and residue management treatments were comparable. ZT+R system recorded taller plants, more leaves/plant (8.09) and length of cob (15.6 cm) followed by CT+R system. These helped in obtaining maximum grain (3.47 t/ha) and stover (7.09 t/ha) yield, net returns (Rs.65971/ha) with B: C (3.22) followed by CT+R.

Similarly, the weed management practices significantly influenced the population of weeds at 60 DAS. The application of atrazine 1.0 kg/ha *fb* topramezone 25.2 g/ha with one hand weeding *fb* WSH suppressed the weed density and biomass with the highest WCE (85.42%) at 60 DAS. Lower weed parameters helped in obtaining taller plants (141.60 cm) with a higher grain (3.63 t/ha) and stover yield (7.33 t/ha) (**Table 1.2.19**).

Table 1.2.19. Effect of different tillage and weed management practices on weeds, yields and economics of maize crop at harvest stage

Treatment	Weed density (no./m^2)	Weed biomass (g/m^2)	Plant height (cm)	Grain yield (t/ha)	Stover yield (t/ha)	Net returns (Rs./ha)	B: C
Tillage and residue management							
CT-CT-CT	11.83 (106.5)	23.98	137.86	4.45	7.23	88332	3.73
CT+R-CT+R-CT+R	11.68 (105.1)	23.82	140.74	4.56	7.37	87569	3.44
ZT-ZT-ZT	11.27 (101.4)	24.59	136.38	4.08	7.00	84103	4.03
ZT+R-ZT+R-ZT+R	11.85 (106.6)	22.41	143.08	4.66	7.79	96384	4.14
SEm±	0.35	1.32	2.56	0.10	0.14	-	-
LSD (p=0.05)	1.22	4.58	8.86	0.36	0.47	-	-
Weed management practices							
Atrazine 1.0 kg/ha *fb* topramezone 25.2 g/ha	17.59 (211.1)	24.91	139.29	4.31	7.37	86384	3.73
Atrazine 1.0 kg/ha *fb* topramezone 25.2 g/ha *fb* HW *fb* WSH	0.71 (8.5)	0.00	141.60	5.04	8.03	101892	3.97
Partially weedy	16.67 (200.1)	46.19	137.66	3.96	6.64	79015	3.72
SEm±	0.50	1.59	1.94	0.10	0.14	-	-
LSD (p=0.05)	1.96	6.25	7.61	0.37	0.56	-	-

ZT+R with atrazine 1.0kg/ha *fb* topramezone 25.2 g/ha *fb* HW *fb* WSH

CT with atrazine+ mesotrione 875 g/ha (20 DAS)

Partially weedy

PJTSAU, Hyderabad

***Kharif* 2024 (Maize)**

In maize during *kharif* 2024, weeds observed in the experimental site were *Cynodon dactylon, Rottboellia cochinchinensis, Dactyloctenium aegyptium, Cyperus rotundus, Trianthema portulacastrum, Amaranthus viridis, Commelina benghalensis, Parthenium hysterophorus, Digera arvensis, Alternanthera sessilis* and *Euphorbia geniculata.* The weed density and biomass did not vary among the main plots both at 20 and 40 DAS. However, weed management practices differed significantly. Herbicide application was found to be better than IWM both at 20 and 40 DAS, with respect to weed density (4.56, 5.35 no./m^2) and biomass (3.79 and 5.21 g/m^2) respectively. Highest values were observed with unweeded check.

Similar to weed parameters, the kernel yield was comparable among the main plots as there was no variation in tillage. Among the weed management treatments, highest kernel yield was recorded with herbicide application (7.24 t/ha) but it was also comparable with IWM treatment and both were superior to unweeded check (**Table 1.2.20**).

Table 1.2.20. Effect of tillage and weed control treatments on weed count (No. / m^2) at 60 DAS in soybean

Treatment		Weed density (No./m^2)		Weed biomass (g/m^2)		Kernel yield (t/ha)
Tillage	WM	20 DAS	40 DAS	20 DAS	40 DAS	
T_1 :(CT-CT-CT)	W_1	4.50 (19.33)	5.38 (28.00)	3.73 (13.00)	5.03 (24.33)	7.32
	W_2	5.32 (27.33)	6.12 (36.33)	4.02 (15.33)	6.71 (44.00)	7.19
	W_3	7.53 (55.67)	9.40 (87.33)	5.39 (28.00)	10.22 (103.67)	3.12
T_2 :(CT+R- CT+R- CT+R)	W_1	4.86 (22.67)	5.40 (28.33)	3.99 (15.00)	5.27 (27.00)	7.19
	W_2	5.41 (28.33)	5.88 (33.67)	3.96 (14.67)	6.87 (46.33)	6.96
	W_3	7.72 (58.67)	9.66 (92.33)	5.22 (26.33)	10.38 (107.00)	2.61
T_3 :(ZT- ZT- ZT)	W_1	4.77 (22.00)	5.10 (25.00)	3.50 (11.33)	5.76 (32.33)	7.45
	W_2	5.74 (32.00)	5.91 (34.00)	4.02 (15.33)	7.18 (50.67)	6.86
	W_3	7.50 (55.33)	9.93 (97.67)	5.28 (27.00)	10.27 (104.7)	2.56
T_3 :(ZT+R- ZT+R- ZT+R)	W_1	4.12 (16.00)	5.54 (29.67)	3.95 (14.67)	4.78 (22.00)	6.99
	W_2	5.83 (33.33)	6.05 (35.67)	4.20 (16.67)	7.36 (53.33)	6.77
	W_3	7.65 (57.67)	9.35 (86.33)	5.25 (26.67)	10.40 (107.3)	2.02
Tillage (Main plots)						
T_1 :(CT-CT-CT)		5.78	6.96	4.38	7.32	5.88
T_2 :(CT+R- CT+R- CT+R-)		6.00	6.98	4.39	7.51	5.59
T_3 :(ZT- ZT- ZT)		6.00	6.98	4.27	7.74	5.62
T_3 :(ZT+R- ZT+R- ZT+R)		5.87	6.98	4.47	7.51	5.26
Weed Management (Sub-plots)						
W_1 : Herbicide rotation		4.56	5.35	3.79	5.21	7.24
W_2: IWM		5.57	5.99	4.05	7.03	6.95
W_3: unweeded check		7.60	9.58	5.28	10.32	2.58

	SEm±	LSD (p=0.05)	SEm±	LSD (p=0.05)	SEm±	LSD (p=0.05)	SEm±	LSD (p=0.05)	SEm±	LSD (p=0.05)
Tillage	0.162	NS	0.060	NS	0.122	NS	0.170	NS	266.3	NS
WM	0.112	0.340	0.093	0.282	0.104	0.313	0.140	0.423	164.3	496.7
Sub at same level of main	0.280	NS	0.104	NS	0.212	NS	0.295	NS	461.3	NS
Main at same level of sub	0.245	NS	0.163	NS	0.209	NS	0.285	NS	378.0	NS

WP 1.2.4. Weed management under conservation tillage system on soybean-based cropping system

Network Centres: CSKHPKV Palampur, MPUAT Udaipur and PDKV Akola

Treatment	Soybean	Wheat	Greengram/green manure
Main plot	Tillage and residue management		
	CT	CT	CT
	CT+R	CT+R	CT+R
	ZT	ZT	ZT
	ZT+R	ZT+R	ZT+R
Sub plot	Weed management		
Herbicide rotation	1st year: Diclosulam 28 g/ha (2 DAS) *fb* imazethapyr 100 g/ha (20 DAS) 2nd year: Sulfentrazone+clomazone 725 g/ha (2 DAS) *fb* propaquizafop + imazethapyr 125 g/ha (20 DAS) 3rd year: Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* imazetapyr + imazamox 70 g/ha (20 DAS)	1st year: Clodinafop + metsulfuron 64 g/ha (20 DAS) 2nd year: Mesosulfuron + iodosulfuron 14.4 g/ha (20 DAS) 3rd year: Pinoxaden + carfentrazone 40 + 20 g/ha or Sulfosulfuron+ metsulfuron 32 g/ha (20 DAS)	-
IWM	Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* weed seed harvest	Clodinafop+ metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS)	-
Unweeded check	Weedy check	Weedy check	-

CSKHPKV, Palampur

Kharif 2024 (Soybean)

In soybean during *kharif* 2024, in the experimental field diverse weed flora comprised of *Ageratum conyzoides, Aeschynomene indica, Panicum dichotomiflorum, Sigesbeckia orientalis, Bidens pilosa, Cyperus* spp., *Digitaria sanguinalis, Erigeron canadensis, Polygonum alatum* and *Ipomoea purpurea* were the major weeds. Significantly lower count of broad - leaved weeds as well as grassy weeds was recorded in ZT+R-ZT+R in both crops though this treatment was at par with CT+R – CT+R (**Table 1.2.21**). Significantly higher seed yield was recorded when both the crops in the system were raised with ZT+R though this treatment was at par with the yield obtained when both the crops were raised with CT+R.

Among weed control treatments, significantly lower count of all the three category of weeds (broad – leaved weeds, grassy weeds and sedges) was recorded with the H – H treatment in which soybean crop was grown with pendimethalin + imazethapyr (RM) 1.0 kg/ha at 2 DAS *fb* imazethapyr + imazamox (RM) 70 g/ha at 20 DAS. Significantly higher seed yield was obtained with the IWM practices being followed in both the crops (IWM – IWM) followed by use of herbicides (H – H) and partially weedy conditions being maintained in both crops (Wc – Wc), each treatment differing significantly (**Table 1.2.21**).

Table 1.2.21. Effect of tillage and weed control treatments on weed count (no. / m^2) at 60 DAS and seed yield in soybean

Treatment	Weed count (no. / m^2)			Seed yield (t/ha)
	Broad leaved weeds	Grassy weeds	Sedges	
Tillage				
CT - CT	6.2 (38.5)	3.4 (11.8)	3.3 (10.9)	1.53
CTR - CTR	5.5 (30.1)	2.9 (8.5)	2.9 (8.4)	1.69
ZT - ZT	7.2 (51.8)	3.9 (15.1)	3.8 (14.2)	1.39
ZTR - ZTR	5.4 (29.2)	3.0 (9.3)	3.0 (8.8)	1.72
LSD (p=0.05)	0.6	0.4	0.3	1.1
Weed control treatment				
H - H	6.0 (3.6)	3.2 (10.2)	3.1 (9.7)	1.58
IWM - IWM	3.7 (13.7)	1.9 (3.4)	2.1 (4.6)	1.86
Wc – Wc (Partially weedy)	8.5 (72.5)	4.9 (24.2)	3.9 (15.4)	1.32
LSD (p=0.05)	0.7	0.5	0.2	1.5

Values given in parentheses are the mean of original values, Data subjected to $\sqrt{x} + 0.5$ square root transformation

MPUAT, Udaipur

***Rabi* 2023-24 (Wheat)**

In wheat during *rabi* 2023-24, the major weed flora observed in the experimental field were grassy and broadleaf weeds including *Chenopodium album* (6.01%), *Chenopodium murale* (12.14%), *Fumaria parviflora* (4.28%), *Melilotus indica* (4.36%), *Convolvulus arvensis* (2.52%), *Avena fatua* (3.16%), *Phalaris minor* (3.18%), *Launaea asplenifolia* (3.43%), *Rumex dentatus* (2.50 %) and *Malva parviflora* (58.42%). Among tillage and residue management, soybean (ZTR)-wheat (ZTR)-greengram (ZTR) resulted in lowest weed density and biomass which was followed by soybean (ZT)- wheat (ZT)- GM (ZT). While soybean (CT)- wheat (CT)- greengram (CT) registered maximum plant height (74.46 cm) and grain/ear (45.06). However, highest grain yield (4.18 t/ha), straw yield (5.84 t/ha) and net returns (Rs. 101126/ha) registered with the treatment soybean (CT)- wheat (CT)- greengram (CT) (**Table 1.2.22**).

Among weed management practices, clodinafop + metsulfuron 64 g/ha (30 DAS) recorded the lowest weed density and biomass at 60DAS. While, clodinafop +metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS) registered maximum plant height (75.46 cm), grain/ear (46.39), test weight (43.55 g), grain yield (4.48 t/ha), straw yield (5.96 t/ha) and net returns (Rs. 106813/ha).

Table 1.2.22. Effect of crop establishment methods and weed management on growth, yield and economics of wheat in soybean-wheat cropping system

Treatment	Plant height (cm)	Grain Yield (t/ha)	Straw yield (t/ha)	Net returns (Rs./ha)	B:C
Tillage and residue management					
CT-CT-CT	74.46	4.08	5.60	97419	3.84
CTR-CTR-CTR	74.04	4.18	5.84	101126	3.42
ZT-ZT-ZT	71.31	3.94	4.98	92456	6.32
ZTR-ZTR-ZTR	69.43	3.62	4.81	83959	4.65
SEm±	0.77	0.10	0.19	2222	0.28
LSD (P=0.05)	2.66	0.34	0.64	7689	0.98
Weed management					
W1	74.99	4.25	5.79	103254	2.84
W2	75.46	4.48	5.96	106813	2.91
W3	66.48	3.13	4.18	71153	2.92
SEm±	0.93	0.07	0.10	1573	0.41
LSD (P=0.05)	2.79	0.21	0.30	4716	1.22
Interaction LSD	74.99	4.25	5.79	103254	2.84

***Kharif* 2024 (Soybean)**

In soybean during *kharif* 2024, the experimental plot was infested with *Dinebra retroflexa* (33.89%), *Echinochloa colona* (22.74%), *Elusine indica* (11.45%), *Digera arvensis* (12.00%), *Commelina benghalensis* (3.24%), *Physalis minima* (2.79%), *Trianthema portulacastrum* (8.50%), *Cynadon dactylon* (3.85%) and *Amaranthus viridis* (1.53%). At 60 DAS, soybean (ZT+R)- wheat (ZT+R)- greengram (ZT+R) resulted in lowest weed density and biomass which was followed by soybean (ZT)- wheat (ZT)- greengram (ZT). However, soybean (CT+R)- wheat (CT+R)- greengram (CT+R) resulted the maximum no. of pods/plant (44.40), seed yield (1.84 t/ha), haulm yield (2.47 t/ha) and net returns (Rs. 69138/ha). While, highest B: C recorded with soybean (CT)- wheat (CT)- greengram (CT).

Among weed management, application of sulfentrazone+clomazone 725 g/ha *fb* propaquizafop+ imazethapyr 125 g/ha (20 DAS) registered the lowest weed density and biomass. Pendimethalin + imazethapyr 1.0 kg/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* weed seed harvest registered maximum no. of pods/plant (49.89), no. of branches/plant (2.69), 100-seed weight (13.75), seed yield (1.73 t/ha), haulm yield (2.25 t/ha), net returns (Rs. 75482/ha) and B: C (2.23) which was followed by sulfentrazone+clomazone 725 g/ha *fb* propaquizafop+ imazethapyr 125 g/ha (20DAS) (**Table 1.2.23**).

Table 1.2.23. Effect of tillage, residue and weed management on weeds at 60 DAS, yield, yield attributes and economics in soybean (2024)

Treatment	Total weed density (no./m²)	Total biomass (g/m²)	No. of branches/ plant	Seed yield (t/ha)	Haulm yield (t/ha)	Net returns (Rs/ha)	B:C
Tillage and residue management							
CT-CT-CT	4.78 (48.76)	4.08 (34.33)	2.57	1.49	1.89	61467	2.29
CTR-CTR-CTR	5.12 (48.71)	4.29 (34.47)	2.69	1.73	2.25	69138	2.04
ZT-ZT-ZT	4.63 (37.29)	3.93 (26.31)	2.08	1.49	1.94	60863	2.11
ZTR-ZTR-ZTR	4.18 (34.67)	3.57 (24.94)	1.89	1.30	1.68	47055	1.49
SEm±	0.08	0.06	0.11	0.04	.060	2587	0.09
LSD (p=0.05)	0.27	0.21	0.37	0.15	0.20	8951	0.30
Weed management							
W1	1.33 (1.37)	1.17 (0.92)	2.61	1.71	2.26	69551	2.21
W2	1.62 (2.52)	1.38 (1.66)	2.56	1.84	2.47	75482	2.23
W3	11.08 (123.19)	9.35 (87.45)	1.75	0.96	1.11	33860	1.51
SEm±	0.09	0.07	0.06	38	43	2162	0.08
LSD (p=0.05)	0.26	0.21	0.19	115	128	6482	0.23

CT+Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* imazetapyr + imazamox 70 g/ha (20 DAS)

CT+R Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* HW (30 DAS)

ZT+R with Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* imazetapyr + imazamox 70 g/ha (20 DAS)

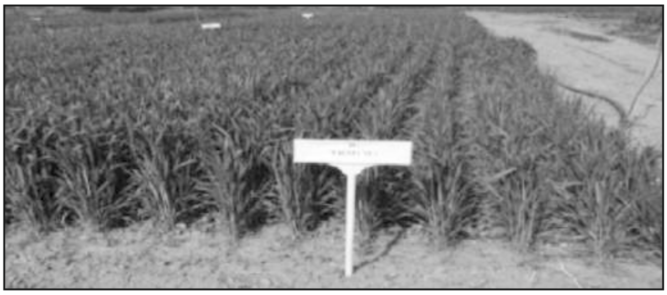
ZT with Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* imazetapyr + imazamox 70 g/ha (20 DAS)

Weed management in soyben-wheat cropping system under conservation agriculture systems

Weed management in soyabeen -wheat cropping system under conservation agriculture system

ZT with W2

ZT+R with W2



CT+R with W2

CT with W3

PDKV, Akola

***Kharif* 2024 (Soybean)**

In soybean during *kharif* 2024, *Cynodon dactylon, Commelina benghalensis, Brachiaria eruciformis, Elusine indica, Digitaria sanguinalis, Dinebra retroflexa,* were major dominant monocot weeds. Among dicot *Parthenium hysterophorus, Phyllanthus niruri, Digera arvensis, Euphorbia geniculata, Euphorbia hirta, Ipomoea* spp, were pre-dominant in the experimental plot. Among tillage treatments, total weed density and weed biomass did not differ significantly at 60 DAS. However, it was recorded minimum under CT+R closely followed by CT. Significantly higher plant height (54.57 cm), seed yield (1.68 t/ha) and test weight (11.38 g) was recorded under CT+R. While CT treatment registered maximum net returns (Rs. 31199/ha) and B: C (1.62).

Among different weed management treatments, at 60 DAS significantly minimum weed density and biomass were observed with IWM (pendimethalin + imazethapyr 1.0 kg/ha *fb* HW at 30 DAS), which is closely followed by diclosulam 26 g/ha (2 DAS) *fb* quizalofop-ethyl + imazethapyr (RM), 98.435 g/ha (20 DAS) over weedy check treatment. Maximum plant height (54.25 cm), seed yield (1.92 t/ha), test weight (11.21 g) and net returns (Rs. 39671/ha) were recorded in IWM (pendimethalin + imazethapyr 1.0 kg/ha *fb* HW at 30 DAS) (**Table 1.2.24**).

Table 1.2.24. Weeds, growth parameters, yield parameters, yield and economics as influenced by different treatments in soybean

SN	Treatment	Total weed density (no./m^2)	Total weed biomass (g/m^2)	Plant height at harvest (cm)	Seed yield (t/ha)	Net returns (Rs/ha)	B: C
A	Main plot - *Tillage practices*						
T_1	CT (Once Ploughing + Once Harrow with tyne cultivator + Once Harrow with blade harrow)	7.98 (63.22)	6.75 (45.00)	53.92	1.61	31199	1.62
T_2	CT + Residue of previous crop	7.76 (59.78)	6.59 (42.89)	54.57	1.68	29426	1.53

Table contd...

T_3	MT (Cultivator+Rotavator)	8.07 (64.67)	6.78 (45.51)	49.91	1.49	27053	1.56
T_4	ZT + Residue of previous crop	8.24 (67.44)	6.94 (47.72)	48.50	1.39	21028	1.43
	SEm±	0.17	0.14	1.36	36	1709	--
	LSD (p=0.05)	NS	NS	4.78	128	6029	--
B	Sub plot - *Weed management*						
W_1	Diclosulam 26 g/ha (2 DAS) *fb* quizalofop at 7.5% + imazethapyr at 15% EC (RM), 98.435 g/ha (20 DAS)	8.49 (71.50)	6.01 (35.57)	51.06	1.78	38150	1.78
W_2	Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* weed seed harvest	5.11 (25.58)	4.67 (21.32)	54.25	1.92	39671	1.73
W_3	Weedy check	9.73 (94.25)	8.91 (78.96)	49.88	941	3709	1.09
	SEm±	0.14	0.09	0.46	27	1257	--
	LSD (p=0.05)	0.44	0.27	1.39	81	3801	--

Biological and physical properties

Among different tillage practices, after PE application of herbicides dehydrogenase activity (µg TPF/g/24 hr) was higher in ZT+R followed by CT+R, CT and MT practices. The carbon dioxide evolution (mg/100g soil) was recorded higher in the CT+R, followed by ZT+R, CT, and MT. Similar trend was recorded after the application of PoE for both parameters (**Table 1.2.25**).

Among herbicide-treated plots application of pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* hand weeding at 30 DAS recorded higher dehydrogenase activity over sequential application of diclosulam 26 g/ha (PE) *fb* quizalofop + imazethapyr (RM), 98.435 g/ha at 20 DAS, whereas higher dehydrogenase activity was observed in weedy check treatments. The CO_2 evolution was followed the trend of dehydrogenase activities after PE and PoE applications.

Lower penetration resistance was significantly lower in CT+R and higher under ZT+R. Similarly, different weed management treatments did not influence the physical parameters significantly.

Table 1.2.25. Soil biological and physical properties as influenced by different treatments

SN	Treatment	After PE herbicides spray		After POE herbicides spray		Physical properties		
		CO_2 evolution (mg 100^{-g} soil)	DHA (µg TPF g^{-1} 24 hr^{-1})	CO_2 evolution (mg 100^{-g} soil)	DHA (µg TPF g^{-1} 24 hr^{-1})	Penetration resistance (Kpa)	Bulk density (g/m^3)	Porosity (%)
A	**Main Plot-** ***Tillage practices***							
T_1	CT (Once Ploughing + Once Harrow with tyne cultivator + Once Harrow with blade harrow)	31.47	38.93	32.43	40.06	231	1.31	50.13
T_2	CT + Residue of previous crop	32.82	39.98	33.45	41.08	284	1.31	49.40
T_3	MT (Cultivator+Rotavator)	30.98	38.57	32.04	39.14	291	1.33	49.84
T_4	ZT + Residue of previous crop	31.82	40.24	32.78	40.50	182	1.29	50.26
	SEm±	**0.34**	**0.35**	**0.24**	**0.36**	**1.45**	**0.006**	**0.215**
	LSD (p=0.05)	**1.17**	**1.21**	**0.85**	**1.24**	**5.03**	**0.02**	**NS**

Table contd...

B	**Sub plot-** ***Weed management***							
W_1	Diclosulam 26 g/ha (2 DAS) *fb* quizalofop at 7.5% + imazethapyr at 15% EC (RM), 98.435 g/ha (20 DAS)	31.13	38.76	31.50	39.70	249	1.31	49.68
W_2	Pendimethalin+imazethapyr 1.0 kg/ha (2 DAS) *fb* hand weeding (30 DAS) *fb* weed seed harvest	31.69	39.39	32.92	40.24	246	1.32	49.69
W_3	Weedy check	32.50	40.14	33.61	40.65	247	1.30	50.36
	SEm±	**0.39**	**0.31**	**0.44**	**0.63**	**0.64**	**0.007**	**0.221**
	LSD (p=0.05)	**NS**	**0.94**	**1.31**	**NS**	**1.92**	**NS**	**NS**

WP 1.2.4. Weed management under conservation tillage system in cotton-based cropping system.

Centre: TNAU Coimbatore

Treatment	**Cotton**	**Maize/babycorn**	**Greengram/green manure**
Main plot	Tillage and residue management		
	CT CT+R ZT ZT+R	CT CT+R ZT ZT+R	CT CT+R ZT ZT+R
Sub plot	Weed management		
Herbicide rotation	**1st year:** Pyrithiobac sodium 3.1% w/w + pendimethalin 34% w/w ZC 742 g/ha (2DAS) *fb* pyrithiobac sodium 6% EC +quizalofop ethyl 4% EC w/w MEC 125 g/ha (4-6 weed leaf stage) *fb* directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g/ha at 50-55DAS **2nd year:** Pendimethalin 30% EC 1.0 kg/ha (2DAS) *fb* pyrithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g/ha (4-6 weed leaf stage) *fb* directed spray (inter-row) of paraquat dichloride 24% SL 500 g/ha at 50-55 DAS **3rd year:** Diuron 80 WP 750 g/ha (2 DAS) *fb* pyrithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g/ha (4-6 weed leaf stage) *fb* directed spray (inter-row) of glufosinate ammonium 13.5%SL 500 g/ha at 50-55 DAS	**1st year:** Atrazine 500 g/ha +pendimethalin 450 g/ha (2DAS) *fb* topramezone 25.2 g/ha (20 DAS) **2nd year:** Pyroxasulfone 127.5 g/ha (2 DAS) *fb* tembotrione 120 g/ha (20DAS) **3rd year:** Atrazine + mesotrione 875 g/ha (20 DAS)	-
IWM	Pyrithiobac sodium 3.1% w/w +pendimethalin 34% w/w ZC 742 g/ha (2DAS) *fb* HW at 30 and 60 DAS *fb* WSH	Atrazine 1.0 kg/ha (2DAS) *fb* topramezone 25.2 g/ha (20DAS) *fb* HW (40 DAS) *fb* WSH	-
Unweeded check	Weedy check	Weedy check	-

Late *Kharif* 2024 (Cotton)

Weed management in cotton-baby corn-based cropping system under conservation agriculture

During *Kharif* 2024, CT+R - CT+R - CT+R recorded the lower total weed density (16.33 and 12.56/m^2), biomass (4.60 and 2.50 g/m^2) and higher WCE (68.1 and 47.7%) at 30 and 60 DAS, respectively compared to other tillage methods. This was followed by CT-CT-CT system. The higher total weed density (35.88 and 18.67/m^2) and biomass (17.59 and 8.25 g/m^2) were recorded under ZT-ZT-ZT system at 30 and 60 DAS, respectively.

Among weed management practices, application of pendimethalin 30 EC 1.0 kg/ha at 2 DAS *fb* pyrithiobac sodium 6% + quizalofop ethyl 4% EC MEC 125 g/ha (4-6 weed leaf stage) *fb* directed spray (inter-row) of paraquat dichloride 24 SL 500 g/ha at 50-55 DAS recorded the lowest total weed density (12.83 and 9.75/m^2), biomass (6.64 and 2.19 g/m^2) and higher WCE (75.0 and 59.4%) at 30 and 60 DAS, respectively compared to other weed management practices. It was followed by application of pyrithiobac sodium 3.1 + pendimethalin 34 ZC 742 g/ha at 2 DAS *fb* HW at 30 and 60 DAS *fb* weed seed harvest. Weedy check recorded significantly higher total weed density and biomass at all stages of cotton crop (**Table 1.2.26**).

Table 1.2.26. Effect of conservation tillage and weed management practices on total weed density (no./m^2), biomass (g/m^2) and WCE (%) in cotton - Late *kharif*, 2024

Treatments	30 DAS			60 DAS		
	Total weed density (no./m^2)	**Total weed biomass (g/m^2)**	**WCE (%)**	**Total weed density (no./m^2)**	**Total weed biomass (g/m^2)**	**WCE (%)**
Tillage methods						
T1(CT - CT - CT)	4.64 (24.44)	3.10(9.47)	52.3	3.82(14.56)	2.05(3.97)	39.3
T2(CT+R - CT+R - CT+R)	3.64(16.33)	2.26(4.60)	68.1	3.52(12.56)	1.71(2.50)	47.7
T3(ZT - ZT - ZT)	5.88(35.88)	4.15(17.59)	31.0	4.32(18.67)	2.85(8.25)	22.2
T4(ZT+R - ZT+R - ZT+R)	5.07(29.11)	3.23(10.91)	43.2	3.87(15.33)	2.43(6.04)	36.1
SEm±	0.08	0.05	-	0.05	0.04	
LSD (p=0.05)	0.22	0.12	-	0.11	0.11	
Weed management practices						
W1- Herbicide rotation	3.53(12.83)	2.62(6.64)	75.0	3.19(9.75)	1.62(2.19)	59.4
W2- IWM	3.81(15.25)	3.09(9.71)	70.2	3.53(12.08)	2.25(4.90)	49.7
W3- Weedy check	7.08(51.25)	3.84(15.58)	-	4.94(24.00)	2.92(8.49)	-
SEm±	0.36	0.27	-	0.09	0.17	-
LSD (p=0.05)	0.76	0.56	-	0.20	0.36	-

Weed management in cotton-based cropping system under conservation tillage

WP 1.3 Weed management strategies in natural farming/organic agriculture

WP 1.3.2. (i) Weed management in organically grown rice-based cropping system (rice–vegetable pea – sweet corn) (Collaboration with Network project on organic farming)

Centre: GBPUAT, Pantnagar

Treatments:

Main Plot:

Season	*Kharif*	*Rabi*	*Spring*
M1	Stale seed bed - Direct seeded rice +*Sesbania* between rows	Vegetable pea	Sweet corn
M2	Direct seeded rice (without stale bed)	Vegetable pea	Sweet corn
M3	*Sesbania* (Green manure) *fb* Transplanted rice	Vegetable pea	Sweet corn
M4	Transplanted rice	Vegetable pea	Sweet corn

Note: At the place of incorporation, *Sesbania* will be sown as an alternate planting system, and it may be incorporated with the help of cono-weeder after 25-30 days of seeding. In M-2 treatment, only cono-weeder will be drawn after 25-30 DAS without *Sesbania*.

Sub Plot:

S1: Mechanical weeding (Two pass of Cono-weeder)

S2: Mechanical weeding (one pass of Cono-weeder) *fb* one Hand Weeding

S3: One Mechanical weeding (By hoe) & one hand weeding (25 and 45 DAS/DAT)

Note: Vegetable Pea -During *Rabi* season incorporation of rice crop residue *fb* one mechanical weeding (by power weeder) at 20-25 DAS *fb* hand weeding at 40-45 DAS

Sweet corn: During Spring season incorporation of vegetable pea crop residue *fb* one mechanical weeding (by power weeder) *fb* earthing After harvest of sweet corn shredding of maize residue and incorporate in soil, Design: Split Plot; Replication: 03; Plot size-3m x 5m

Vegetable Pea (*Rabi* 2023-24)

The total weed density and total weed dry weight at 30 DAS, was found not significantly affected due to different establishment methods and weed management treatments. The lowest total weed density and total weed dry weight was recorded with transplanted rice. Mechanical weeding with one pass of conoweeder *fb* one HW 25 & 45 DAS/DAT recorded the lowest total weed density, while no difference in total dry weight was recorded among the weed management treatments.

Yield attributes like no. of pod/plant, grains/pod were not significantly affected by the establishment methods except pod yield. Among the different weed management treatments, no. of pod/plant (6.5), pod yield (7.83 t/ha) was not significantly affected by weed management treatments

Among different establishment methods, the highest net return (Rs. 1,26,166/ha) and benefit cost ratio (2.68) were recorded with *Sesbania* (GM)-TPR and within weed management treatments, mechanical weeding (by hoe) *fb* one HW (25 & 45 DAS) recorded the highest net return (Rs.1,28,787/ha) and benefit cost ratio (2.72).

Sweet corn (Spring 2024)

Transplanted rice recorded the lowest total weed density and dry matter accumulation while DSR (Without Stale seed bed) also recorded total dry matter accumulation among the establishment methods. Under weed management treatments, the lowest total weed density recorded under mechanical weeding with one pass of cono-weeder *fb* one HW 25 & 45 DAS/DAT and dry matter accumulation under mechanical weeding with two passes of cono-weeder at 25 & DAS/ DAT.

Highest plant population (56.3'000/ha), number of cobs (41.2 '000/ha) and cob yield (17.60 t/ha) were recorded with stale seed bed-DSR + *Sesbania*. Among the different weed management system, plant population (55.7 '000/ha), number of cobs (40.4 '000/ha) and cob yield (17.22 t/ha) were recorded with mechanical weeding with two passes of cono-weeder at 25 & DAS/ DAT (S1).

Among different establishment methods, the highest net return (Rs. 638728/ha) and benefit cost ratio (20.57) were recorded with stale seed bed-DSR + *Sesbania* (M1) and within weed management practices, mechanical weeding (by hoe) *fb* one HW (25 & 45 DAS/DAT) recorded the highest net return (Rs. 554710/ha) and benefit cost ratio (17.99).

Rice (*Kharif* 2024)

Under different establishment methods, transplanted rice recorded the lowest weed density and dry weight of grassy weeds whereas, lowest density and dry weight of broad leaf weeds were completely controlled under *Sesbania* (GM)-transplanted rice and transplanted rice. Among the weed management treatments, mechanical weeding with two passes of conoweeder at 25 & DAS/ DAT recorded lowest total weed density and dry matter accumulation of grassy weeds while total weed density & dry weight of broad leaf weeds was completely control with mechanical weeding (by hoe) *fb* one HW at 25 & 45 DAS/DAT.

Highest grain yield of rice (4.4 t/ha) were recorded with *Sesbania* (GM)-transplanted rice among the establishment methods whereas among the different weed management system, the highest yield of rice (4.3ton/ha) were recorded with mechanical weeding with one pass of cono-weeder *fb* one HW at 25 & 45 DAS/DAT.

Among different establishment methods, the highest net return (Rs. 84143/ha) was recorded under *Sesbania* (GM)-transplanted rice whereas benefit cost ratio (2.61) recorded under direct seeded rice (Without Stale seed bed) and within weed management practices, mechanical weeding (Two pass of cono-weeder at 25 & 45 DAS/DAT) recorded the highest net return (Rs. 80804/ha) as well as benefit cost ratio (2.61).

(ii) Comparison of weed management in rice-vegetable pea-sweet corn cropping system under natural farming, organic farming and conventional farming.

Centre: GBPUAT, Pantnagar

Natural production systems

- **Seed treatment:** With Beejamrit in all the crops.
- **Nutrient management:** With herbal kunap jal/Jeevamrit in all the crops.
- **Weed management:** With cover crops/ mulches
- **Plant protection:** With Neemastra /Dashparni ark in all the crops.
- **Transplanted Rice:** Sesbania green manure-transplanted rice
- **Weed management:** Water stagnation up to 15 DAT fb uprooting of weeds at 45 DAT, which will be used as mulch in the field.
- **Vegetable Pea:** During Rabi season mulching of rice crop residue

- **Weed management:** Uprooting of weeds at 25 and 45 DAS and will be used as mulch.
- **Sweet corn:** During Spring season mulching of vegetable pea crop residue in between the rows of corn
- **Weed management**: Uprooting of weeds at 25 and 45 DAS and will be used as mulch. After harvest of sweet corn residue will be shredded and incorporation in soil

Organic production systems

- **Nutrient management:** A uniform dose of FYM 10 t/ha followed by vermi-compost 5 t/ha at 30- 35 DAS/DAT will be applied in every crop season
- **Transplanted Rice:** Sesbania green manure-transplanted rice (Weed management- one pass of cono-weeder at 25DAT fb one hand weeding at 45DAT)
- **Vegetable Pea:** During Rabi season incorporation of rice crop residue
- **Weed management:** One mechanical weeding (by hoe) at 20-25 DAS fb one hand weeding at 40- 45 DAS
- **Sweet corn:** During Spring season incorporation of vegetable pea crop residue
- **Weed management:** One mechanical weeding (by power-weeder) at 20-25 DAS fb earthing at 45DAS After harvest of sweet corn, shredding of maize residue and incorporated in soil

Chemical production systems

Transplanted Rice

- **Nutrient management:** N120, P60 and K40 Kg/ha, (Full dose of P and K and half dose of N will be as basal and rest amount of N will be applied at tillering and panicle initiation stage)
- **Weed management:** Penoxsulam 1.02%+Cyhalofop 5.1%OD (RM) 135g/ha at 15-20DAT fb one hand weeding at 45DAT
- **Vegetable Pea-** During *Rabi* season incorporation of rice crop residue
- **Nutrient management:** N20-30, P50-60 and K50 Kg/ha Full dose of N, P and K is given at the time of sowing
- **Weed management:** Pendimethalin 1.0 Kg/ha (pre-emergence) fb one hand weeding at 20-25 DAS
- **Sweet corn:** During Spring season incorporation of vegetable pea crop residue
- **Nutrient management:** N120, P60 and K40 Kg/ha
- **Weed management:** Atrazine50WP 1.0 Kg/ha as pre-emergence *fb* Tembotrione 34.4 SC 120g/ha (Post-emergence) at 20-25 DAS After harvest of sweet corn residue will be shredded and incorporated in soil.

Vegetable Pea (*Rabi* 2023-24)

The farming (Natural, organic and conventional) did not show any significant influence on the density of different weed species except of *Fumaria parviflora* which was significantly lowest in conventional farming method and at par with natural farming method. Though weed density of *Anagallis arvensis, Polygonum plebeium, and Chenopodium album* weeds were completely controlled under conventional farming methods

All the farming systems did not show any significant effects on the weed density, total weed bio mass, no. of pod/plants and no. of grain/pod while the pod yield was affected significantly. Pod yield (7.8 t/ha) was reported highest under conventional farming system.

The highest net return (Rs.1,21,212.00/ha) and benefit cost ratio (2.56) was recorded under conventional farming method.

Natural Farming

Sweet corn (Spring 2024)

Organic Farming

Organic Farming

Significantly lowest weed density was recorded under conventional farming which was at par with organic farming. All yield attributes characters and yield were not significantly influenced due to different farming methods, though highest no. of cobs (48.5' 000/ha), individual cob weight (350.3g) and cob yield (16.9 t/ha) were recorded under conventional farming. The highest net return (Rs. 313940.00/ha) and benefit cost ratio (10.97) was recorded under conventional farming method.

Natural Farming

Organic Farming

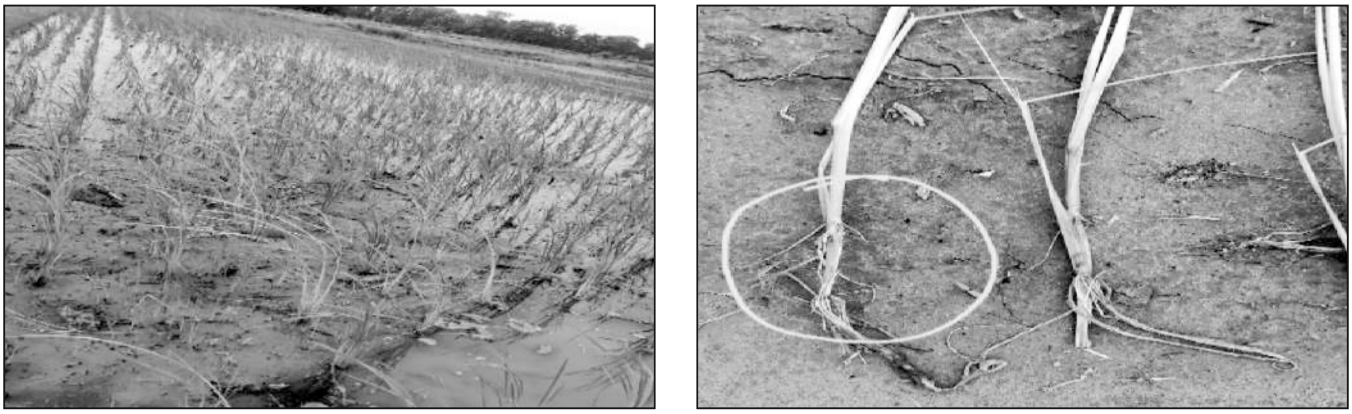
Conventional Farming

Rice (*Kharif* 2024)

Among natural, organic and conventional farming system, observations on weeds were recorded at 60 DAT. The experimental field was mainly infested with *Echinochloa colona*, *Echinochloa crus-galli*, *Dactyloctenium aegyptium, Caesulia axillaris, Eclipta alba, Ammannia baccifera*, *Cyperus difformis*, *Fimbristylis miliacea*, *Cyperus iria* and *Cyperus rotundus*.

The lowest total weed density and dry weight of broad-leaf weeds was recorded under the conventional farming system, and the lowest weed density & dry weight of sedges was recorded under natural farming methods.

The rice plant height (118.3 cm), grain yield (4.1 t/ha) and straw yield (8.4 t/ha) did not show any significant influence due to either of the farming systems. The highest net return (Rs. 61010.00/ha) and benefit cost ratio (2.21) were recorded under the conventional farming system.



Bakanae Disease in var-Pusa 1509 under conventional, organic and natural farming experiment

Natural Farming

Organic Farming

Conventional Farming

`WP 1.3.3. Weed management in natural farming systems in direct-seeded scented rice and cowpea (vegetable)

Network centres: IGKV Raipur and BCKV Kalyani

Treatments:

	Scented rice	Cowpea (vegetable)
1.	Stale seedbed *fb* live mulch (dhaincha/Sesbania) and *in-situ* incorporation at 30-35 DAS	Stale seedbed *fb* live mulch (fenugreek) and *in-situ* incorporation at 30-35 DAS
2.	Stale seedbed *fb* straw mulch incorporation of previous rice crop	Stale seedbed *fb* rice straw mulching @ 4-5t/ha of previous crop
3.	Straw mulch incorporation of previous rice crop *fb* 1 HW at 25-30 DAS	Straw mulching @ 4-5 t/ha of previous rice crop 20 DAS
4.	Live mulch with dhaincha/Sesbania and *in-situ* incorporation *fb* at 30-35 DAS	Intercropping with spinach up to 35 days (1:1 additive series)
5.	Residue incorporation of previous crop before sowing *fb* one mechanical weeding through Cono/Ambika paddy weeder at 25-30 DAS	Closer sowing (20 cm row spacing) + Straw mulching @ 4-5 t/ha *fb* 1 HW
6.	Soil mulch *fb* HW at 20 and 40 DAS	Soil mulch *fb* HW at 20 and 40 DAS
7.	ICM practices	ICM practices

IGKV, Raipur

The significantly, lowest weed biomass at all these stages was recorded under soil mulch *fb* HW at 20 and 40 DAS and under ICM practices (Green manuring + Ghan Jeevamrit + Jeevamrit) treatment. Stale seedbed *fb* live mulch (dhaincha) and *in-situ* incorporation at 30-35 DAS also found to be comparatively better than residue incorporation of previous crop before sowing *fb* one mechanical weeding through Ambika paddy weeder at 25-30 DAS which came out with significantly highest weed biomass and live mulch with dhaincha and *in-situ* incorporation *fb* at 30-35 DAS.

Natural farming treatment of ICM practices (Green manuring + Ghan Jeevamrit + Jeevamrit) produced the tallest plant and significantly highest numbers of effective tillers (258/m^2), grain yield (3.10 t/ha) and net return (Rs.37410/ha) with maximum B:C of 2.10 over the others. Soil mulch *fb* HW at 20 and 40 DAS also registered comparable grain yield of 2.93 t/ha. Residue incorporation of previous crop before sowing *fb* one mechanical weeding through Ambika paddy weeder at 25-30 DAS found to be lowest yield producer than the others.

Weed management in natural farming system in direct seeded rice-cowpea (veg) cropping system 2024

BCKV, Kalyani

Weed control efficiency was seen highest in ICM practices which was 83.90 % at 40 DAS and 82.99 % at 60 DAS which was appreciably higher than the weed control efficiency of live mulch with dhaincha and *in-situ* incorporation *fb* at 30-35 DAS. Soil mulch *fb* HW at 20 and 40 DAS performed well after ICM practices with weed control efficiency 75.06 % at 40 DAS and 80.99 % at 60 DAS which is only 2% lower than the best practice. At 60 DAS Soil mulch *fb* HW at 20 and 40 DAS and ICM practices demonstrated weed control efficiency more than 80%. Live mulch with *dhaincha* and *in-situ* incorporation *fb* at 30-35 DAS and Stale seedbed *fb* straw mulch incorporation of previous rice crop was not much effective in controlling weeds.

Highest grain yield was recorded in ICM practices which was (2.8 ton/ha) and least yield was recorded from Live mulch with dhaincha and *in-situ* incorporation *fb* at 30-35 DAS (1.8 ton/ha). Soil mulch *fb* HW at 20 and 40 DAS yield better than Straw mulch incorporation of previous rice crop *fb* 1 HW at 25-30 DAS. ICM practices noted with highest straw yield (4.67 t/ha) followed by Soil mulch *fb* HW at 20 and 40 DAS (4.36 t/ha). The highest cost of cultivation was noted in ICM Practices which was (Rs.68000/ha) followed by (Rs.66800/ha) observed in Soil mulch *fb* HW at 20 and 40 DAS. Highest net return of (Rs.134420/ha) was achieved in ICM practices with the highest benefit cost ratio among all the seven treatments and proved as the best treatment next followed by Soil mulch *fb* HW at 20 and 40 DAS.

WP 1.3.4. Weed management in coconut plantation

Centre: KAU, Thrissur

Treatments:

1. Horsegram - Horse gram- @20 kg/ha
2. Horse gram +marigold - horse gram
3. *Indigofera tinctoria* @ 3 kg/ha
4. Hybrid napier
5. Coconut fronds mulch @ 20 t/ha
6. Ploughing alone (three times /year)
7. Unweeded control

Weed density and dry matter was recorded at 2, 4 and 6 months of imposing weed management treatments. Weed infestation could be considerably controlled by various treatments compared to UWC. The trend was almost similar to that registered in the case of weed count. Lower and statistically comparable values were observed in horse gram, horse gram + marigold as well as coconut frond mulching.

By 4th and 6th months, coconut frond mulching registered higher weed dry matter due to profuse weed growth. However, this was statistically different from that of UWC. At 4 months UWC registered weed dry matter of 270 g/m^2 compared to 181.67 g/m^2 in coconut frond mulched plots. The lowest values of 74 g and 62.33g were registered for horse gram, horse gram + marigold which were comparable. The weed dry matter in these two treatments continued to be lowest at 6 months also and were superior to all other weed management practices in terms of weed control efficiency. At this stage weed dry matter was lower in ploughing alone plot due to a second round of ploughing operation done at 4 months. Intercropping of indigofera or hybrid Napier were not very effective, as the interspaces between the plants favored weed germination and growth.

General view after ploughing the interspaces

Marigold + Horse gram intercropping

Horse gram as intercrop

Indigofera as intercrop

Weed growth in non-intercropped area

Severe weed infestation two months after coconut frond mulching

One month after mulching

WP 1.3.5. Evaluation of weed management practices in maize-fennel under Natural Farming systems

Centre: MPUAT, Udaipur

Treatments:

	Maize	Fennel
1.	Hand weeding at 20 and 40 DAS	Hand weeding at 20 and 40 DAS
2.	One weeding at 20 DAS by animal drawn weeder + one hand weeding at 40 DAS	One weeding at 20 DAS by animal drawn weeder + one hand weeding at 40 DAS
3.	Intercropping with blackgram (2:2)	Intercropping with chickpea (1:2)

Table contd...

4.	Stale seed bed + reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS	Stale seed bed + reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS
5.	Maize: blackgram (2:2) intercropping	Fennel: Chickpea (1:2) intercropping
6.	Stale seed bed preparation+Maize :blackgram (2:2)	Stale seed bed preparation+Fennel :Chickpea (1:2)
7.	Stale seed bed preparation +Maize : blackgram (2:2) + 1 hand weeding at 50 DAS	Stale seed bed preparation +Fennel : Chickpea (1:2)+1 hand weeding at 50 DAS
8.	Stale seed bed preparation +Maize : blackgram (2:2) + straw mulch (5 t/ha) at 30 DAS	Stale seed bed preparation +Fennel : Chickpea (1:2)+straw mulch (5 t/ha) at 30 DAS
9.	Maize: blackgram (2:2) + Stale seed bed preparation + straw mulch (5 t/ha) at 30 DAS+1 hand weeding at 50 DAS	Fennel : Chickpea (1:2)+ Stale seed bed preparation + straw mulch (5 t/ha) at 30 DAS+1 hand weeding at 50 DAS
10.	Control (Direct sowing & no other treatment)	Control (Direct sowing & no other treatment)

The major weeds in the experimental field were *Chenopodium album (36.7%), Chenopodium murale (8.44), Fumaria parviflora (4.9%), Melilotus indica (13.8%), Convolvulus arvensis (5.6%), Cynodon dactylon (5.9 %), Phalaris minor (4.9 %), Malva parviflora (5.1%) and Cyperus rotundus (4.3 %) at 30 DAS.*

Stale seed bed +Maize: black gram (2:2) + straw mulch (5 t/ha) at 30 DAS proved most effective and recorded nil population of weeds with negligible weed dry matter in comparison to weedy check while maximum weed control efficiency at 30 DAS and 60 DAS was observed with treatment Stale seed bed+ reduced spacing (up to 25%) +mulching with previous crop residues + one hand weeding at 20 DAS. All the organic weed management treatments recorded significantly higher yield attributes and yield compared to weedy check. Maximum grain, stover and biological yield was recorded with treatment stale seed bed preparation +maize: black gram (2:2) + 1 hand weeding at 50 DAS over rest of the treatments. Superiority of hand weeding at 20 and 40 DAS and maize: black gram (2:2) intercropping treatments in organic weed management was observed by harvest index. The highest net return (Rs.74293/ha) was obtained with Stale seed bed preparation +Maize: black gram (2:2) + 1 hand weeding at 50 DAS whereas maximum BC ratio (3.67) was recorded Intercropping with black gram (2:2).

WP 1.3.6. Weed management practices in organically grown cotton

Centre: PDKV, Akola

Treatments:

1. Stale seedbed + Hand weeding at 20 & 40 DAS
2. Intercrop Green gram (2:1)
3. Mulching of *Sunhemp* (2:1) at 30-35 DAS
4. Weeding with power weeder at 20 DAS (weed mulch)
5. Straw mulch (5 t/ha) at 20 DAS
6. Farmers practice 3 hoeings 20 Days interval *fb* 2 HW 20 & 40 DAS
7. Weedy check

During *kharif* season in cotton crop *Cynodon dactylon, Commelina benghalensis, Digitaria sanguinalis, Dinebra retroflexa and Cyperus rotundus (sedges)* were dominant in monocot. Among dicot, the density of *Digera arvensis, Euphorbia geniculata, Parthenium hysterophorus, Alternanathera triandra, Trainthema portulacastrum, Portulaca oleracea, Amaranthus viridis, Digera arvensis, Phyllanthus niruri* were the predominant in the experimental plots.

The highest weed control efficiency was recorded with farmers practice throughout the growth stages stale seed bed + twice hand weeding and straw mulch at 20 DAS this may be due to better control of weeds. While lowest weed control efficiency was noticed in mulching of sunnhemp, intercrop of green gram (1:2) and weeding with power weeder at 20 DAS.

Lowest weed index was recorded with straw mulch at 20 DAS followed by stale seed bed+hand weeding at 20 & 40 DAS. The significantly higher gross returns were recorded with farmers practice (3 hoeings+2 hand weeding) followed by straw mulch at 20 DAS, stale seedbed + hand weeding at 20 & 40 DAS. However, higher net monetary return was also registered the same trend as of gross monetary return whereas benefit cost ratio was higher with straw mulch at 20 DAS and stale seedbed with twice hand weeding.

WP 1.3.7. Weed management in green gram-onion cropping system under organic agriculture

Centre: PJTSAU, Hyderabad

Treatments:

No.	Green gram (*Kharif*)	Onion (*Rabi*)
1.	Hoeing at 15 and 30 DAS + intra row HW	Hoeing at 20 and 40 DAT + intra row HW
2.	Stale seed bed *fb* HW at 15 & 30 DAS	Rice husk mulch 3 t/ha
3.	Poly mulch + intra row manual weedingat 30 DAS	Poly mulch + intra row manual weeding at 30DAT
4.	Rice straw mulch 5 t/ha *fb* intra rowHW at 30 DAS	Rice straw mulch 5 t/ha+ intra row HW at 30DAT
5.	Sorghum leaf extract @ 30% on 3 DAS *fb* MW/HW at 30 DAS	Sorghum leaf extract @ 30% on 3 DA *fb* MW/HW at 30 DAT
6.	*Eucalyptus* leaf extract @ 30% on 3DAS *fb* MW/HW at 30 DAS	*Eucalyptus* leaf extract @ 30% on 3 DA *fb* MW/HW at 30 DAT
7.	Gunny bag mulching *fb* intra row HWat 30 DAS	Gunny bag mulching *fb* intra row HW at 30DAT
8.	Unweeded control	Unweeded control

The weed control efficiency observed at 15 DAS was above 80% with polymulch, rice straw mulch, stale seed bed, hoeing and gunny bag treatments. Sorghum leaf extract and *Eucalyptus* leaf extract were inferior with respect to weed control. At 30 DAS, except gunny bag munching, all the above treatments could effectively control the weeds with higher weed control efficiency.

Among all the non-chemical methods of weed control in green gram under organic cultivation, highest seed yield was recorded with stale seed bed *fb* HW at 15 and 30 DAS and it was comparable with polymulch, rice straw mulch and hoeing at 15 and 30 DAS *fb* intra row HW. Gunny bag munching even though found to suppress weeds at 15 DAS, *Cyperus rotundus* emerged at later stages. Hence lower yield was recorded i.e., 56% of that of polymulch. Allelopathic treatments of sorghum leaf extract and *Eucalyptus* leaf extract was inferior with respect to seed yield of green gram due to poor weed control.

Treatment effect at 60 DAS

WP 1.3.8. Weed management in brinjal- barnyard millet- green manure cropping system under natural farming

Centre: TNAU, Coimbatore

Treatments: Brinjal (*Kharif*)- barnyard millet (*Rabi*) - green manure

S.No.	*Kharif* and *Rabi*
1.	Multi-varietal techniques (mulching after 20 DAS) *fb* HW at 40 DAP
2.	Stale seed bed *fb* HW at 40 DAP
3.	Intercrop green leaf vegetable (20 DAS) *fb* HW at 40 DAP
4.	Live mulch of cowpea (20 DAS) *fb* HW at 40 DAP
5.	Previous crop mulch @ 5 t/ha *fb* HW at 40 DAP
6.	Hand Weeding at 20 & 40 DAP
7.	Unweeded control

Among the weed management practices, hand weeding at 20 & 40 DAP (T_6) recorded the lowest total weed density (16.0 and 36.33/m^2), dry weight (3.62 and 11.20 g/m^2) and higher WCE (71.9 and 57.1%) at 30 and 60 DAP, respectively than other treatments and it was followed by previous crop mulch @ 5 t/ha (T_5). The highest total weed density (57.00 and 84.67/m^2) and dry weight (24.28 and 60.40 g/m^2) were recorded under unweeded control (T_7) at 30 and 60 DAP, respectively.

The higher yield (19.7 t/ha) of brinjal was recorded with hand weeding at 20 & 40 DAP (T_6) than other weed management practices. This was followed by previous crop mulch @ 5t/ha (T_5). The lowest yield (5.7 t/ha) of brinjal was recorded under unweeded control (T_7). Higher gross returns (Rs.7,87,536/ha), net returns (Rs.5,77,396/ha) and B:C ratio (3.7) were recorded in hand weeding at 20 & 40 DAP (T_6) and it was followed by previous crop mulch @ 5t/ha (T_5).

WP 1.3.10. (A) Weed management in pearl millet - chickpea cropping system under natural farming

Centre: RVSKV, Gwalior

Treatments:

S.No.	Pearl millet (*Kharif*)	Chickpea (*Rabi*)
1.	Reduced spacing (30 cm) *fb* 1 hoeing at 20DAS	Reduced spacing (30 cm) *fb* 1 hoeing at 20DAS
2.	Normal spacing (40 cm) *fb* 1 hoeing at 20DAS	Normal spacing (40 cm) *fb* 1 hoeing at 20DAS
3.	Stale seed bed *fb* 1 hoeing 20 DAS	Stale seed bed *fb* 1 hoeing at 20 DAS
4.	Sesbania in situ mulch at 30 DAS	intercropping with Fenugreek
5.	Intercropping with green gram	Intercropping with mustard
6.	Previous crop residue mulch	Previous crop residue mulch
7.	Two hand weeding at 20 & 40 DAS	Two hand weeding at 20 & 40 DAS
8.	Unweeded check	Unweeded check

Among the different weed management practices, the maximum weed control efficiency (85%) at 30 DAS and (94.10%) at 60 DAS was recorded in plots where two hand weeding at 20 and 40 DAS was done. As per weed control efficiency, all weed management practices suppressed more than 40% weed growth.

The highest pearl millet equivalent yield (4.35 t/ha) was recorded in plots where green gram was sown as intercrop. Whereas, the highest grain (4.01 t/ha) and stover (8.69 t/ha) yield of pearl millet was recorded in plots where two hand weeding at 20 and 40 DAS was done, which was closely followed by yield (grain 3.89 t/ha and stover 8.36 t/ha) under treatment sesbania in situ mulch at 30 DAS. The lowest grain (2.65 t/ha) and stover (5.74 t/ha) yield were recorded in weedy check plots.

The maximum net return (Rs. 83227/ha) and B C ratio (3.97) were obtained in plots where green gram was sown as intercrop with pearl millet, which was closely followed by treatment sesbania in situ mulch at 30 DAS, where net return (Rs. 72632/ha) and B C ratio (3.69) was obtained.

Effect of Intercropping with green gram in pearl millet crop

Effect of two hand weeding at 20 & 40 DAS in pearl millet crop

(B) Weed management in organically grown maize-potato-green manure cropping system

Treatments:

	Maize	Potato
T_1	Black plastic mulch (25µ)	Black plastic mulch (25µ)
T_2	Soil solarization *fb* Plastic mulch (25µ)	Soil solarization *fb* Plastic mulch (25µ)
T_3	Soil solarization *fb* one HW at 40 DAS	Soil solarization *fb* one HW at 40 DAS
T_4	Straw mulch of the previous crop at 5 DAS	Straw mulching of the previous crop at 5 DAP
T_5	Stale seed bed *fb* one HW at 40 DAS	Stale seed bed *fb* one HW
T_6	Hoeing at 20 & 40 DAS	Earthing up at 20 & 40 DAS
T_7	Weedy check	Weedy check
T_8	One hand weeding at 20 DAS *fb* Straw mulch (5 t/ha) at 25 DAS	One hand weeding at 20 DAS fb straw mulch (5 t/ha) at 25 DAS

Potato

The lowest density of weeds at 30 and 60 DAP was observed in plots where earthing up at 20 and 40 DAP and one hand weeding at 20 DAP *fb* straw mulch (25µ) at 25 DAP was applied, it was *fb* soil solarization *fb* plasic mulch. The weed density was significantly higher in weedy check. Although the population of sedges was very high in the weedy check plot.

At 30 DAP the minimum dry weight of weeds was recorded in plots whereon hand weeding at 20 DAP *fb* straw mulch (5 t/ha) at 25 DAP was applied. Whereas, at 60 DAP minimum dry weight of weeds was recorded in soil solarization *fb* plastic mulch. Application of one hand weeding at 20 DAS *fb* straw mulch (5 t/ha) at 25 DAP fetched significantly maximum net returns (Rs.225041/ha) and BC ratio (3.0) *fb* earthing up at 20 and 40 DAP (Rs. 214928/ha) and BC ratio (2.92). The minimum net returns (Rs. 29099/ha) and BC ratio (1.11) was recorded in the plots where soil solarization *fb* plastic mulch was done.

Soil solarization *fb* Plastic mulch (25µ) in potato crop

One hand weeding at 20 DAS *fb* straw mulch (5 t/ha) at 25 DAS in potato crop

WP 1.3.11. Weed management in naturally grown little millet -horse gram cropping system

Centre: UAS, Bengaluru

Treatments:

1. Stale seed bed followed by crop residue mulch at 0-3 DAS
2. Stale seed bed followed by one-hand weeding at 30 DAS
3. Inter-cultivation followed by hand weeding at 20 and 40 DAS.
4. Little millet + Black gram at 2:1 ratio (Replacement series)
5. Reduced spacing (22.5 cm) followed by one-hand weeding at 25 DAS
6. Two-hand weeding at 20 and 40 DAS
7. Control (No weed management, other practices being same)

Among the non-chemical method of weed control, Two hand weeding at 20 and 40 DAS recorded the highest WCE of 39.2% and 63.5% at 30 DAS and 60 DAS respectively followed by Inter-cultivation followed by hand weeding at 20 and 40 DAS (35.4% and 58.8% respectively) and Stale seedbed *fb* 1 HW 30 DAS at 30 DAS (31.3% and 57.0 % respectively) and even at latter stage of the crop**.**

The highest gross return was obtained in two hand weeding at 20 and 40 DAS (Rs 42,350/ha) followed by Inter-cultivation followed by hand weeding at 20 and 40 DAS (Rs 40,600/ha) and stale seedbed fb 1 HW 30 DAS (Rs 38,500/ha). While the highest net return of (Rs 24,917) and B:C (3.36) was obtained in Little millet + Black gram at 2:1 ratio (Replacement series), though the effectiveness of this treatment to control weeds was lowest but cost incurred to grown little millet under this treatment was less followed by two hand weeding at 20 and 40 DAS (Rs. 20,350/ha and 1.92 respectively) and Stale seed bed followed by one-hand weeding at 30 DAS (Rs. 20,000/ha and 2.08, respectively). However, un-weeded treatment recorded the lowest B:C of 1.52 due to severe weed infestation.

T_3 - Inter-cultivation followed by hand weeding at 20 and 40 DAS

T_4 - Little millet + Black gram at 2:1 ratio (Replacement series)

T_6 - Two-hand weeding at 20 and 40 DAS

T_7 - Control (No weed management, other practices being same)

Effect of weed management practices on naturally grown little millet at 30 DAS

WP 1.3.12. (A) Evaluation of mechanical weeding in basmati rice and beetroot under organic farming

Centre: SKUAST, Jammu (Collaboration: Division of Vegetable Science, SKUAST-J)

Treatments:

S.No.	Basmati rice	Beetroot
1.	Cono weeder at 20 DAT with plant spacing 25x 10 cm	Cycle wheel hoe at 20 DAS
2.	Cono weeder at 20 DAT & 40 DAT withplant spacing 25 x 10 cm	Cycle wheel hoe at 20 DAS & 40 DAS
3.	Azolla 2.0 t/ha with normal plant spacing 20 x10 cm	Single wheel hoe at 20 DAS
4.	Azolla 2 t/ha with close plant spacing 15 x10cm	Single wheel hoe at 20 DAS & 40 DAS
5.	MSM 2.5 t/ha with normal plant spacing 20 x10 cm	Twin wheel hoe at 20 DAS
6.	MSM 2.5 t/ha with close plant spacing 15 x 10cm	Twin wheel hoe at 20 DAS & 40 DAS
7.	Weedy check	Weedy check

The major weed flora in organic basmati rice was *viz., Echinochloa* spp., *Cyperus* spp, *Caesulia axillaris, Physalis minima* and *Digitaria sanguinalis.* The lowest weed density was recorded in MSM 2.5 t/ha with normal plant spacing 15 x 10 cm at 30 and 60 DAT. Also, the lowest biomass of weeds was observed in MSM 2.5 t/ha with close plant spacing 15 x 10 cm at 30 and 60 DAT followed by MSM 2.5 t/ha with normal plant spacing 20 x 10 cm and cono-weeder at 20 DAT & 40 DAT with plant spacing 25 x 10 cm.

The highest growth, yield attributes and yield of organic basmati rice were recorded in treatment MSM 2.5 t/ha with close plant spacing 15 x 10 cm at followed by MSM 2.5 t/ha with normal plant spacing 20 x 10 cm and cono-weeder at 20 DAT & 40 DAT with plant spacing 25 x 10 cm. The highest net returns and B:C were recorded in cono-weeder at 20 DAT & 40 DAT with plant spacing 25 x 10 cm. Whereas, due to higher cost of MSM found lower net returns and B:C.

Cono-weeder at 20 DAT

MSM 2.5 t/ha with normal plant Spacing 20 x 10 cm

Weedy check

(B) Weed management in organically grown basmati rice- vegetable pea-sweet corn cropping system

Centre: SKUAST, Jammu

Collaboration: AICRP on Vegetable (weed control), SKUAST-Jammu.

Treatments:

S. No.	Basmati rice (Main-plot)	Vegetable pea (sub-plot)	Sweet corn (sub-sub-plot)
1.	Sesbania green manure before transplanting *fb*1 mechanical weeding at 30 DAT	Intercropping with radish	Intercropping with Sesbania and kept as mulch at 40 DAS
2.	*Sesbania* green manure before transplanting *fb* Hand weeding at 30 DAT	Intercropping with green onion	Intercropping with black gram
3.	Two hand weeding at 20 and 40 DAT	Two hand weeding at 20 and 40 DAT	

Vegetable pea

Among broad-leaved weeds, *Anagallis arvensis, Vicia sativa, Melilotus indica, and Medicago denticulata* were the most common weed species; among grassy weeds, *Phalaris minor* and *Cynodon dactylon* were the most common, and among sedges, *Cyperus rotundus* was recorded in vegetable pea. Two-hand weeding at 20 and 40 DAS produced the lowest weed density and biomass of broad-leaved, grassy, and sedge followed by intercropping with radish while the intercropping with onion produced the highest weed biomass at 30 and 60 DAS.

The highest plant height, number of pods/plant, seeds/pod, green pod yield, gross returns, and net returns were recorded in the two hand weeding at 20 and 40 DAS. While the higher B:C was recorded in the vegetable pea intercropping with radish, the lowest green pod yield, net return, and benefit ratio were noted in the vegetable pea intercropping with onion.

Two hand weeding at 20 and 40 DAS

Intercropping with onion

Sweet corn

Solanum nigrum, Amaranthus viridis, Physalis minima, and Trianthema spp. were found to be broad-leaved weeds in the sweet corn experiment, while *Imperata cylindrica, Cynodon dactylon, and Cyperus rotundus* were found to be grassy weeds and sedge weeds, respectively. The intercropping with sesbania and kept as mulch at 40 DAS had the lowest weed biomass and density of broad-leaved, grassy and sedge weeds at 60 DAS.

When compared to intercropping with black gram, the highest plant height, cob length, cob girth, green cob yield, and green fodder of sweet corn were recorded when Intercropping with sesbania and kept as mulch at 40 DAS. Whereas the highest B:C, net returns, and gross returns were recorded in Intercropping with sesbania and kept as mulch at 40 DAS.

Basmati rice

The highest rice grain equivalent yield (REY), net returns and benefit cost ratio were recorded in sesbania green manure before transplanting *fb*1 mechanical weeding at 30 DAT in basmati rice. Where as in vegetable pea sequence the maximum REY and net returns and B:C were recorded in vegetable pea intercropping with radish crop. In sweet crop sequence the highest REY and net returns and B:C ration were recorded in sweet corn Intercropping with black gram.

WP 1.3.13. Weed management in organically raised sugarcane-ratoon system

Centre: PAU, Ludhiana

Treatments:

1. Sugarcane + Cane trash mulch @ 8-10 t/ha
2. Sugarcane + Paddy straw mulch @ 8-10 t/ha
3. Sugarcane + Summer green gram + Mulch @ 6 t/ha
4. Sugarcane + Summer black gram + Mulch @ 6 t/ha
5. Sugarcane + Cowpea + Mulch @ 6t/ha
6. Sugarcane + Summer green gram + One mechanical weeding
7. Sugarcane + Summer black gram + One mechanical weeding
8. Sugarcane + Cowpea + One mechanical weeding
9. Sole sugarcane (Mechanical weedings)
10. Sole sugarcane (partially weed- weeds removed after critical period)

At 60 DAP statistically least count of *Cyperus rotundus* was recorded in mechanical weeded plots followed by cane trash mulch, this implies that paddy straw mulch offers least mechanical impedance to *Cyperus rotundus* than cane trash mulch (CTM). Similar trend was recorded in density of *Rumex dentatus, Medicago denticulata, Chenopodium album, Amaranthus viridus, Digitaria sanguinalis* and *Dactyloctenium aegyptium*. But *Coronopus didymus* was equally suppressed by PSM and CTM and its population was least but statistically at par with mechanical weeding treatment. At 90 DAP, population of all weed species was statistically lowest in plots, where mechanical weeding was performed repeatedly and maximum population of weeds was under partially weeding treatment. Similar trend was recorded in weed biomass at 60 and 90 DAP.

The highest cane yield (87.2 t/ha) was recorded in treatment where mechanical weeding was performed. This yield was highest amongst all treatments applied for managing weeds in organically raised sugarcane, but its lesser by 10 t/ha than the yield of sugarcane that was raised by using chemical methods of weed control. Treatments where both type of mulches (PSM & CTM) were applied were remained at second position and at par with each other in terms of yield. Yield of natural farming (58.3 t/ha) was least amongst all treatments.

WP 1.3.14. (i) Weed management in organically grown maize-wheat cropping system

(Continuing Trial)

Centre: CSKHPKV, Palampur

Treatments:

S.No.	Maize (*Kharif*)	Wheat (*Rabi*)
1.	Hand weeding/hoeing (HW)	Hand weeding on 30 & 60 DAS
2.	Stale seed bed + HW	Stale seed bed + HW
3.	Raised stale seed bed + HW	Raised stale seed bed + HW
4.	Mulch 5 t/ha + HW	Mulch 5 t/ha + HW
5.	Stale seed bed + mulch 5 t/ha + HW	Stale seed bed + mulch 5 t/ha + HW
6.	Raised stale seed bed + mulch5t/ha + HW	Raised stale seed bed + mulch@5t/ha + HW
7.	Intercropping (soybean) + hoeing/HW	Intercropping (mustard) +hoeing/HW
8.	* Maize / soybean + hand weeding	*Wheat/mustard + hoeing + earthingup
9.	Mulch + manual weeding *fb* relay crop of mustard (green)	Mulch + manual weeding fb summercrop of buckwheat
10.	Mechanical weeding/weeding with hoes	Hoeing

Wheat

The major weeds that infested this experiment included *Phalaris minor, Poa annua* and *Lolium temulentum* (grassy weeds) and *Stellaria media, Tulipa gesneriana, Spergula arvensis, Anagallis arvensis, Coronopus didymus* and *Ranunculus arvensis* (broad leaved weeds). The count of grassy weeds, broad-leaved weeds and total weed count at 60 DAS behaved in an identical manner with significantly lower counts recorded with Raised Stale Seed Bed + Mulch 5 t/ha + HW though this treatment behaved in a statistically similar manner with Stale Seed Bed + Mulch 5 t/ha + HW , Mulch 5 t/ha + HW, Raised Stale Seed Bed + HW, intercropping mustard with wheat + HW, pure crop of mustard + HW as well as intensive cropping.

The highest wheat grain yield (4.94 t/ha) was obtained under Raised Stale Seed Bed + Mulch 5 t/ha + HW followed by Stale Seed Bed + Mulch 5 t/ha + HW (4.90 t/ha) and Mulch 5 t/ha + HW (4.56 t/ha) while lowest wheat yield was recorded when wheat crop was intercropped with mustard (2.69 t/ha) as mustard was intercropped as replacement series (2:1). Significantly higher wheat equivalent yield was observed in Raised Stale Seed Bed + Mulch 5 t/ha + HW though this treatment was at par with Stale Seed Bed + Mulch 5 t/ha + HW, Mulch 5 t/ha + HW as well as intensive cropping where wheat was cultivated with application of mulch along with hand weeding. The highest net returns (110.7 x 10^3/ha) were obtained from Stale Seed Bed + Mulch 5 t/ha + HW followed closely by Raised Stale Seed Bed + Mulch 5 t/ha + HW, Mulch 5 t/ha + HW and Intensive cropping while lowest net return was obtained with the sole crop of mustard raised with one hand weeding.

Maize

The major weeds found infesting the maize crop grown in organic maize – wheat cropping system included *Echinochloa colona*, *Polygonum* spp., *Digitaria sanguinalis*, *Commelina benghalensis*, *Ageratum conyzoides*, *Aeschynomene indica* and *Cyperus iria.*

The significantly higher weed dry weight at 60 DAS was observed in Hand Weeding treatment though this treatment was at par with Stale Seed Bed + Mulch, Raised Stale Seed Bed + Mulch, Mechanical weeding as well as intensive cropping (mulch + manual weeding + relay crop of mustard). The data also revealed that mulching is essential for reducing the weed count and dry weight in organic production system. Also integrating raised stale seed beds, stale seed bed, mulching and hand weeding proved better in suppressing weeds.

The highest maize cob equivalent yield (13.16 t/ha) was observed under the Raised Stale Seed Bed + Mulch 5 t/ha + HW though this treatment was at par with Stale Seed Bed + Mulch 5 t/ha + HW. Significantly lower maize cob equivalent yield was observed in the treatment where soybean was cultivated alone with hand weeding. Raised Stale Seed Bed + Mulch 5 t/ha + HW and Stale Seed Bed + Mulch 5 t/ha + HW also recorded higher gross return while highest net return and benefit cost ratio was observed in maize cultivated with one mechanical weeding owing to the lower cost of cultivation. Intercropping maize with soybean + hoeing provided a balanced cob equivalent yield of 11.86 t/ha and a favorable BC ratio of 2.47. Thus, integrated weed management strategies involving stale seed beds, mulch, and mechanical weeding emerged as the most efficient for sustainable maize production in an organic system.

(ii) Weed management in maize – wheat cropping system under natural farming

Centre: CSHPKV, Palampur

Treatments:

S.No.	Maize (*Kharif*)	Wheat (*Rabi*)
1.	Maize alone (check, no weed control)	Wheat alone (check, no weed control)
2.	Maize alone (with mulch 5 t / ha)	Wheat alone (with mulch 5 t / ha)
3.	Maize + soybean (check, no weed control)	Wheat + gram (check, no weed control)
4.	Maize + soybean + 1 HW at 20 DAS	Wheat + gram + 1 HW at 20 DAS
5.	Maize + soybean (with mulch 5 t / ha)	Wheat + gram (with mulch 5 t / ha)
6.	Maize + soybean (with mulch 5 t / ha) + 1 HW at 20 DAS	Wheat + gram (with mulch 5 t / ha) + 1HW at 20 DAS
7.	Maize + soybean + 2 HW at 20 & 50 DAS	Wheat + gram + 2 HW at 20 & 50 DAS
8.	Maize + soybean (with mulch 5 t / ha) + 2 HW at 20 & 50 DAS	Wheat + gram (with mulch 5 t / ha) + 2HW at 20 & 50 DAS
9.	Maize alone (weed free) 3 - 4 HW asrequired	Wheat alone (weed free) 3 - 4 HW asrequired
10.	Maize + soybean (weed free) 3 - 4 HW as required	Wheat + gram (weed free) 3 - 4 HW asrequired

The major weeds that infested the experimental field included *Digitaria sanguinalis*, *Polygonum* spp., *Commelina benghalensis*, *Ageratum conyzoides*, *Aeschynomene indica*, *Cyperus iria* with small population of *Oxalis latifolia* and *Bidens pilosa*. The study revealed that treatments T_9 (Maize alone, weed-free) and T_{10} (Maize + Soybean, weed-free) achieved with 3-4 hand weedings recorded significantly lower weed dry weight across all species at 30 DAS and 60 DAS. These treatments were followed by treatments T_7 (Maize +

Soybean + 2 hand weedings) and T_8 (Maize + Soybean with mulch 5 t/ha + 2 hand weedings) which were statistically comparable showing effective weed suppression at 30 DAS and 60 DAS.

The data on maize cob equivalent yield revealed significantly lowest equivalent yield was observed with maize alone without weed control. Intercropping soybean with maize and kept weed free resulted in significantly higher maize cob equivalent yield though this treatment was at par with maize + soybean intercropping treatments with two hand weedings at 20 & 50 DAS either alone or along with mulch.

Intercropping of soybean with maize resulted in higher benefit cost ratio as compared to treatments where maize was taken alone with similar weed management practice. Highest B:C was observed in maize + soybean along with two hand weedings at 20 & 50 DAS followed by maize + soybean+ mulch+ one hand weeding at 20 DAS and maize + soybean + mulch.

WP 1.3.15. Weed management practices in organically grown cotton

Centre: ANGRAU, Guntur

Treatments:

1. Stale seedbed + Hand weeding at 20 & 40 DAS
2. Plastic mulch at sowing on broad beds
3. Cotton + Cowpea* (2:1)
4. Cotton + Sunhemp* (2:1)
5. Weeding with power weeder at 20 & 40 DAS
6. Straw mulch (5 t/ha) at 20 DAS
7. Farmers practice (3 hoeing 20 Days interval *fb* 2 ine weeding 20 & 40 DAS)
8. Pendimethalin PE *fb* Pyrithiobac Sodium + Quizalofop-ethyl (RM) @ 1125 ml/ha at 20- 25 DAS
9. Weed check

Among the different weed management practices tested in organically grown cotton, treatment i.e. Farmers practice (3 hoeings at 20 days interval *fb* 2-line weedings at 20 & 40 DAS) recorded significantly highest growth parameters, yield attributes, yield and economics. Lower density and dry weight of weeds were observed in treatment i.e. Farmers practice (3 hoeings at 20 days interval *fb* 2-line weedings at 20 & 40 DAS) which was comparable with treatment i.e. Plastic mulch at sowing on broad beds and treatment i.e. Stale seed bed preparation + hand weeding at 20& 40 DAS) at 30, 60 DAS and at harvest stages of cotton. Highest cost of cultivation was recorded in treatment i.e. Plastic mulch at sowing on broad beds.

T_7: Farmers practice (3 hoeings at 20 Dasys interval fb 2 line weedings at 20 & 40 DAS)

T_2: Plastic mulch at sowing on broad beds

T_1: Stale seedbed preparation + Hand weeding at 20 & 40 DAS

T_9: Weedy check

WP1.4. Management of parasitic weeds

WP 1.4.1. Management of *Striga* in sugarcane

Network centres: UAS Dharwad and PJTSAU Hyderabad

Objectives:

1. To study the effect of different herbicides on the emergence of *Striga*
2. Evaluation of native UAS-D AMF consortium against *Striga* emergence in sugarcane
3. To study the visual phyto-toxicity on sugarcane crop

Treatments:

1. 2,4-D sodium salt 44% + metribuzin 35% + pyrazosulfuron ethyl 1.0% WDG 2400 g a.i./ha as post-emergence
2. Atrazine 1.0 kg/ha on 3 DAP + HW on 45 DAP + earthing up on 60 DAP + POE 2,4-D Na salt 5 g/L + urea 20 g/L on 90 DAP fb trash mulching at 5 t/ha on 120 DAP
3. UAS-D AMF consortium*+ T2
4. UAS-D AMF alone
5. Desmodium intercrop
6. Untreated check

* Pre-colonization of the sugarcane sets with UAS-D AMF consortia (@ 2 kg/m^2. Soil application of consortium (@ 20 kg/ha mixed with 200 kg Vermicompost) at the time of planting

Observations:

1. No. of *Striga* emerged per/m^2 at 60, 90,120 DAP and at harvest
2. Dry biomass of *Striga* per/m^2 at 60, 90,120 DAP and at harvest
3. Phyto-toxicity symptoms on sugarcane (if any).
4. Yield attributes and yield of sugarcane.
5. Residual toxicity on the succeeding crop
6. Economics of *Striga* management.

UAS, Dharwad

At 220 and 330 DAS, application of UASD AMF consortium at the time of planting as soil application followed by atrazine 1.0 kg/ha at 3 DAP reduced the *Striga* emergence (2.00 and 5.0/ M^2), which was statistically at par with the plots received atrazine 1.0 kg/ha on 3 DAP + HW on 45 DAP + earthling up on 60 DAP + POE 2,4-D Na salt 5 g/L + urea 20 g/L on 90 DAP *fb* trash mulching at 5 t/ha on 120 DAP (1.2 and 3.4 / M^2). However, the treatment receiving UAS-D AMF consortium alone reduced the *Striga* emergence to a tune 5.7 and 7.6 / M^2, which is superior to the plots receiving 2,4-D Na 2.0 kg/ha + metribuzine 1.0 kg/ha at the time of *Striga* emergence (5.7 and 7.6 M^2) (**Table 1.4.1, 1.4.2** and **1.4.3**).

Table 1.4.1. Interactive effect of herbicide molecules and UASD AMF consortia on *Striga* emergence

Treatments	*Striga* emergence (No/Sq m)	
	220 DAP	330 DAP
T_1	8	9.9
T_2	1.2	3.4
T_3	5.7	7.6
T_4	8.9	10.7
T_5	2	5
LSD (p = 0.05)	**0.91**	**1.20**
S.Em. ±	**0.28**	**0.37**

Table 1.4.2. Growth, Physiological and microbiological parameters as influenced by different herbicide and UASD AMF consortium at 210 DAP

Treatments	Plant height (cm)	Relative chlorophyll content (SPAD values)	Stem girth (cm)	No. of tillers	Dehydrogenase (µg TPF formed g^{-1} soil d^{-1})
T_1	237.26	38.14	11.35	4.20	41.00
T_2	268.50	42.24	13.80	4.80	46.00
T_3	245.19	41.78	11.50	4.60	51.10
T_4	211.00	34.08	11.45	4.00	39.00
T_5	237.63	39.66	12.25	4.40	43.00
LSD (p = 0.05)	**25.78**	**4.767**	**N/A**	**0.46**	**4.54**
S.Em. ±	**8.28**	**1.53**	**0.62**	**0.15**	**1.46**

Table 1.4.3. Growth, Physiological, microbiological and cane yield as influenced by different herbicide and UASD AMF consortium at 330 DAP.

Treatments	Plant height (m)	Relative chlorophyll content (SPAD values)	Stem girth (cm)	Dehydrogenase (µg TPF formed g^{-1} soil d^{-1})	Phosphatase activity (µg pnp released g^{-1} soil h^{-1})	Cane Yield t/ha
T_1	3.74	35.83	16.60	23.36	293.80	66.66
T_2	4.36	44.13	19.60	33.21	385.73	82.48
T_3	4.50	42.37	18.60	28.28	481.27	81.39
T_4	3.52	34.20	14.00	17.12	264.30	45.42
T_5	3.79	40.47	16.80	25.83	334.83	67.73
LSD ($p = 0.05$)	**0.41**	**5.52**	**2.09**	**2.61**	**49.13**	**4.34**
S.Em. ±	**0.13**	**1.66**	**0.67**	**0.79**	**14.84**	**1.31**

Land preparation

Mixing of UAS-D AMF consortium with

Compost

Soil application of AMF consortium

2,4-D Na 2.0 kg/ha + Metribuzine 1.0 kg/ha at the time of Striga emergence

Atrazine 1.0 kg/ha on 3 DAP + HW on 45 DAP + earthing up on 60 DAP + POE 2,4-D Na salt 5 g/L + urea 20 g/L on 90 DAP *fb* trash mulching at 5 t/ha on 120 DAP

UAS-D AMF consortium*

Untreated check

Atrazine 1.0 kg/ha and UAS-D AMF consortium*

Impact of 2,4-D Sodium Salt 44% + Metribuzin 35% + Pyrazosulfuron Ethyl 1.0% WDG (Triskele) on Striga in sugarcane

WP 1.4.7. Chemical control of parasitic weed *Loranthus (Dendrophthoe falcata)* in mango orchards

Centre: KAU, Thrissur

Objective:

1. To arrive at herbicidal management measures against the parasitic weed *Loranthus* on mango trees

Treatments:

1. 2,4- D Na salt 80WSP 1 %
2. 2,4- D Na salt 80WSP 1 % + Cu SO_4 (2%)
3. Metribuzine 70 WP 0.5 %
4. Glufosinate ammonium 15 SL 1 %
5. Ethrel (39 SL) @ 2.5 %
6. Unsprayed check
7. Design: RBD, Replications -3

Note: In all treatments except ethrel, urea (5%) will be tank mixed to increase efficacy and sticker will be also added @ 2ml/ L of spray fluid

Observation:

1. Regeneration of the pest in the treated plant and their growth parameters.

Ethrel exhibited immediate effect on loranthus and on 1st day after spraying considerable leaf shedding was observed. Complete leaf shedding of loranthus was seen within 5 days after spraying and some leaves of host plant also was shed.

2,4-D Na salt+ $CuSO_4$, metsulfuron methyl, glufosinate ammonium, metribuzin, 2,4-D Na salt also showed drying and leaf shedding when observations were recorded at 15 days of spraying. However, regrowth of loranthus was observed on 2,4-D Na salt+ $CuSO_4$, glufosinate ammonium at 15 days after spraying.

2,4-D Na salt padding and metribuzin padding did not show any phytotoxicity on loranthus till 15th day after application. Observations are being continued to assess regrowth if any in all treatments (**Table 1.4.7.1**).

Table 1.4.7.1. Phytotoxicity symptoms on loranthus.

Sl.No.	Treatments	Days after treatment application				
		Day 1	Day 3	Day 5	Day 7	Day 14
1.	2,4-D Na salt	0	0	0	1	2
2.	2,4-D Amine	0	0	0	1	3
3.	2,4-D Na salt+urea	1	2	3	4	4
4.	2,4-D Amine+urea	1	1	2	3	4
5.	2,4-D Na salt+$CuSO_4$+urea	1	3	4	5	5
6.	Glufosinate ammonium	0	2	4	5	5
7.	Metribuzin	0	2	4	4	5
8.	Ethrel	3	4	5	5	5
9.	Metsulfuron methyl	1	3	4	5	5
10.	2,4-D Na salt padding	0	0	0	0	0
11.	Metribuzin padding	0	0	0	0	0
12.	Unsprayed check	0	0	0	0	0

Effect of herbicides on loranthus at 15 days after spraying

2,4-D Na salt

2,4-D amine

2,4-D Na salt+urea

2,4-D amine+urea

2,4-D Na salt+CuSO4+urea

Glufosinate ammonium+urea

Metribuzin+urea

Ethrel

Metribuzin (padding)

Unsprayed check

WP-1.5 Management of herbicide resistance in weeds

WP 1.5.1 Monitoring the development of herbicide resistance in weeds

Network Centres: All centres, including voluntary centres

Guidelines

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

AAU, Anand

1. Escape incidence of *Leptochloa chinensis* in paddy nursery

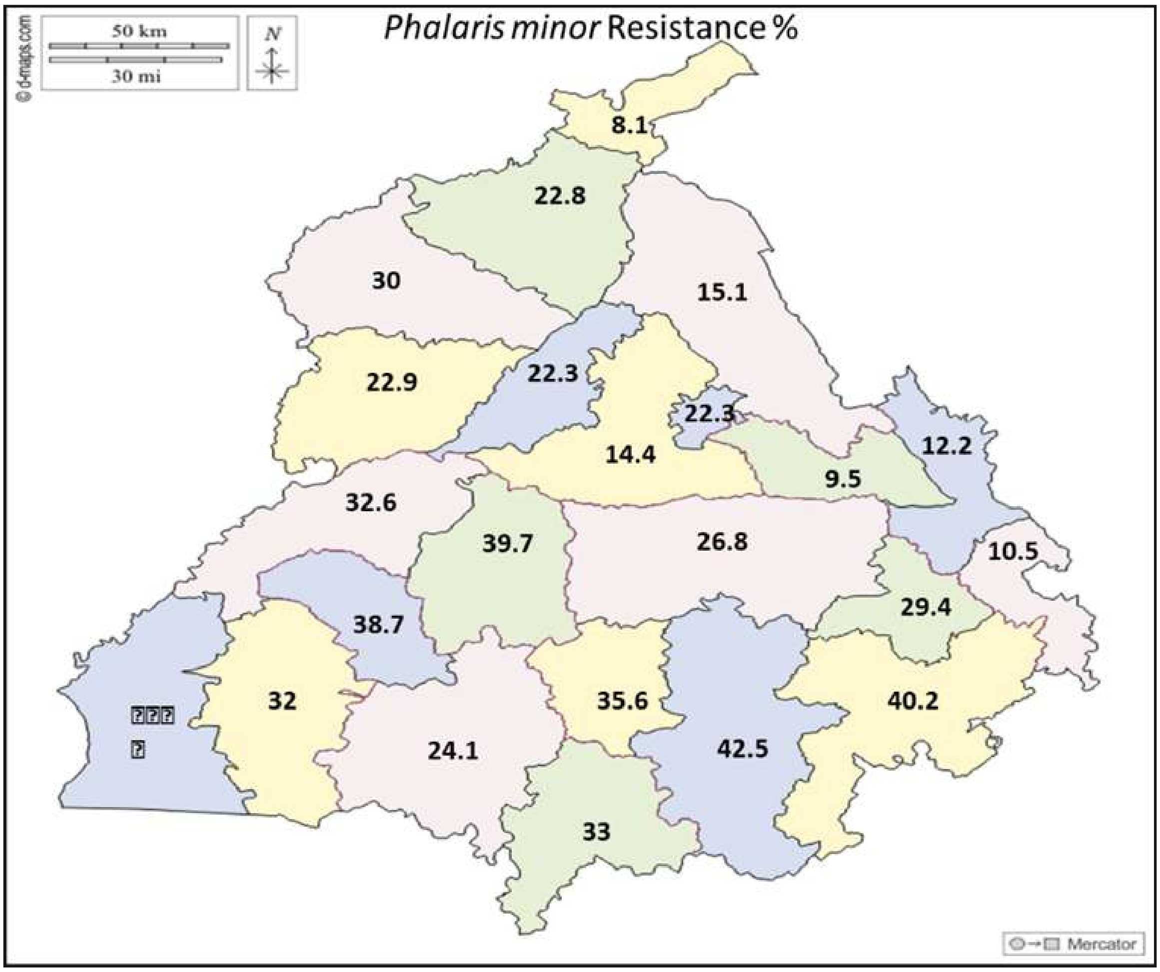
The escape incidence of *Leptochloa chinensis* in paddy nursery was observed under the application of bispyribac-sodium at 10EC 20 g/ha PoE, bispyribac sodium 20% + pyrazosulfuron ethyl 15% WDG (RM) and bispyribac-sodium + chlorimuron ethyl + metsulfuron methyl (RM) 43 g/ha as PoE.

Escape incidence of *Commelina benghalensis* in groundnut against application of pendimethalin 30 EC 750 g/ha as PE, pendimethalin 38.7 CS 750 g/ha as PPI, fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL 250 g/ha (RM) and imazethapyr 10% 75 g/ha alone and RM with another herbicide.

Application of 2,4-D amine salt 58% 145 g/ha, 2,4-D ethyl ester 38% 145 g/ha and 2,4-D ethyl ester 38% 290 g/ha provided effective control of *Commelina benghalensis* in groundnut during *kharif* season.

PAU, Ludhiana

A systematic survey was conducted during 2023-24 in different districts of Punjab with 300 farmers on the herbicide resistance in *Phalaris minor*. High resistance zones, with levels exceeding 30%, were observed in several districts, indicating widespread adaptation of *P. minor* to herbicide applications, likely due to intensive wheat cultivation and repetitive use of similar herbicides. Moderate resistance levels (20-35%) were predominant across many regions, suggesting that resistance management strategies are still partially effective but require strengthening to prevent further escalation. Low resistance levels, observed in a few districts with values as low as 8.1 and 9.5%, may reflect diverse agricultural practices, such as crop rotation or reduced herbicide dependence. This survey data is solely an outcome of farmers' perception and experience.



WP1.5.2 Management of resistant *Phalaris minor* and other weeds with new herbicide combinations

Network Centres: GBPUAT Pantnagar and CCSHAU Hisar

Objective:

1. To find out suitable options for effective management of resistant *Phalaris minor* and other weeds in wheat under variable paddy residue management scenarios

Treatments:

A (Tillage and residue management-3):

1. Conventional tillage (without residue)
2. Zero till with residue retention on surface (Happy seeder)
3. Conventional tillage with residue incorporation (Super seeder)

B (Weed control-4):

1. Unsprayed control
2. Pyroxasulfone 100 g + pendimethalin 800 g/ha (Pre-emergence)
3. Pyroxasulfone 127.5 g + metribuzin 150 g/ha (Pre-emergence)
4. Pinoxaden 50 g + metribuzin 175 g/ha (Post-emergence)

Design: Split-plot (A in main plot and B in subplot); Replications: 3

Observations:

1. Weed density (25 DAS, 50 DAS, at harvest)
2. Weed biomass (25 DAS, 50 DAS, at harvest)
3. Crop growth parameters (plant height and crop biomass at harvest)
4. Grain yield and attributes

CCSHAU, Hisar

Before spray of PoE herbicide at 30 DAS, pyroxasulfone at 100 g + pendimethalin at 800 g/ha (pre-emergence) and pyroxasulfone 127.5 g + metribuzin at 150 g/ha (PRE) significantly reduced the density of all weeds as compared to weedy check, except *M. denticulata,* which showed poor efficacy of these herbicide mixture on this particular weed at lower doses (**Table 1.5.1**).

At 75 day after sowing, minimum weed density was observed for the treatment pinoxaden at 50 g + metribuzin at 175 g/ha (post emergence), which was at par with pyroxasulfone at 100 g + pendimethalin at 800 g/ha (pre-emergence) except for the density of *Medicago denticulata*. Among tillage and residue management, sowing of wheat with Happy Seeder under zero till with residue retention on surface resulted higher grain yield (4838 kg/ha), while all the treatments were statistically at par with each other. Similarly higher grain yield (**Table 1.5.2**) was recorded with post emergence application of pinoxaden at 50 g + metribuzin at 175 g/ha (5395 kg/ha), which was statistically at par with pre-emergence application of pyroxasulfone at 100 g + pendimethalin at 800 g/ha (5075 kg/ha) followed by pre-emergence application of pyroxasulfone at 127.5 g + metribuzin at 150 g/ha (4934 kg/ha).

Table 1.5.1. Effect of tillage, residue management and weed control treatments on weed density before spray of PoE in wheat

Treatment details	Weed density (no./m²) before PoE spray 30 DAS		
	Phalaris minor	*Rumex dentatus*	*Medicago denticulata*
Tillage and residue management (main plots)			
Zero till with residue retention on surface (Happy Seeder)	4.05 (16.4)	3.79 (14.6)	1.89 (3.25)
Conventional tillage (without residue)	4.48 (24.9)	1.38 (1.3)	3.11 (9.00)
Conventional tillage with residue incorporation (Super Seeder)	4.64 (24.1)	1.84 (3.0)	3.22 (9.75)
LSD (*p=0.05*)	**0.46**	**1.23**	**0.47**
Weed control (sub plots)			
Pyroxasulfone 100 g + pendimethalin at 800 g/ha (PRE)	2.57 (6.0)	1.89 (3.5)	2.56 (6.7)
Pyroxasulfone 127.5 g + metribuzin at 150 g/ha (PRE)	2.82 (7.2)	2.01 (4.0)	2.47 (6.0)
Pinoxaden at 50 g + metribuzin at 175 g/ha (PoE)	6.12 (37.3)	2.81 (9.3)	2.92 (8.2)
Weedy Check	6.05 (36.7)	2.64 (8.3)	3.01 (8.5)
LSD (*p=0.05*)	**0.42**	**0.45**	**NS**

**The original figures in parenthesis were subjected to (√(X+1) square root transformation

Table 1.5.2. Effect of tillage, residue management and weed control treatments on weed density and dry weight at 75 days after sowing in wheat

Treatment details	(no./m²)			Tillers/m	Plant height (cm)	Grain yield (kg/ha)
	P. minor	*R. dentatus*	*M. denticulata*			
Tillage and residue management						
Conventional tillage (without residue)	3.60 (16.6)	1.81 (2.9)	3.24 (11.2)	73.5	84.0	4730
Zero till with residue retention on surface (Happy Seeder)	3.87 (15.5)	2.65 (8.6)	2.58 (6.1)	71.3	84.4	4838
Conventional tillage with residue incorporation (Super Seeder)	4.02 (17.9)	2.10 (4.4)	3.79 (15.1)	72.6	83.2	4646
LSD (*p=0.05*)	**NS**	**0.37**	**0.88**	**NS**	**NS**	**NS**
Weed control						
Unsprayed control	6.43 (41.0)	3.79 (14.5)	3.59 (12.3)	60.9	82.0	3549
Pyroxasulfone at 100 g + pendimethalin at 800 g/ha (Pre-emergence)	3.19 (9.5)	1.97 (3.5)	3.60 (13.5)	74.6	84.1	5075
Pyroxasulfone at 127.5 g + metribuzin at 150 g/ha (Pre-emergence)	3.62 (12.3)	1.61 (2.0)	3.67 (14.3)	72.4	84.4	4934
Pinoxaden at 50 g + metribuzin at 175 g/ha (Post emergence)	2.09 (3.8)	1.37 (1.2)	1.97 (3.2)	81.9	84.8	5395
LSD (*p=0.05*)	**0.44**	**0.41**	**0.57**	**4.3**	**1.4**	**175**

**The original figures in parenthesis were subjected to (√(X+1) square root transformation

WP 1.5.3 Management of resistance developed in *Cyperus difformis* against bispyribac-sodium in rice

Centre: IGKV, Raipur

Objective:

1. To find out suitable options for effective management of herbicide resistant *C. difformis* in rice

Treatments:

1. Pyrazosulfuron 20 g/ha PE
2. Bispyribac Na 25 g/ha 20 DAT
3. Pyrazosulfuron 20 g/ha PE *fb* penoxsulam 22.5 g/ha 20 DAT (RM)
4. Pyrazosulfuron 20 g/ha PE *fb* metsulfuron +chlorimuron 4 g/ha 20DAT
5. Florpyrauxifen-benzyl + penoxsulam 40.63 g/ha PoE 20 DAT (RM)
6. Bentazone 960 g/ha PoE 20 DAT
7. Triafamone + ethoxysulfuron 67.50 g/ha PoE 20 DAT (RM)
8. Unweeded control

Season: *Kharif* 2024 & 2025 **Design:** RBD; Replication: 4

Observations:

1. Weed density (25 DAS, 50 DAS, at harvest)
2. Weed biomass (25 DAS, 50 DAS, at harvest)
3. Crop growth parameters (plant height and crop biomass at harvest)
4. Grain yield and attributes

Density and biomass of *Cyperus difformis*

The density of *C. difformis* was found non-significant at 20 DAT. Lesser density of *C. difformis* was recorded under florpyrauxifen-benzyl + penoxsulam 40.63 g/ha PoE 20 DAT followed by bentazone 960 g/ha PoE 20 DAT at 25 and 50 DAT (**Table 1.5.3.**). *C. difformis* contributed almost 82 to 90% of the total weed density at 50 DAT in the plots where bispyribac Na 25 g/ha 20 DAT was used. A similar trend was observed in weed biomass at 25 and 50 DAT and at harvest. Results showed that the inoculated C. difformis has resistance to the application of bispyribac Na 25g/ha 20 DAT and not controlled at 25 and 50 DAT over pre-treatment stage at 20 DAT.

Table 1.5.3. Weed density at 25 DAT, 50 DAT and at harvest as influenced by different weed management practices for control of resistant *Cyperus difformis*.

S. No.	Treatment	Weed density (No. m^{-2})								
		20 DAT	25 DAT			50 DAT			At harvest	
		*C. difformis***	*Cyperus difformis*	Others	Total	*Cyperus difformis*	Others	Total	*C. difformis*	Others
1	Pyrazosulfuron ethyl 10% WP	10.02 100.00*	6.20 38	4.34 69	7.54 56.33	7.58 57	5.45 29.17	9.31 86.17	**0.71** 0.00	**5.48** 29.50
2	Bispyribac sodium 10% SC	11.29 127.00	10.14 102.3	4.71 114.65	11.16 123.97	9.40 87.8	10.41 107.95	14.01 195.75	**0.71** 0.00	**4.83** 22.83
3	Pyrazosulfuron ethyl 20 g/ha PE *fb* Penoxsulam 22.5 g/ha PoE 20 DAT	8.46 71.00*	6.72 44.7	3.19 57.85	7.41 54.37	5.08 25.3	2.71 6.83	5.71 32.13	**0.71** 0.00	**3.86** 14.42
4	Pyrazosulfuron ethyl 20 g/ha PE *fb* Metsulfuron methyl + Chlorimuron ethyl 4 g/ha PoE 20 DAT	9.41 88.00*	4.77 22.3	3.83 55.15	6.08 36.47	4.56 20.3	3.25 10.04	5.55 30.34	**0.71** 0.00	**4.22** 17.33
5	Florpyrauxifen-benzyl + Penoxsulam 40.63 g/ha PoE 20 DAT	9.67 93.00	1.67 2.3	3.58 47.65	3.89 14.63	0.71 0	3.03 8.67	3.03 8.67	**0.71** 0.00	**4.05** 15.92
6	Bentazone 960 g/ha PoE 20 DAT	11.22 125.33	4.27 17.7	4.43 71.51	6.11 36.87	3.18 9.6	4.08 16.17	5.13 25.77	**0.71** 0.00	**4.83** 22.83
7	Triafamone + Ethoxysulfuron 67.50 g/ha PoE 20 DAT	10.48 109.33	5.93 34.7	4.95 72.01	7.69 58.70	5.55 30.3	3.69 13.08	6.62 43.38	**0.71** 0.00	**4.68** 21.42
8	Unweeded control	12.09 145.67	11.98 143	5.46 144.3	13.15 172.33	11.88 140.7	6.09 36.58	13.33 177.28	**0.71** 0.00	**8.67** 74.67
	SEm±	**0.89**	**0.08**	**0.31**	**0.36**	**0.05**	**0.43**	**0.27**	**0.00**	**0.64**
	LSD (p=0.05)	**NS**	**0.24**	**0.95**	**1.08**	**0.14**	**1.29**	**0.81**	**0.00**	**1.91**

Figures in Parentheses are original values; data were transformed to values $\sqrt{(x+0.5)}$

***: Density at 0 to 7 DAT.**

****: Seeds of Cyperus difformis were inoculated after transplanting when moisture was at field capacity.**

Weed control efficiency, grain yield and economics

Highest weed control efficiency (82.13%) at 25 DAT and grain yield (5.83 t/ha) was recorded under pyrazosulfuron 20 g ha^{-1} PE *fb* penoxsulam 22.5 g/ha 20 DAT. Comparable grain yield (5.83 t/ha), highest net return (Rs 117514/ha) and B:C (3.47) was found under triafamone + ethoxysulfuron 67.50 g/ha PoE 20 DAT (RM). Florpyrauxifen-benzyl + penoxsulam 40.63 g/ha PoE 20 DAT (RM) gave 100% WCE to control *C. difformis* with comparable grain yield to that of pyrazosulfuron 20 g/ha PE *fb* penoxsulam 22.5 g/ha 20 DAT. However, due to higher cost of chemical, it generated lesser B:C of 3.01 (**Table 1.5.4 and 1.5.5**).

Table 1.5.4. Weed control efficiency at 25 DAT, 50 DAT and at harvest as influenced by different weed management practices for control of resistant *Cyperus difformis*.

S. No	Treatment	WCE %				
		25 DAT		50 DAT		At harvest
		C. difformis	Total	*C. difformis*	Total	Total
1	Pyrazosulfuron ethyl 10 % WP	95.77	74.45	82.08	48.02	28.71
2	Bispyribac sodium 10 % SC Pyrazosulfuron ethyl 20 g/ha PE *fb*	56.31	63.58	53.20	56.24	45.16
3	Penoxsulam 22.5 g/ha PoE 20 DAT	92.38	82.13	91.80	77.71	74.58
4	Pyrazosulfuron ethyl 20 g/ha PE *fb* Metsulfuron methyl + Chlorimuron ethyl 4 g/ha PoE 20 DAT	97.76	76.61	95.56	71.25	68.98
5	Florpyrauxifen-benzyl + Penoxsulam 40.63 g/ha PoE 20 DAT	100.00	78.76	100.00	76.23	72.76
6	Bentazone 960 g/ha PoE 20 DAT	96.30	73.86	95.12	59.28	52.34
7	Triafamone + Ethoxysulfuron 67.50 g/ha PoE 20 DAT	92.47	63.57	87.58	60.44	55.98
8	Unweeded control	-	-	-	-	-

Table 1.5.5. Yield and economicas influenced by different weed management practices for control of resistant *Cyperus difformis*.

S. No.	Treatment	Grain yield (t/ha)	Treatment cost (Rs./ha)	Net returns (Rs./ha)	B:C
T_1	Pyrazosulfuron 20 g ha^{-1} PE	4.46	1396	85330	3.08
T_2	Bispyribac Na 25 g ha^{-1} 20 DAT	4.71	2816	82366	2.94
T_3	Pyrazosulfuron 20 g ha^{-1} PE *fb* Penoxsulam 22.5 g ha^{-1} 20 DAT	5.83	5045	117514	3.63
T_4	Pyrazosulfuron20g/haPE*fb* metsulfuronmethyl + chlorimuron4.0g/ha20DAT	5.42	2450	108131	3.57
T_5	Florpyrauxifen-benzyl + penoxsulam 40.63g/haPoE 20 DAT (RM)	5.59	4899	89545	3.01
T_6	Bentazone 960 g/ha PoE 20 DAT	5.00	3879	118680	3.73
T_7	Triafamone + ethoxysulfuron 67.50 g/ha PoE20 DAT (RM)	5.38	5379	123498	3.74
T_8	Unweeded control	3.90	-	73774	2.86
SEm±		**0.35**	-	-	-
LSD (p=0.05)		**1.06**	-	-	-

WP 1.5.5 Management of herbicide-resistant *Phalaris minor* in wheat

Centre: CCSHAU, Hisar

Objective:

1. To study the efficacy of different pre-emergence herbicides alone and in combination with PoE herbicides for control of resistant *P. minor* in wheat

Treatments:

1. Pyroxasulfone 127.5 (PRE)
2. Pendimethalin + metribuzin 875 + 87.5 (PRE)
3. Pyroxasulfone + pendimethalin 127.5 + 1500 (PRE)
4. Pendimethalin + metsulfuron-methyl (TM) 1500 + 4 g/ha (PRE)
5. Pyroxasulfone + metsulfuron-methyl (TM) 127.5 + 4 g/ha (PRE)
6. Pendimethalin + metribuzin 875 + 87.5 (EPoE)
7. Pyroxasulfone + pendimethalin 127.5 + 1500 (EPoE)
8. Pendimethalin + metsulfuron-methyl (TM) 1500 + 4 g/ha (EPoE)
9. Pyroxasulfone + metsulfuron-methyl (TM) 127.5 + 4 g/ha (EPoE)
10. Metribuzin + clodinafop 210 + 60 (PoE)
11. Weed free
12. Weedy

Design: RBD; **Replications:** 03

Observations:

1. Weed density at 60 and 90 DAS
2. Weed dry weight at 60 and 90 DAS
3. Phyto-toxicity on the crop at 10 and 20 DAT
4. Yield and yield attributes of wheat

P. minor as a grassy weed; while the *C. album, C. didymus, M. denticulata, R. dentatus* and *C. arvensis* were the dominant broad-leaved weeds (BLWs) infesting the experimental field (**Table** 1.5.6.). *Phalaris minor* density was significantly lower with application of pyroxasulfone 127.5 g/ha as pre-emergence or early post-emergence and more effective as compared to the post-emergence application. Application of pyroxasulfone 127.5 g/ha (EPoE) *fb* clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE), pyroxasulfone 127.5 g/ha (EPoE) *fb* pinoxaden + metribuzin 50 + 175 g/ha (TM) (PoE) provided 100% control of all the weeds except *Convolvulus arvensis*. Application of pyroxasulfone 127.5 g/ha (EPoE) *fb* clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE)/ pinoxaden + metribuzin 50 +175 g/ha, clodinafop + metribuzin 60 + 210 provided 100% control of *Phalaris minor* and more than 95% control of BLWs (**Fig. 1.5.1.**). Pooled WCE was also 100% for *Phalaris minor* and more than 95% for BLWs at 90 DAS.

Weed free treatment resulted in higher grain yield (5783 kg/ha) which was at par with application of pyroxasulfone 127.5 g/ha (EPoE) *fb* clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE) and pyroxasulfone 127.5 g/ha (EPoE) *fb* pinoxaden + metribuzin 50 + 175 g/ha (TM) (PoE) but significantly higher than other herbicide application. Application of pyroxasulfone 127.5 g/ha ad PRE or EPOE were at par with each other in terms of grain yield (**Table 1.5.7**). Weed index was also recorded higher with pyroxasulfone 127.5 g/ha (EPoE) *fb* clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE).

Table 1.5.6. Effect of different herbicide treatments on weed density at 90 DAS in wheat.

Treatments	Weed density (No./m^2)					
	P. minor	*M. denticulata*	*C. didymus*	*R. dentatus*	*C. arvensis*	*C. album*
Pyroxasulfone 127.5 g/ha (PRE)	1.2 (0.7)	4.8 (22.7)	2.5 (5.3)	1.0 (0.0)	2.1 (3.3)	1.0 (0.0)
Pyroxasulfone + pendimethalin 127.5 + 1500 g/ha (PRE)	1.0 (0.7)	4.3 (17.3)	1.7 (2.0)	1.0 (0.0)	1.2 (0.7)	1.0 (0.0)
Pyroxasulfone + metribuzin 127.5 + 132 g/ha (ha) (PRE)	1.2 (0.7)	4.6 (20.0)	2.6 (6.0)	1.0 (0.0)	1.0 (0.0)	1.7 (2.0)
Pyroxasulfone 127.5 g/ha (EPoE)	1.0 (0.0)	4.6 (20.0)	2.4 (4.7)	1.5 (1.3)	1.9 (2.7)	1.9 (2.7)
Pyroxasulfone 150 g/ha (EPoE)	1.0 (0.0)	4.1 (16.0)	2.1 (3.3)	1.2 (0.7)	2.4 (4.7)	1.0 (0.0)
Pyroxasulfone 127.5 g/ha (PoE)	2.1 (3.3)	4.6 (20.0)	2.4 (4.7)	1.7 (2.0)	2.1 (3.3)	1.0 (0.0)
Pyroxasulfone 150 g/ha (PoE)	1.9 (2.7)	4.8 (22.0)	1.0 (0.0)	1.0 (0.0)	2.4 (4.7)	1.0 (0.0)
Pyroxasulfone 127.5 g/ha (EPoE) *fb* clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE)	1.0 (0.0)	1.2 (0.7)	1.0 (0.0)	1.0 (0.0)	1.5 (1.3)	1.0 (0.0)

Table contd....

Pyroxasulfone + metribuzin (TM) 127.5 + 175 g/ha (TM) (PoE)	1.5 (1.3)	2.5 (5.3)	1.0 (0.0)	1.2 (0.7)	1.9 (2.7)	1.0 (0.0)
Pyroxasulfone 127.5 g/ha (EPoE) *fb* pinoxaden + metribuzin 50 + 175 g/ha (TM) (PoE)	1.0 (0.0)	2.5 (5.3)	1.0 (0.0)	1.0 (0.0)	1.5 (1.3)	1.0 (0.0)
Clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.9 (2.7)	1.0 (0.0)
Pinoxaden + metribuzin 50 + 175 g/ha (TM) (PoE)	1.0 (0.0)	2.1 (3.3)	1.0 (0.0)	1.0 (0.0)	2.2 (4.0)	1.0 (0.0)
Weedy check	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
Weed free	2.5 (5.3)	6.1 (36.7)	3.3 (10.0)	2.1 (3.3)	2.4 (4.7)	2.4 (4.7)
SEm (±)	0.1	0.2	0.1	0.1	0.2	0.1
CD (p=0.05)	0.4	0.7	0.3	0.4	0.5	0.2

PRE- Pre-emergence, PoE-Post-emergence, EPoE-Early post-emergence

****The original figures in parenthesis were subjected to (**√ (X+1) square root transformation

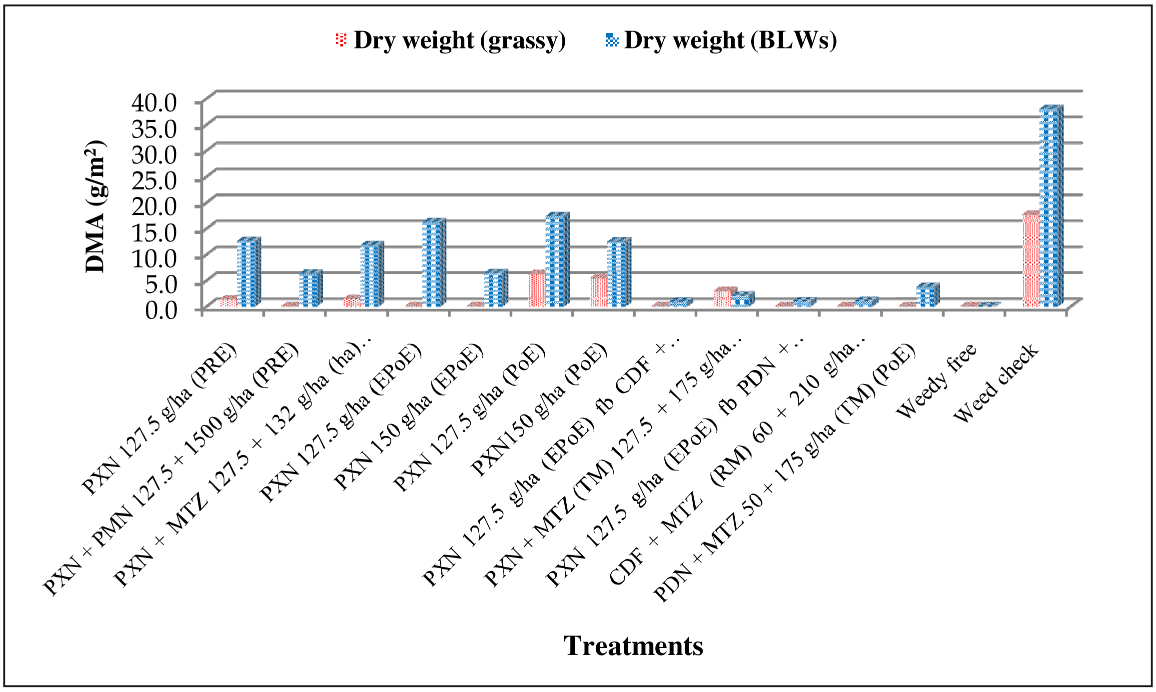


Fig. 1.5.1: Effect of different herbicide treatments on weed dry matter at 90 DAS

PXN-Pyroxasulfone, PMN-Pendimethalin, PDN-Pinoxaden, MTZ- Metribuzin, CDF-Clodinafop

Table 1.5.7. Effect of different herbicide treatments on yield attributes, yield and weed index of wheat

Treatments	Effective tillers/m (No.)	Yield (kg/ha)		Weed index (%)	
		2023-24	Pooled	2023-24	Pooled
Pyroxasulfone 127.5 g/ha (PRE)	73.5	4805	4713	16.9	17.5
Pyroxasulfone + pendimethalin 127.5 + 1500 g/ha (PRE)	78.4	5212	5003	9.9	12.4
Pyroxasulfone + metribuzin 127.5 + 132 g/ha (ha) (PRE)	75.4	4927	4850	14.8	15.1
Pyroxasulfone 127.5 g/ha (EPoE)	73.1	4784	4697	17.3	17.8
Pyroxasulfone 150 g/ha (EPoE)	74.6	4855	4764	16.0	16.6
Pyroxasulfone 127.5 g/ha (PoE)	71.2	4519	4466	21.0	21.3
Pyroxasulfone 150 g/ha (PoE)	71.2	4555	4491	20.4	20.9

Pyroxasulfone 127.5 g/ha (EPoE)*fb* clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE)	81.3	5569	5540	3.7	3.0
Pyroxasulfone + metribuzin (TM) 127.5 + 175 g/ha (TM) (PoE)	77.9	5112	4953	11.6	13.3
Pyroxasulfone 127.5 g/ha (EPoE)*fb* pinoxaden + metribuzin 50 + 175 g/ha (TM) (PoE)	79.2	5319	5400	8.0	5.4
Clodinafop + metribuzin (RM) 60 + 210 g/ha (PoE)	78.5	5212	5186	9.9	9.2
Pinoxaden + metribuzin 50 + 175 g/ha (TM) (PoE)	78.2	5212	5159	9.9	9.7
Weedy check	65.2	4020	4063	30.5	28.8
Weed free	83.0	5783	5712	0.0	0.0
SEm (±)	**2.6**	**152**	**128**		
LSD (p=0.05)	**7.5**	**445**	**363**		

WP 1.5.6. Monitoring and management of herbicide resistance to different herbicides in *P. minor* biotypes from HAU farm and farmers' fields (Pot study)

Centre: CCSHAU, Hisar

Objectives:

1. To evaluate the inheritance of resistance to alternate herbicides in different biotypes of *P. minor*.
2. To compute the GR50 values of different herbicides.

Different biotypes of *P. minor* collected from farmers' fields will be subjected to the following treatments for resistance studies.

Treatments:

S No.	Herbicide	Dose (g/ha)	Time of Application
1.	Clodinafop	30	2-4 Leaf stage
2.	-do-	60	"
3.	-do-	120	"
4.	Sulfosulfuron	12.5	"
5.	-do-	25	"
6.	-do-	50	"
7.	Mesosulfuron+ iodosulfuron (RM)	7.2	"
8.	-do-	14.4	"
9.	-do-	28.8	"
10.	Pinoxaden	25	"
11.	-do-	50	"
12.	-do-	100	"
13.	Clodinafop + metribuzin	135	"
14.	-do-	270	"
15.	-do-	540	"
16.	Pyroxasulfone	64	PRE
17.	-do-	128	"
18.	-do-	256	"
19.	Untreated check	--	--

Design: CRD; **Replications:** 3

Observations:

1. Per cent control of *P. minor* at 30 days after spray.
2. Weed dry weight (g/pot) at 30 days after spray.
3. Computation of GR50 values of different herbicides

At Hisar, all the biotypes showed variable phytotoxicity with graded doses of different herbicides. Two biotypes (Prem Nagar and HAU, Hisar) biotypes shows ⩾ 70 % control with 1/2X, three (Mattenhel, Prem Nagar and HAU, Hisar) to X and six (Mattenhel, Prem Nagar, Karotha, Bhanderi, Bhogpur and HAU, Hisar) to 2X (X-recommended dose 60 g/ha) of clodinafop (**Fig. 1.5.2**). Five, eight and thirteen biotypes showed more than 70% mortality at X/2, X and 2X dose of sulfosulfuron (X=25 g/ha). Seven and Nineteen biotypes showed more than 70% mortality at recommended dose of pinoxaden (50 g/ha) and mesosulfuron + iodosulfuron (14.4 g/ha), respectively. All biotypes showed 100% mortality to the recommended dose of clodinafop + metribuzin (60 +210 g/ha). This study showed that the higher level of resistance has developed against these herbicides. Biotypes of Natwan (Ratia, Fatehabad), Dhachar (Karnal) showed no mortality against the graded doses of clodinafop, sulfosulfuron and pinoxaden, and less than 50% to 2x dose of mesosulfuron + iodosulfuron, however susceptible to even 1/2X of clodinafop + metribuzin (**Fig. 1.5.2.**).

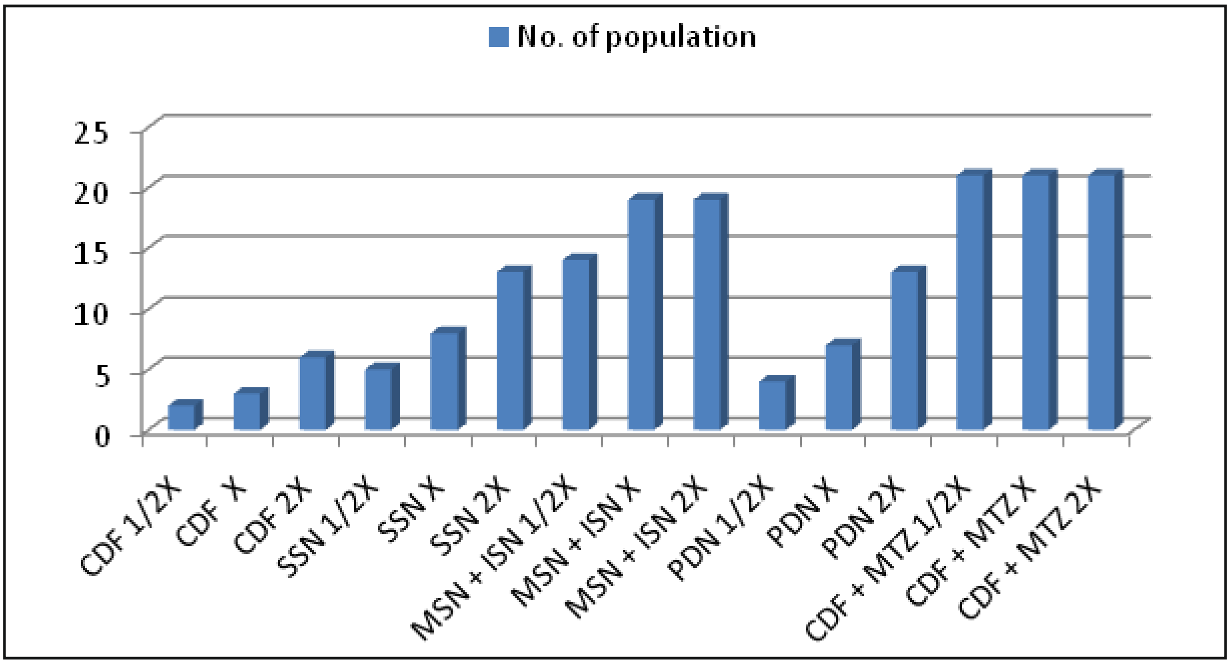


Fig. 1.5.2. Efficacy (⩾70%) of different herbicides against *P. minor* biotypes in pot studies

Fig. 1.5.3. Dhacchar (Karnal) biotype response (L-R)to recommended dose of clodinafop, sulfosulfuron, pinoxaden, meso +iodosulfuron and clodinafop + metribuzin (RM)

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

WP 2.1. Management of weeds in non-cropped area

Center : UAS, Bangalore

Treatments

1. Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) (Alion plus) @ 1050 ml/ha
2. Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) (Alion plus) @ 2100 ml/ha
3. Tiafenacil 70 WG @ 105 ml / ha + Adjuvant
4. Tiafenacil 70 WG @ 140 ml / ha + Adjuvant
5. Tiafenacil 70 WG @ 175 ml / ha + Adjuvant
6. Paraquat 24 % SL @ 6 ml per liter of water
7. Glyphosate 71 % SG @ 6 ml per liter of water
8. Unweeded check

Observations

1. Weed count prior to herbicide application and at 7, 14, 28 and 35 days after herbicide spray
2. Weed dry weight at 7, 14, 28 and 35 days after herbicide spray will be taken
3. Weed control efficiency at 7, 14, 28 and 35 days after herbicide spray will be calculated

***Kharif* 2024**

The major weed species observed in the experimental plots were *Digitaria marginata, Cynodon dactylon*, *Eleusine indica,* and *Melinis repens* (among grasses) and among broad leaved weeds *Acanthospermum glaberata*, *Mimosa pudica, Alternanthera sessilis* and *Richardia scabra*. Out of eight weed species *Richardia scabra* dominated weed flora found in the experimental plot**.**

Weed control efficiency

Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) @ 2100 ml a.i/ha was found effective in controlling following weed species, *Melinis repens (*83.78 %) and *Richardia scabra* (84.26 %) at 7 DAA, while at 14 DAA, *Alternanthera sessilis* (94.84 %), *Melinis repens* (92.88%) and *Mimosa pudica* (100.0%)and at 28 DAA *Alternanthera sessilis (*97.26%), *Melinis repens* (96.42%), *Mimosa pudica* (97.25%) and *Eleusine indica* (97.81%) indicating its efficacy to control these weeds more efficiently compared to others.

Among all the treatments, Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) @ 2100 ml a.i/ha recorded the highest weed control efficiency for both grasses and BLW followed by Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) @ 1050 ml a.i/ha at all stages of observations. Among the different doses of Tiafenacil 70 WG + adjuvant in combination with Glufosinate ammonium 13.5% SL (500g a.i /ha) at higher dosage (175 a.i/ ha + 2 ml /L of water adjuvant) recorded the highest weed control efficiency and was comparable with standard herbicide for non-cropped area (*i.e.,* Glyphosate and paraquat)

From the above study for weed management in non-cropped area all the herbicides showed the advantageous effect on weed density, dry weight and weed control efficiency. However, the Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) @ 2100 ml a.i/ha and at 1050 ml a.i/ha recorded the lowest weed density and dry weight at all stages of observations followed by Tiafenacil 70 WG @ 175 a.i/ ha + adjuvant 2 ml /L of water + Glufosinate ammonium 13.5% SL (500g a.i /ha) and were comparable with glyphosate and paraquat. Weeds treated with Indaziflam 20 + Glyphosate IPA 540 SC (1.65 %w/w + 44.63 % w/w) @ 2100 ml a.i/ha and at 1050 ml a.i/ha showed its efficacy upto 56 days after herbicide application while other treatments recorded the new flushes of weeds from 23rd days after herbicide application

Indaziflam 20 + Glyphosate IPA 540 SC @ 1050 ml a.i / ha

Indaziflam 20 + Glyphosate IPA 540 SC @ 2100 ml a.i / ha

Tiafenacil 70 WG @ 105 ml a.i /ha + Glufosinate ammonium 13.5% SL @ 500 g a.i /ha

Tiafenacil 70 WG @ 140 ml a.i /ha + Glufosinate ammonium 13.5% SL @ 500 g a.i /ha

Tiafenacil 70 WG @ 175 ml a.i /ha + Glufosinate ammonium 13.5% SL @ 500 g a.i /ha

Paraquat dichloride 24% SL @ 3000 ml/ha

Glyphosate 71% SG @ 3000 ml/ha

Weedy check

Effect of Different herbicides at 21 Days after herbicide spray

WP 2.4 Evaluation of new herbicide for the management of *Parthenium hysterophorus* in non-cropped areas

Center: TNAU, Coimbatore

Objective:

1. To evaluate the new herbicide and its optimum dose for the management of *Parthenium* in non-cropped areas.

S.No.	Treatment
1.	Glufosinate ammonium 13.5% SL @ 500g/ha
2.	Glufosinate ammonium 13.5% SL @ 750g/ha
3.	Glufosinate ammonium 13.5% SL @ 500g/ha + 2,4 D Na salt @1.25 kg/ha
4.	Glufosinate ammonium 13.5% SL @ 750g/ha+ 2,4 D Na salt @1.25 kg/ha
5.	Glyphosate 41 % SL @ 3.0 kg/ha
6.	2,4 D Na salt 80 % WP @ 3.0 kg/ha
7.	Untreated check

In the experimental field, the predominant weed observed was *Parthenium hysterophorus*, accounting for more than 90% of the total weed population. Other weeds observed were *Cyperus rotundus*, *Dinebra retroflexa*, *Echinochloa colona*, *Rottboellia cochinchinensis*, and *Datura metel*.

Total weed density and dry weight were recorded at 14 DAHA. The results indicated that application of glufosinate ammonium 13.5 SL 750g/ha + 2,4 D Na salt 80 WP 1.25 kg/ha recorded lesser total weed density ($0.67/m^2$), dry weight ($0.39\ g/m^2$) and higher WCE (99.6%) than the other treatments. However, it was comparable with T_3, T_2, T_1 and T_5. Whereas, application of 2,4 D Na salt 80 WP 3.0 kg/ha recorded lower WCE because the grassy weeds were not controlled. Untreated check recorded higher total weed density ($159.33/m^2$) and dry weight ($132.79\ g/m^2$). Further observations are being recorded for the regrowth of weeds.

Evaluation of new herbicide for the management of *Parthenium hysterophorus* in non- cropped areas

WP 2.5. Organic acids for management of invasive aquatic weed *Pistia*

Centre : KAU, Thrissur

Table 2.5.1. Phytotoxicity on *Pistia*

No	Treatments	Days after treatment application			Extent of control (%)	Regrowth (3 weeks after application)
		Day 1	Day 3	Day 5		
1	2.5% acetic acid	3	3	3	28	Regrowth observed
2	5% acetic acid	3	3	3	54	Regrowth observed
3	10% acetic acid	4	4	5	61	Noregrowth observed
4	2.5% lactic acid	3	3	2	14	Regrowth observed
5	5% lactic acid	3	3	3	35	Regrowth observed
6	10% lactic acid	4	4	4	57	No Regrowth observed

Lactic acid 5%

Acetic acid 5%

Lactic acid 10%

Acetic acid 10%

Unsprayed

WP 2.6. Testing of product (Product Code AGLC#14) from AgBio systems to control Water hyacinth, *Parthenium and Lantana*

Treatment	
T1	Fresh water
T2	Organic acids
T3	Product with water
T4	Product with water + organic acid

Testing of product (Product Code AGLC#14) from ag bio systems to control *Lantana Camara*

Network Centre :UAS Bengaluru, CSKHPKV Palampur, SKUAST Jammu and DWR Jabalpur.

ICAR-DWR, Jabalpur: Two sprays were made on consecutive day and drying percentatge was recorded. There was no significant difference in drying among treatments and 100 % plants regenerated.

Table 2.6.2. Testing of product (Product Code AGLC#14) from ag bio systems to control *Lantana Camara*

Treatment	Days/ Hours of application							
	2hrs after the spray	3 DAHS	4 DAHS	5 DAHS	6DAHS	7 DAHS	8 DAHS	9 DAHS
	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)
T1	0	0	0	0	0	0	0	0
T2	2	3	3	3	3	3	3	3
T3	5	6	6	6	6	6	6	6
T4	10	20	24	25	25	25	25	25

UAS, Bengaluru

Table 2.6.3.Testing of product (Product Code AGLC#14) from ag bio systems to control *Lantana Camara*

Treatment	Days/ Hours of application							
	2hrs after the spray	3 DAHS	4 DAHS	5 DAHS	6DAHS	7 DAHS	8 DAHS	9 DAHS
	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)
T1	0	0	0	0	0	0	0	0
T2	0	0	0	0	0	0	0	0
T3	0	0	0	0	0	0	0	0
T4	0	0	0	0	0	0	0	0

CSKHPKV, Palampur

Table 2.6.4. Effect of AGLC#14 application on the drying percentage of Lantana camara

Treatment	Drying percentage	
	2 days after first spray	7 days after second spray
T1	0.0	0.0
T2	8.0	10.0
T3	4.0	4.0
T4	5.0	6.0

SKUAST, Jammu

The effect of Product (*Product Code AGLC#14*) with water + organic acid showed a slight effect on leaves of *Lantana camera*. However, later on there was a regrowth of the leaves was recorded.

Testing of product (Product Code AGLC#14) from ag bio systems to control *Parthenium hysterophorus*

Network Centre : AAU Anand, MPUAT Udaipur, IGKV Raipur and DWR Jabalpur.

ICAR-DWR, Jabalpur: On application of product twice in consecutive day the plants regenrated completely after initial drying.

Table 2.6.5. Testing of product (Product Code AGLC#14) from ag bio systems to control *Parthenium hysterophorus*

Treatment	Days/ Hours of application							
	2hrs after the spray	3 DAHS	4 DAHS	5 DAHS	6DAHS	7 DAHS	8 DAHS	9 DAHS
	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)	Dry (%)
T1	0	0	0	0	0	0	0	0
T2	12	15	20	20	20	20	20	20
T3	15	20	25	25	25	25	25	25
T4	50	60	100	100	100	100	100	100

AAU, Anand

Table 2.6.6. Phytotoxicity score (0-10) of applied AGLC#14 on Parthenium at various intervals

Sr. No.	Treatment	After 2 hours	1 DAA	2 DAA	3 DAA	4 DAA	5 DAA	6 DAA	7 DAA	8 DAA	9 DAA	10 DAA
1.	Fresh water	0	0	0	0	0	0	0	0	0	0	0
2.	Organic acids	0	0	2	2	2	2	2	1	0	0	0
3.	Product with water	0	0	1	1	1	1	1	0	0	0	0
4.	Product + organic acid	0	0	2	2	2	2	2	1	0	0	0

MPUAT, Udaipur

Table 2.6.7. Drying percentage observations AGLC#14 treatments on Parthenium at various intervals

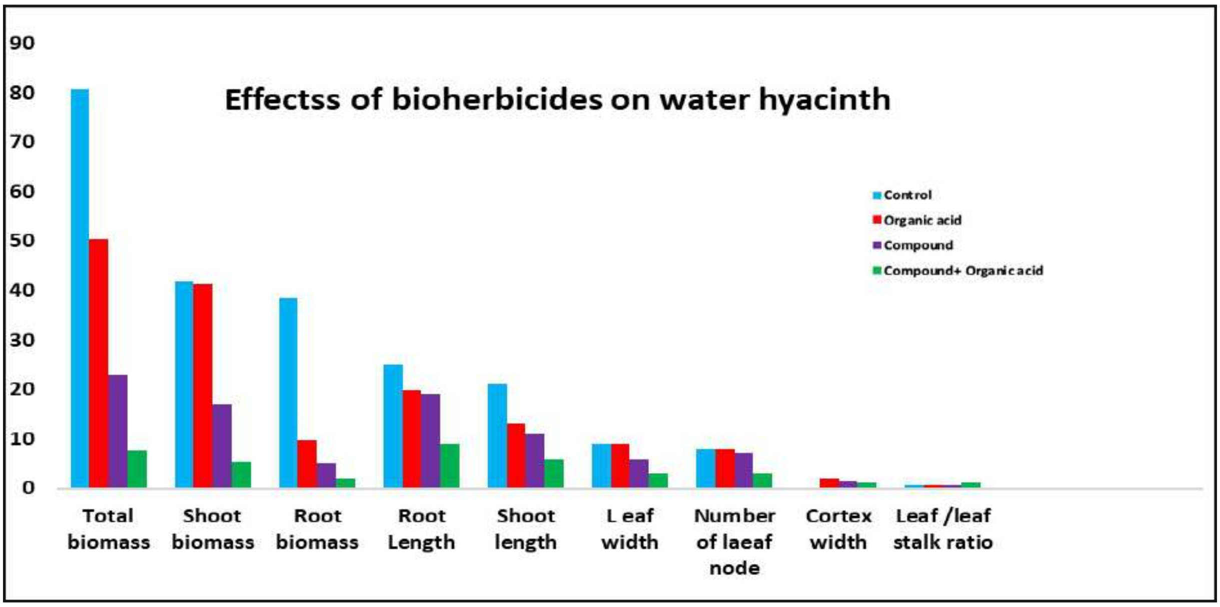
Treatment		Drying percentage observations						
		After 2 hours of treatment application	2nd day	3rd day	4th day	6th day	8th day	10th day
T11	**Fresh water**	0	0	0	0	0	0	0
T2	**Organic acids**	0	0	0	0	0	0	0
T3	**Product with water**	99	78	66	60	58	51	43
T4	**Product + water + organic acid**	100	100	90	87	82	75	67

Testing of product (Product Code AGLC#14) from Ag bio systems to control Water hyacinth.

Network Centre : KAU, Thrissur, IGKV, Raipur, BCKV, Kalyani, PJTSU, Hyderabad, PAJNCOA & RI Puducherry, DWR, Jabalpur.

DWR, Jabalpur-

After two sprays, plant has completely dried but regrowth has occurred. In regrowth sufficient reduction of biomass has been observed. Different parameters (Total biomass, Root Biomass, Shoot biomass, Root length, Shoot lemgth, Leaf width, number of leaf nodes, cortex width, leaf to leaf-stalk ratio) have been recorded and the significant reduction has been found in treated as compared to control.



WP 2.7. Biological control of *Salvinia molesta*

Network centres: IGKVV Raipur, CCSHAU Hisar and PDKV Akola

IGKVV, Raipur: Infestation of Salvinia recorded in Haldi Pond, District Rajnandgaon during Sepember 2024

WP 2.8. Biological control of water hyacinth by *Neochetina* sp.

Network centres: AAU Anand, MPUAT Udaipur, RVSKVV Gwalior, IGKV Raipur, CCSHAU Hisar, PDKV Akola, PAJNCOA & RI Puducherry and BCKV Kalyani

AAU, Anand

Some feeding scars were observed on the water hyacinth leaves/plant. Some dieback symptoms were recorded on the water hyacinth plants (1 scale) by the weevil but water hyacinth was not controlled by the weevil.

Observation on water hyacinth for the year 2024 (20-12-2024) (Sadanapura)

MPUAT, Udaipur

Location: Udaisagar, Udaipur, Year: 2024

Plant Numbers	Adults	Damage (0-5 scale)	Clear water surface (10-100%)
Avg. SD	2.5	1	<10%

RVSKVV, Gwalior

The population of bio-agents increased and was average 10.69 adult/plant in the month of March, 2024 after 4.5 years. The feeding scars were also increased and was 33.2/leaf and found 0- 10 on an average. The population of bio-agents increasing as compared to last six months. Dieback symptoms on leaves have also been increased.

IGKV, Raipur

CCSHAU, Hisar

- *Salvinia* collected from the Bhindawas lake and *Eichhornia crassipes* collected from the local pond was grown in the aquatic pits at the Research Farm of The Department of Agronomy.
- The insect was received from the DWR, Jabalpur and were released on 14.08.2024 and 26.09.2024.
- No control of these aquatic weeds was recorded by these biocontrol agents at Hisar conditions as the insect was unable to survive under the Hisar climatic conditions.

WP 2.9. Identification of Weeds of National Importance (WoNI)

A study was conducted by the centres to identify the weeds of national importance. For the purpose, Questionnaire was developed by headquarter and information was collected by the centres through primary and secondary sources from different district of the state where the centre is located. Questionnaire contains the information on different parameters such as invasiveness' and 'impacts' criteria; potential for spread' criterion; socioeconomic and environmental values; economic data for agricultural and forestry weeds (primary industries); environmental values; biodiversity indicators; threatened species data; number of threatened conservation areas; conservation indicators; monoculture potential; social values etc. Based on these criteria, centres identified different weeds of national importance in their state which are summarized in the **Table WP 2.9.1**.

Table 2.9.1 Weeds of National Importance

Centre	District	Name of Weeds of National Importance									
		I	II	III	IV	V	VI	VII	VIII	IX	X
AAU, Anand	Anand Monocot weeds	*Commelina benghalensis*	*Dactyloctenium aegyptium*	*Echinochloa crus-galli*	*Cyperus rotundus*	*Setaria glauca*	*Digitaria sanguinalis*	*Phalaris minor*	*Echinochloa colona*	*Eleusine indica*	*Eragrostis major*
	Dicot weeds	*Parthenium hysterophorus*	*Argemone mexicana*	*Trianthema monogyna*	*Digera arvensis*	*Chenopodium album*	*Vernonia cinerea*	*Boerhavia erecta*	*Portulaca quadrifida*	*Chenopodium murale*	*Phyllanthus niruri*
	Kheda Monocot weeds	*Commelina benghalensis*	*Dactyloctenium aegyptium*	*Cyperus rotundus*	*Echinochloa crus-galli*	*Digitaria sanguinalis*	*Phalaris minor*	*Echinochloa colona*	*Eleusine indica*	*Eragrostis major*	*Setaria glauca*
	Dicot weeds	*Parthenium hysterophorus*	*Trianthema monogyna*	*Argemone mexicana*	*Digera arvensis*	*Chenopodium album*	*Boerhavia erecta*	*Vernonia cinerea*	*Portulaca quadrifida*	*Chenopodium murale*	*Phyllanthus niruri*
	Ahmedabad Monocot weeds	*Cynodon dactylon*	*Cyperus rotundus*	*Commelina benghalensis*	*Dactyloctenium aegyptium*	*Setaria glauca*	*Cyperus difformis*	*Digitaria sanguinalis*	*Leptochloa chinensis*	*Phalaris minor*	*Echinochloa crus-galli*
	Dicot weeds	*Parthenium hysterophorus*	*Tribulus terrestris*	*Argemone mexicana*	*Alhagi pseudalhagi*	*Alternanthera sessilis*	*Chenopodium album*	*Vernonia cinerea*	*Digera arvensis*	*Chenopodium murale*	*Cressa cretica*
	Botad Monocot weeds	*Cyperus rotundus*	*Cynodon dactylon*	*Commelina benghalensis*	*Dactyloctenium aegyptium*	*Setaria glauca*	*Cyperus esculentus*	*Echinochloa crus-galli*	*Echinochloa colona*	*Digitaria sanguinalis*	*Eleusine indica*
	Dicot weeds	*Parthenium hysterophorus*	*Argemone mexicana*	*Alternanthera sessilis*	*Tribulus terrestris*	*Chenopodium album*	*Trianthema monogyna*	*Vernonia cinerea*	*Digera arvensis*	*Chenopodium murale*	*Melilotus indica*
	Vadodara Monocot weeds	*Commelina benghalensis*	*Cynodon dactylon*	*Dactyloctenium aegyptium*	*Cyperus rotundus*	*Setaria glauca*	*Cyperus esculentus*	*Echinochloa crus-galli*	*Leptochloa chinensis*	*Digitaria sanguinalis*	*Eleusine indica*
	Dicot weeds	*Parthenium hysterophorus*	*Amaranthus spinosus*	*Alternanthera sessilis*	*Portulaca spp*	*Trianthema monogyna*	*Chenopodium album*	*Vernonia cinerea*	*Boerhvia erecta*	*Digera arvensis*	*Chenopodium murale*
	Chhotaudepur Monocot weeds	*Commelina forskaolii*	*Cynodon dactylon*	*Dactyloctenium aegyptium*	*Cyperus rotundus*	*Cyperus esculentus*	*Setaria glauca*	*Echinochloa crus-galli*	*Chloris barbata*	*Eleusine indica*	*Digitaria sanguinalis*
	Dicot weeds	*Argemone mexicana*	*Parthenium hysterophorus*	*Celosia argentea*	*Alternanthera sessilis*	*Amaranthus spinosus*	*Portulaca spp*	*Chenopodium album*	*Trianthema monogyna*	*Ageratum conyzoides*	*Boerhvia erecta*
	Dahod Monocot weeds	*Commelina forskaolii*	*Commelina benghalensis*	*Cyperus rotundus*	*Dactyloctenium aegyptium*	*Echinochloa crus-galli*	*Chloris barbata*	*Cynodon dactylon*	*Brachiaria Spp*	*Digitaria sanguinalis*	*Cyperus esculentus*
	Dicot weeds	*Parthenium hysterophorus*	*Tribulus terrestris*	*Argemone mexicana*	*Celosia argentea*	*Amaranthus spinosus*	*Alternanthera sessilis*	*Chenopodium album*	*Ageratum conyzoides*	*Vernonia cinerea*	*Trianthema monogyna*
	Panchmahal Monocot weeds	*Commelina benghalensis*	*Cyperus rotundus*	*Dactyloctenium aegyptium*	*Cynodon dactylon*	*Commelina forskaolii*	*Brachiaria spp*	*Digitaria sanguinalis*	*Echinochloa crus-galli*	*Cyperus esculentus*	*Chloris barbata*
	Dicot weeds	*Parthenium hysterophorus*	*Tribulus terrestris*	*Argemone mexicana*	*Amaranthus spinosus*	*Celosia argentea*	*Alternanthera sessilis*	*Chenopodium album*	*Vernonia cinerea*	*Trianthema monogyna*	*Ageratum conyzoides*
	Mahisagar Monocot weeds	*Cynodon dactylon*	*Dactyloctenium aegyptium*	*Cyperus rotundus*	*Setaria glauca*	*Echinochloa crus-galli*	*Eleusine indica*	*Cyperus esculentus*	*Brachiaria spp*	*Commelina forskaolii*	*Digitaria sanguinalis*
	Dicot weeds	*Argemone mexicana*	*Parthenium hysterophorus*	*Celosia argentea*	*Alternanthera sessilis*	*Chenopodium album*	*Digera arvensis*	*Ageratum conyzoides*	*Amaranthus spinosus*	*Portulaca spp*	*Boerhavia erecta*
CCSHAU, Hisar	Jhajjar	*Parthenium hysterophorus*	*Phalaris minor*	*Rumex dentatus*	*Cyperus rotundus*	*Trianthema portulacastrum*	*Chenopodium* spp	*Echinochloa colona*	*Avena ludoviciana*	*Dactyloctenium aegyptium*	*Leptochloa chinensis*
	Rohtak	*Parthenium hysterophorus*	*Phalaris minor*	*Rumex dentatus*	*Cyperus rotundus*	*Trianthema portulacastrum*	*Chenopodium* spp	*Dactyloctenium aegyptium*	*Echinochloa colona*	*Avena ludoviciana*	*Digera arvensis*
	Karnal	*Phalaris minor*	*Parthenium hysterophorus*	*Cyperus rotundus*	*Echinochloa colona*	*Dactyloctenium aegyptium*	*Rumex dentatus*	*Leptochloa chinensis*	*Chenopodium* spp	*Avena ludovociana*	
	Hisar	*Cyperus rotundus*	*Phalaris minor*	*Trianthema portulacastrum*	*Parthenium hysterophorus*	*Avena ludoviciana*	*Rumex dentatus*	*Dactyloctenium aegyptium*	*Digera arvensis*	*Chenopodium* spp	*Orobanche*
	Sirsa	*Parthenium hysterophorus*	*Phalaris minor*	*Cyperus rotundus*	*Echinochloa colona*	*Rumex dentatus*	*Digera arvensis*	*Chenopodium* spp	*Avena ludovociana*	*Dactyloctenium aegyptium*	*Trianthema portulacastrum*
	Fatehbad	*Parthenium hysterophorus*	*Phalaris minor*	*Rumex dentatus*	*Avena ludoviciana*	*Echinochloa colona*	*Digera arvensis*	*Cyperus rotundus*	*Chenopodium* spp	*Dactyloctenium aegyptium*	*Eleusine* spp
	Mahendargarh	*Parthenium hysterophorus*	*Dactyloctenium aegyptium*	*Cyperus rotundus*	*Echinochloa colona*	*Avena ludoviciana*	*Rumex dentatus*	*Orobanche*	*Trifolium* spp	*Chenopodium* spp	*Trianthema portulacastrum*
	Rewari	*Rumex dentatus*	*Avena ludoviciana*	*Parthenium hysterophorus*	*Cyperus rotundus*	*Chenopodium* spp	*Dactyloctenium aegyptium*	*Amaranthus* spp	*Echinochloa colona*	*Eleusine* spp	*Trianthema portulacastrum*
	Kaithal	*Phalaris minor*	*Parthenium hysterophorus*	*Echinochloa colona/crusgalli*	*Cyperus rotundus*	*Leptochloa chinensis*	*Avena ludoviciana*	*Chenopodium* spp	*Dactyloctenium aegyptium*	*Rumex dentatus*	*Commelina* spp
	Kurukshetra	*Phalaris minor*	*Parthenium hysterophorus*	*Echinochloa colona/crusgalli*	*Cyperus rotundus*	*Rumex dentatus*	*Dactyloctenium aegyptium*	*Chenopodium* spp	*Avena ludoviciana*	*Leptochloa chinensis*	*Digera arvensis*

Table Cont...

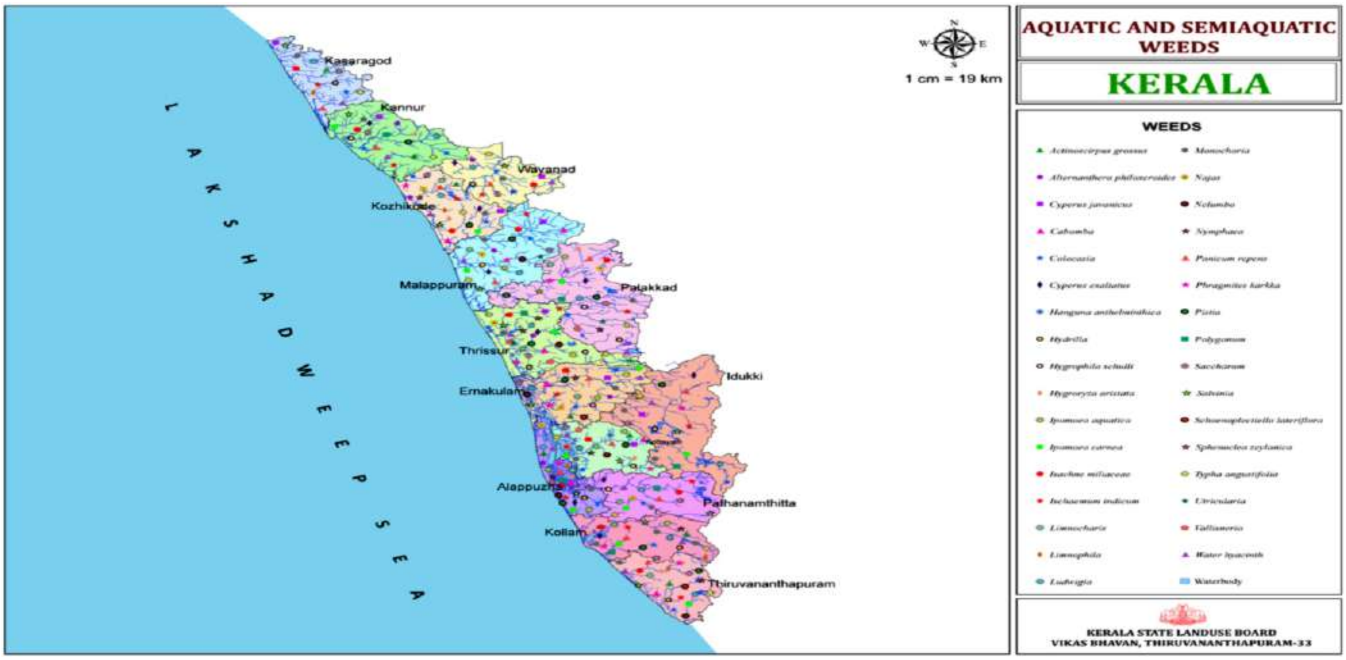
MPUAT, Udaipur	Udaipur	*Parthenium hysterophorus*	*Lantana camara*	*Chenopodium album*	*Echinochloa colona*	*Trianthema portulacastrum*	*Commelina benghalensis*	*Cyprus rotundus*	*Asphodelus tenuifolius*		
	Bhilwara	*Cyprus rotundus*	*Lantana camara*	*Parthenium hystero-phorus*	*Trianthema portulacastrum*	*Commelina benghalensis*	*Asphodelus tenuifolius*	*Chenopodium album*	*Echinochloa colona*		
	Rajsamand	*Cyprus rotundus*	*Parthenium hysterophorus*	*Lantana camara*	*Chenopodium album*	*Asphodelus tenuifolius*	*Echinochloa colona*	*Trianthema portulacastrum*	*Commelina benghalensis*		
	Banswara	*Cyprus rotundus*	*Lantana camara*	*Parthenium hysterophorus*	*Commelina benghalensis*	*Trianthema portulacastrum*	*Asphodelus tenuifolius*	*Chenopodium album*	*Echinochloa colona*		
	Dungarpur	*Cyprus rotundus*	*Lantana camara*	*Parthenium hysterophorus*	*Commelina benghalensis*	*Trianthema portulacastrum*	*Asphodelus tenuifolius*	*Chenopodium album*	*Echinochloa colona*		
	Pratapgarh	*Cyprus rotundus*	*Lantana camara*	*Parthenium hysterophorus*	*Commelina benghalensis*	*Trianthema portulacastrum*	*Asphodelus tenuifolius*	*Chenopodium album*	*Echinochloa colona*		
	Chittorgarh	*Lantana camara*	*Parthenium hysterophorus*	*Cyprus rotundus*	*Commelina benghalensis*	*Trianthema portulacastrum*	*Echinochloa colona*	*Asphodelus tenuifolius*	*Chenopodium album*		
PJTSAU, Hyderabad		*Parthenium hysterophorus*	*Cyprus rotundus*	*Echinochloa crusgalli*	*Celosia argentea*	*Eichornia crassipes*					
RVSKVV, Gwalior	Gwalior	*Parthenium hysterophorus*	*Commelina benghalensis*	*Celosia argentia*	*Echinochloa crusgalli*	*Cucumis pubescens*					
	Morena	*Parthenium hysterophorus*	*Commelina benghalensis*	*Celosia argentia*	*Echinochloa crusgalli*	*Cucumis pubescens*					
	Datia	*Parthenium hysterophorus*	*Commelina benghalensis,*	*Celosia argentia*	*Echinochloa crusgalli*	*Cucumis pubescens*					
	Guna	*Commelina benghalensis*	*Celosia argentia*	*Echinochloa crusgalli*	*Asphodelus tenuifolius*	*Cyperus rotundus*					
	Ashok Nagar	*Cucumis pubescens*	*Commelina benghalensis*	*Celosia argentia*	*Cyperus rotundus*	*Echinochloa crusgalli*					
	Shivpuri	*Echinochloa crusgalli*	*Celosia argentia*	*Commelina benghalensis*	*Convolvulus arvenis*	*Cyperus rotundus*					
	Dhar	*Commelina benghalensis*	*Celosia argentia*	*Cyperus rotundus*	*Parthenium hysterophorus*	*Cucumis pubescens*					
	Sheopur	*Cyperus rotundus*	*Echinochloa crusgalli*	*Celosia argentia*	*Commelina benghalensis*	*Trianthema monogyna*					
	Agar Malwa	*Commelina benghalensis*	*Celosia argentia*	*Echinochloa crusgalli*	*Convolvulus arvenis*	*Cynodon dactylon*					
	Mandsaur	*Commelina benghalensis*	*Celosia argentia*	*Echinochloa crusgalli*	*Cynodon dactylon*	*Cucumis pubescens*					
	Neemuch	*Commelina benghalensis*	*Celosia argentia*	*Chenopodium album*	*Echinochloa crusgalli*	*Cyperus rotundus*					
	Ratlam	*Commelina benghalensis*	*Celosia argentia*	*Cucumis pubescens,*	*Phalaris minor*	*Chenopodium album*					
	Bhind	*Echinochloa crusgalli*	*Chenopodium album*	*Phalaris minor*	*Cyperus rotundus*	*Asphodelus tenuifolius*					
	Khandwa	*Commelina benghalensis*	*Celosia argentia*	*Alternenthera sessilis*	*Cynodon dactylon*	*Chenopodium album*					
	Alirajpur	*Commelina benghalensis*	*Celosia argentia*	*Chenopodium album*	*Cynodon dactylon*	*Argemone mexicana*					
	Jhabua	*Celosia argentia*	*Commelina benghalensis*	*Chenopodium album*	*Cynodon dactylon*	*Argemone mexicana*					
	Dewas	*Commelina benghalensis*	*Chenopodium album*	*Celosia argentia*	*Convolvulus arvensis*	*Rumex dentatus*					
SKUAST, Jammu	**Doda**	*Oxalis corniculata*	*Echinochloa colona*	*Chenopodium album*	*Physalis minima*	*Digitaria sanguinalis*	*Avena fatua*	*Cannabis sativa*	*Datura spp*	*Argemone mexicana*	*Calotropic procara*
	Jammu	*Echinochloa spp*	*Phalaris minor*	*Rumex spp*	*Cyperus spp*	*Anagallis arvensis*	*Digera arvensis*	*Medicago denticulata,*	*Euphorbia hirta*	*Chenopodium album*	*Physalis minima*
	Kishtwar	*Cirsium arvense*	*Vicia sativa*	*Phalaris minor*	*Cannabis sativa*	*Convolvulus arvensis*	*Oxalis corniculata*	*Amaranthus viridis*	*Eragrostis tenella*	*Achyranthes aspera*	*Dactyloctenium aegyptium*

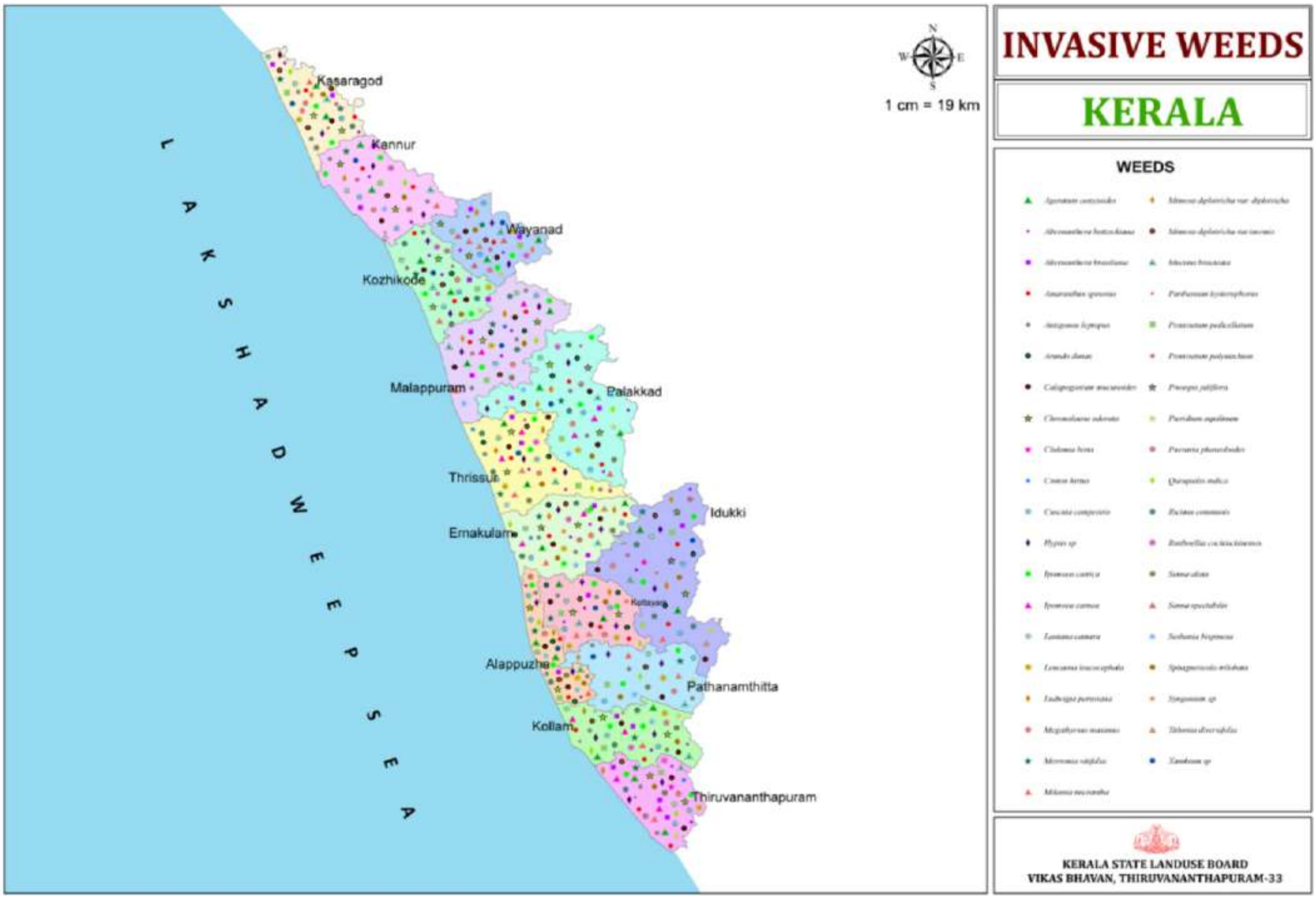
Table Cont...

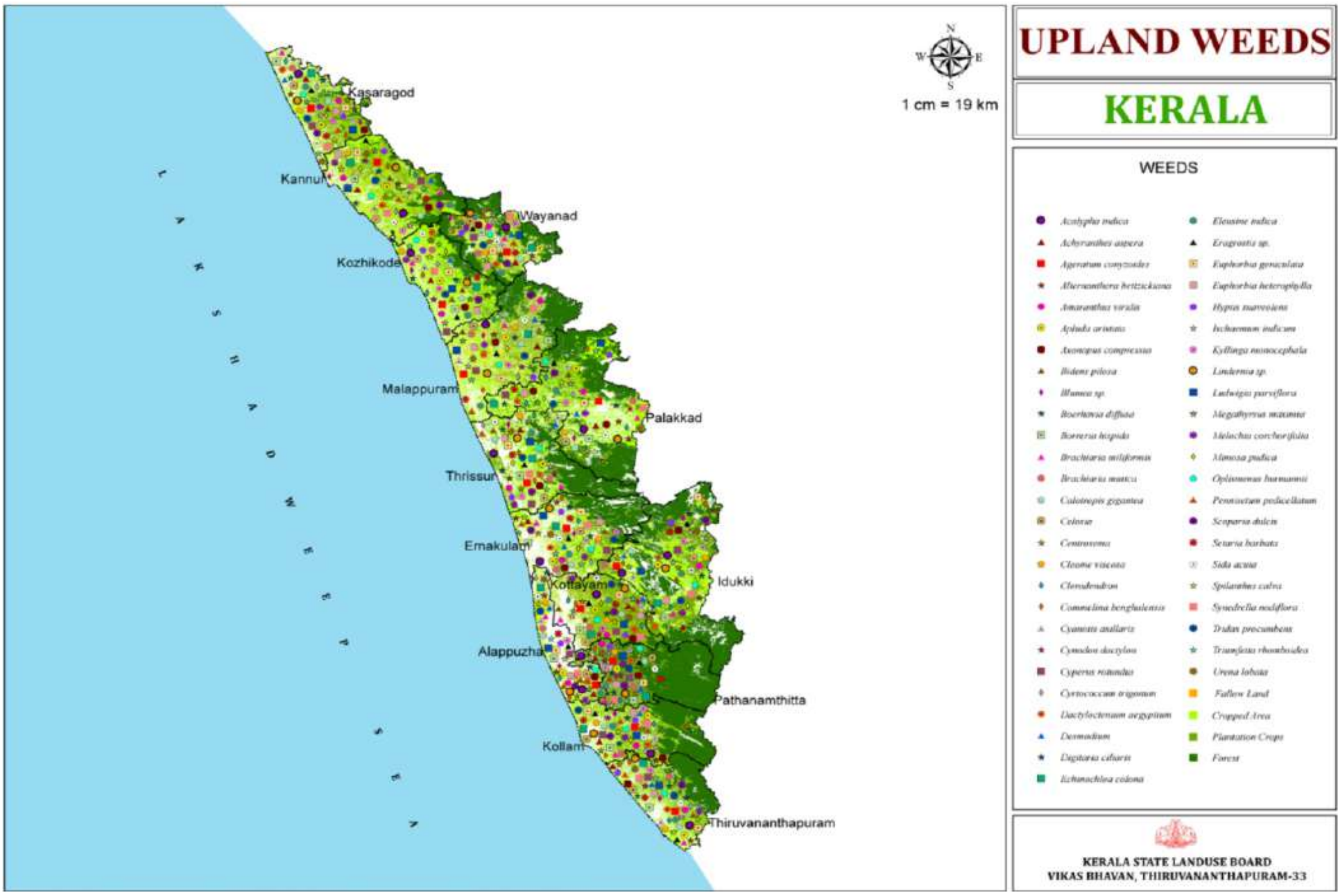
	Kathua	*Amaranthus viridis*	*Commelina benghalensis*	*Avena fatua*	*Ageratum conyzoides*	*Lathyrus aphaca*	*Anagallis arvensis*	*Polygonum glabrum*	*Eleusine indica*	*Argemone mexicana*	*Cannabis sativa*
	Poonch	*Argemone mexicana*	*Cyperus rotandus*	*Cannabis sativa*	*Avena fatua*	*Echinochloa colona*	*Anagallis arvensis*	*Eleusine indica*	*Ludwigia parviflora*	*Cynodon dactylon*	*Oxalis corniculata*
	Rajouri	*Oxalis corniculata*	*Phalaris minor*	*Cyperus spp*	*Avena fatua*	*Vicia sativa*	*Anagallis arvensis*	*Lathyrus aphaca*	*Digitaria sanguinalis*	*Medicago polymorpha*	*Euphorbia hirta*
	Ramban	*Oxalis corniculata*	*Convolvulus arvensis*	*Argemone mexicana*	*Setaria verticillata*	*Echinochloa colona*	*Cirsium arvensis*	*Eichhornia crassipes*	*Imperata cylindrica*	*Medicago denticulata*	*Malva parviflora,*
	Reasi	*Medicago polymorpha*	*Lathyrus aphaca*	*Argemone mexicana*	*Anagallis arvensis*	*Ageratum conyzoides*	*Avena fatua*	*Euphorbia hirta*	*Lantana camara*	*Solanum nigrum*	*Dactyloctenium aegyptium*
	Samba	*Cyperus* spp	*Rumex* spp	*Chenopodium album*	*Cynodon dactylon*	*Digitaria sanguinalis*	*Digera arvensis*	*Echinochloa colona*	*Avena fatua*	*Medicago denticulata*	*Anagallis arvensis*
	Udhampur	*Phalaris minor*	*Rumex* spp	*Digera arvensis*	*Lantana camara*	*Polygonum glabrum*	*Echinochloa colona*	*Physalis minima*	*Chenopodium album*	*Medicago denticulata*	*Euphorbia hirta*
TNAU, Coimbatore	Ariyalur, Cuddalore, Dharmapuri, Erode, Kanyakumari, Karur, Krishnagiri, Perambalur, Ramnathapuram, Tenkasi, Thanjavur, The Nilgris, Thoothukudi, Tiruvannamalai, Tiruvallur and Vilupuram	*Cyperus rotundus*	*Trianthema portulacastrum*	*Echinochloa colona*	*Cynodon dactylon*	*Panicum repens*	*Parthenium hysterophorus*	*Amaranthus viridis*	*Cyperus iria*	*Ipomea seperia*	*Echinochloa crusgalli*

KAU, Thrissur

In case of aquatic -wetland weeds, upland weeds, invasive weeds and occurrence of regulated weeds; district wise maps were prepared as there was not much variation in occurrence of weeds across the State.

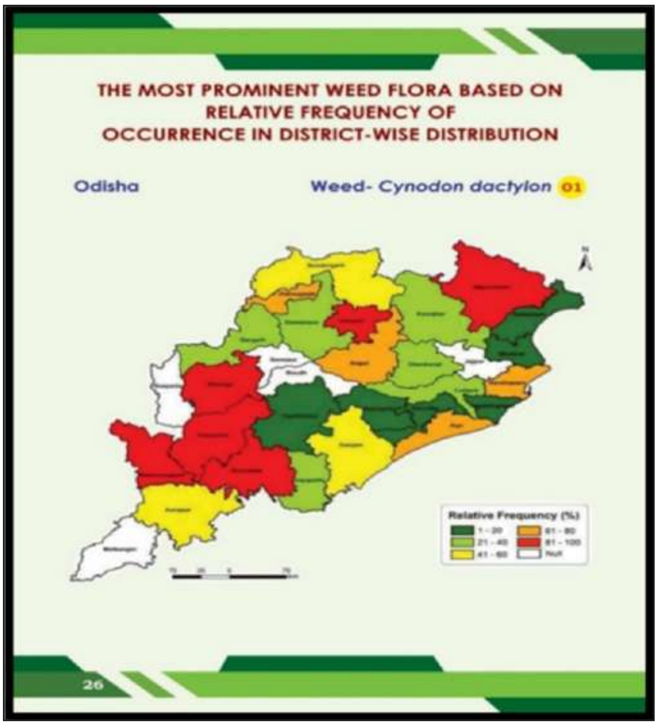






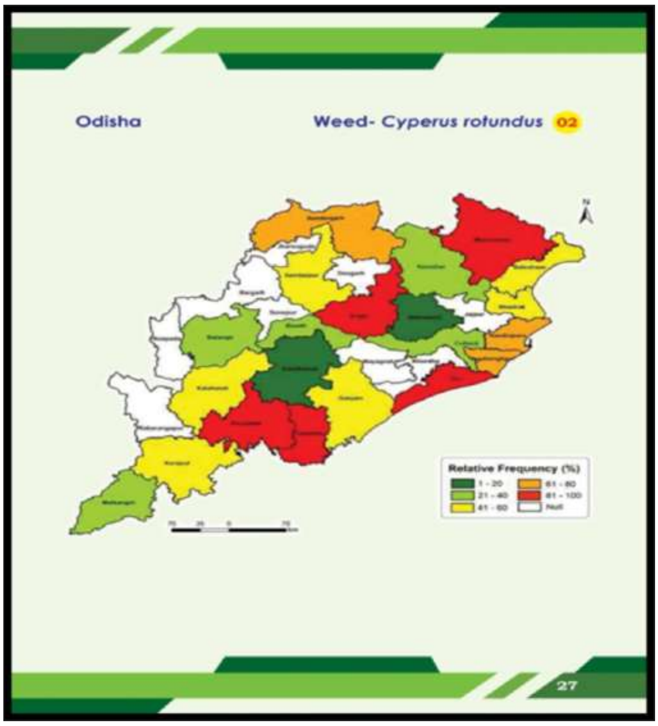
OUAT Bhubaneswar

Centre prepared maps of most prominent weed flora based on relative frequency of occurrence of weeds in different districts. Few maps are depicted below:

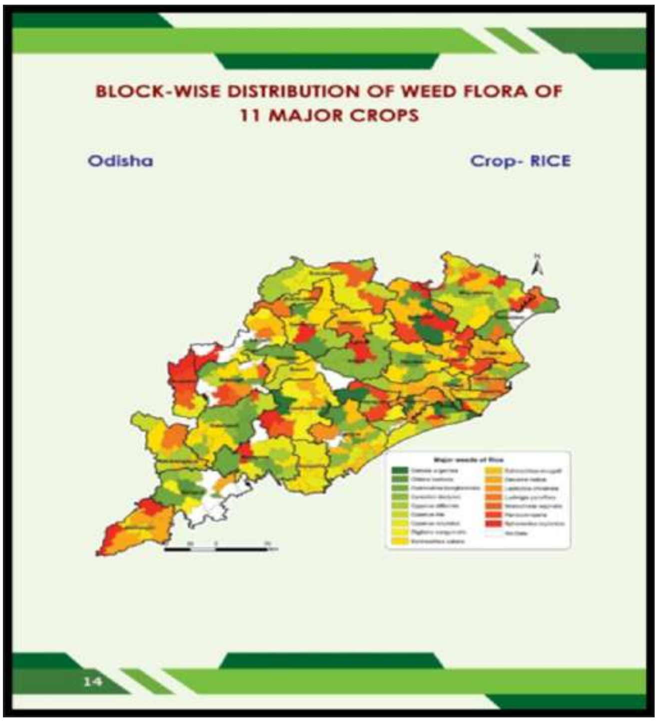

THE MOST PROMINENT WEED FLORA BASED ON RELATIVE FREQUENCY OF OCCURRENCE IN DISTRICT-WISE DISTRIBUTION

Odisha

Weed- *Cynodon dactylon* 01


Odisha

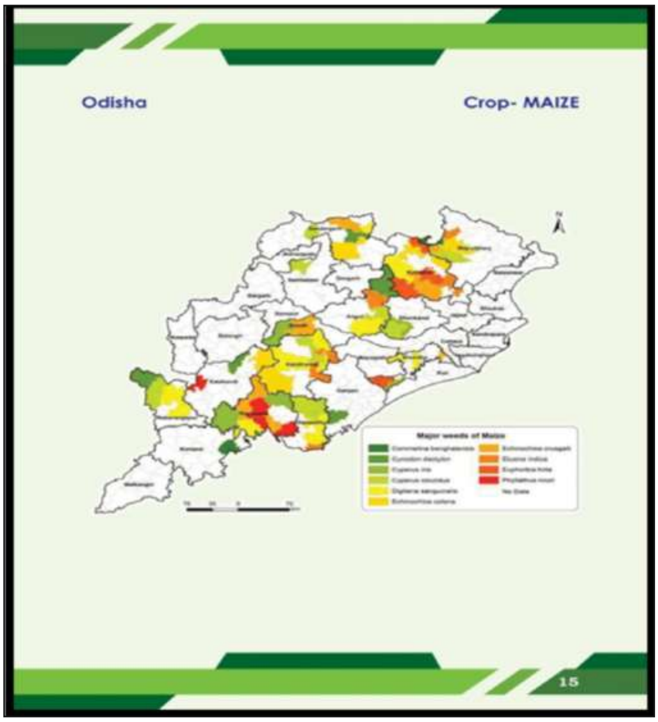
Weed- *Cyperus rotundus* 02



BLOCK-WISE DISTRIBUTION OF WEED FLORA OF 11 MAJOR CROPS

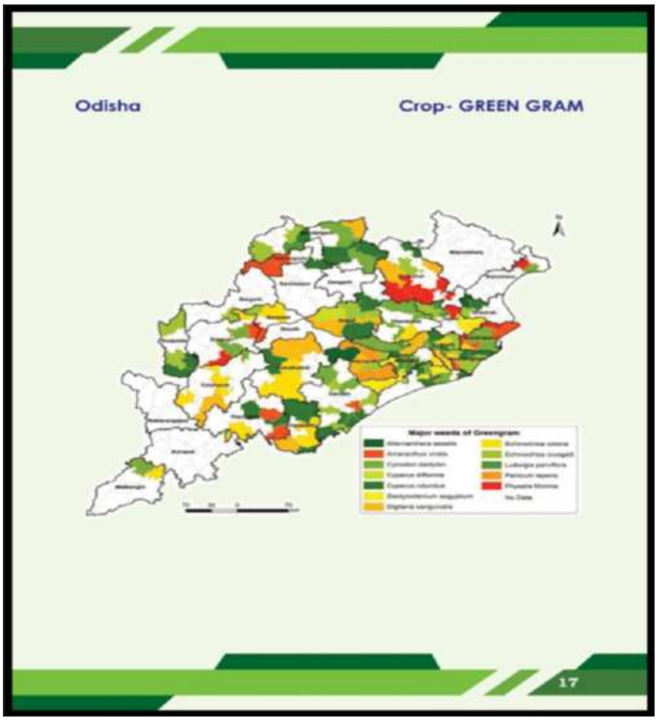
Odisha

Crop- RICE



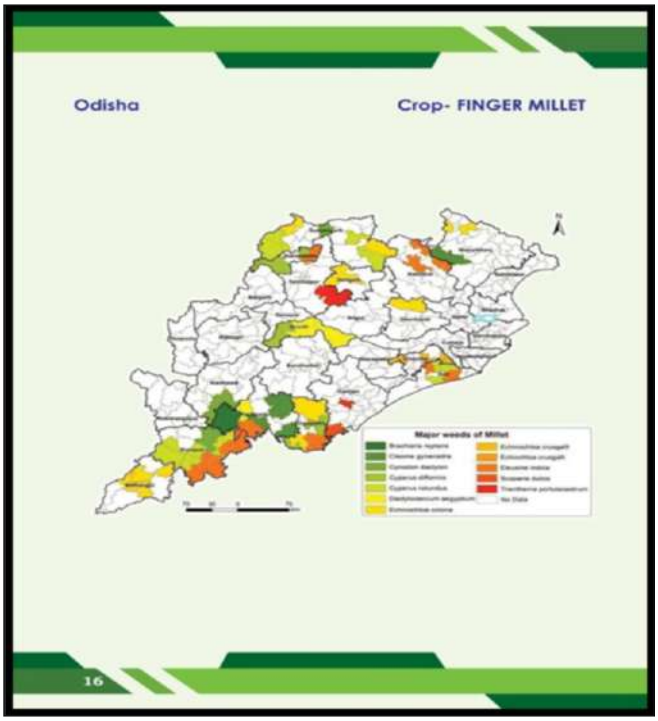
Odisha

Crop- MAIZE



Odisha

Crop- GREEN GRAM

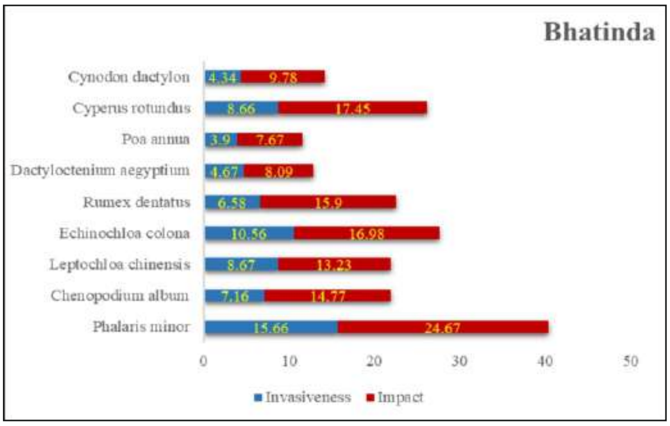


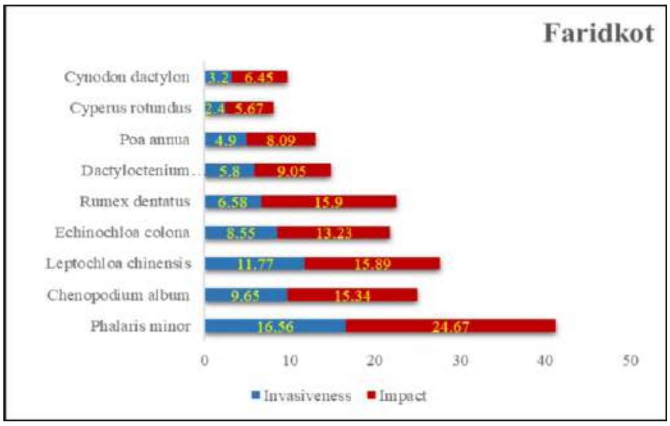
Odisha

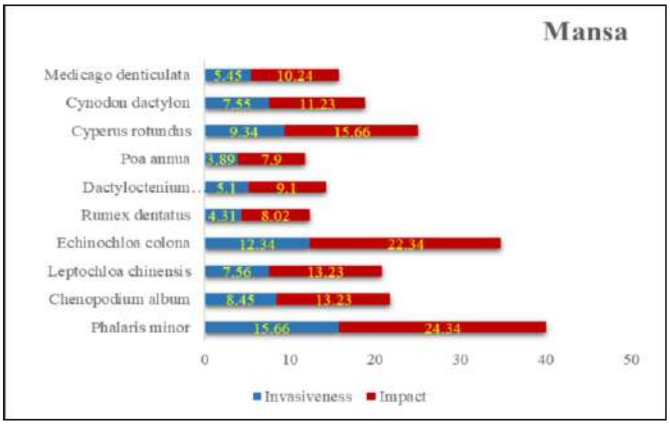
Crop- FINGER MILLET

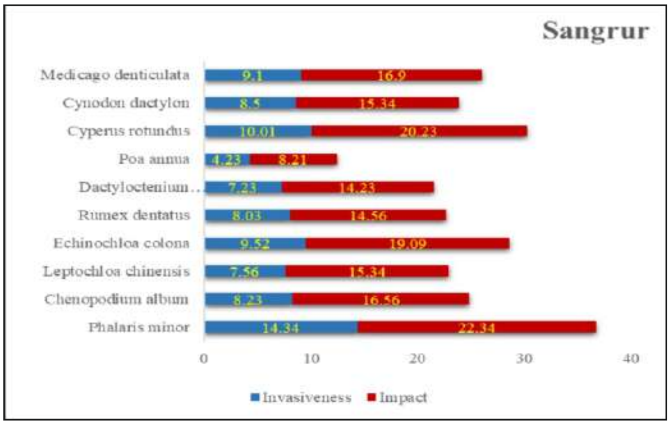
PAU, Ludhiana

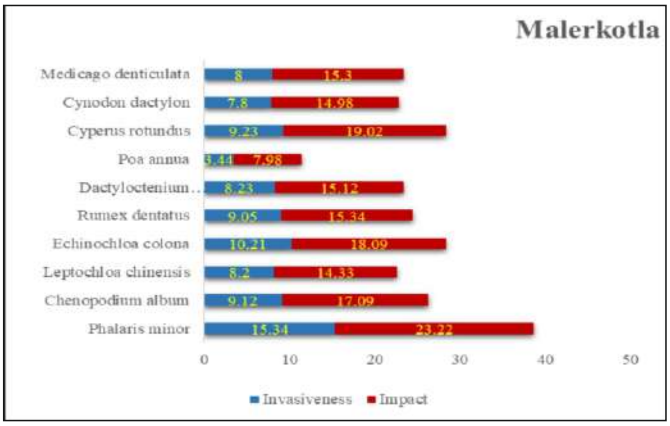
A random survey of 300 farmers from Bhatinda, Faridkot, Mansa, Sangrur, Malerkotla, Ludhiana, Shri Fatehgarh Sahib, Fazilka, Ferozpur, Kapurthala, SBS Nagar, Muktsar and Patiala districts of Punjab, having rice-wheat as the dominant system, was conducted. The survey revealed that *Phalaris minor* was the most dominant present at all locations. The farmers reported that *Phalaris minor, Medicago denticulate, Echinochloa colona, Rumex dentatus* and *Chenopodium album* were the most troublesome weeds.

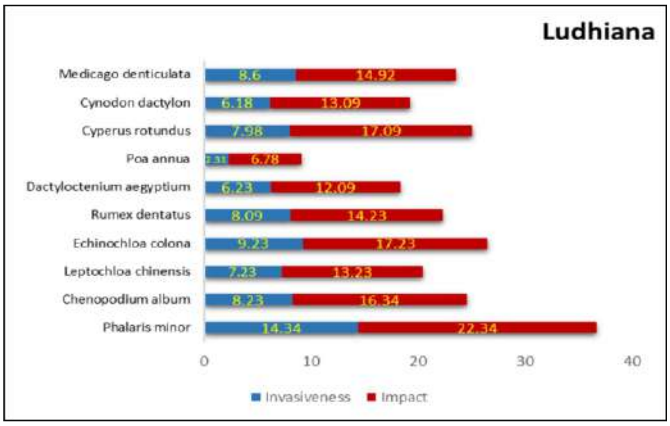

Bhatinda
Cynodon dactylon 4.34 9.78
Cyperus rotundus 8.66 17.45
Poa annua 3.9 7.67
Dactyloctenium aegyptium 4.67 8.09
Rumex dentatus 6.58 15.9
Echinochloa colona 10.56 16.98
Leptochloa chinensis 8.67 13.23
Chenopodium album 7.16 14.77
Phalaris minor 15.66 24.67
0 10 20 30 40 50
Invasiveness Impact

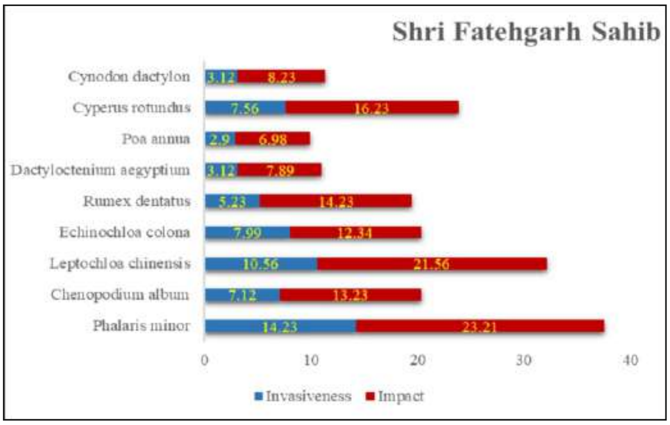

Faridkot
Cynodon dactylon 3.2 6.45
Cyperus rotundus 2.4 5.67
Poa annua 4.9 8.09
Dactyloctenium… 5.8 9.05
Rumex dentatus 6.58 15.9
Echinochloa colona 8.55 13.23
Leptochloa chinensis 11.77 15.89
Chenopodium album 9.65 15.34
Phalaris minor 16.56 24.67
0 10 20 30 40 50
Invasiveness Impact

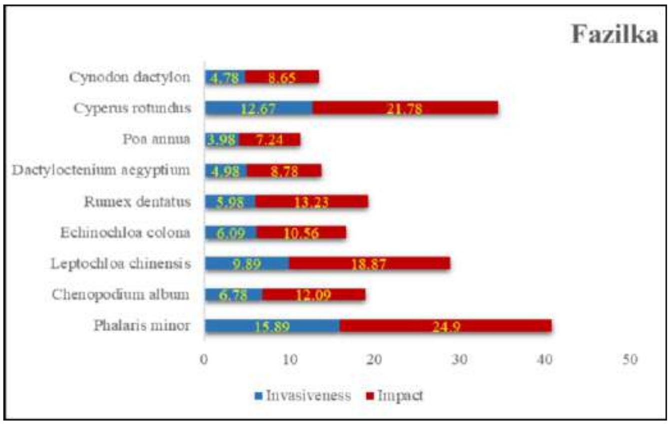

Mansa
Medicago denticulata 5.45 10.24
Cynodon dactylon 7.55 11.23
Cyperus rotundus 9.34 15.66
Poa annua 3.89 7.9
Dactyloctenium… 5.1 9.1
Rumex dentatus 4.31 8.02
Echinochloa colona 12.34 22.34
Leptochloa chinensis 7.56 13.23
Chenopodium album 8.45 13.23
Phalaris minor 15.66 24.34
0 10 20 30 40 50
Invasiveness Impact


Sangrur
Medicago denticulata 9.1 16.9
Cynodon dactylon 8.5 15.34
Cyperus rotundus 10.01 20.23
Poa annua 4.23 8.21
Dactyloctenium… 7.23 14.23
Rumex dentatus 8.03 14.56
Echinochloa colona 9.52 19.09
Leptochloa chinensis 7.56 15.34
Chenopodium album 8.23 16.56
Phalaris minor 14.34 22.34
0 10 20 30 40
Invasiveness Impact


Malerkotla
Medicago denticulata 8 15.3
Cynodon dactylon 7.8 14.98
Cyperus rotundus 9.23 19.02
Poa annua 3.44 7.98
Dactyloctenium… 8.23 15.12
Rumex dentatus 9.05 15.34
Echinochloa colona 10.21 18.09
Leptochloa chinensis 8.2 14.33
Chenopodium album 9.12 17.09
Phalaris minor 15.34 23.22
0 10 20 30 40 50
Invasiveness Impact


Ludhiana
Medicago denticulata 8.6 14.92
Cynodon dactylon 6.18 13.09
Cyperus rotundus 7.98 17.09
Poa annua 2.31 6.78
Dactyloctenium aegyptium 6.23 12.09
Rumex dentatus 8.09 14.23
Echinochloa colona 9.23 17.23
Leptochloa chinensis 7.23 13.23
Chenopodium album 8.23 16.34
Phalaris minor 14.34 22.34
0 10 20 30 40
Invasiveness Impact


Shri Fatehgarh Sahib
Cynodon dactylon 3.12 8.23
Cyperus rotundus 7.56 16.23
Poa annua 2.9 6.98
Dactyloctenium aegyptium 3.12 7.89
Rumex dentatus 5.23 14.23
Echinochloa colona 7.99 12.34
Leptochloa chinensis 10.56 21.56
Chenopodium album 7.12 13.23
Phalaris minor 14.23 23.21
0 10 20 30 40
Invasiveness Impact


Fazilka
Cynodon dactylon 4.78 8.65
Cyperus rotundus 12.67 21.78
Poa annua 3.98 7.24
Dactyloctenium aegyptium 4.98 8.78
Rumex dentatus 5.98 13.23
Echinochloa colona 6.09 10.56
Leptochloa chinensis 9.89 18.87
Chenopodium album 6.78 12.09
Phalaris minor 15.89 24.9
0 10 20 30 40 50
Invasiveness Impact

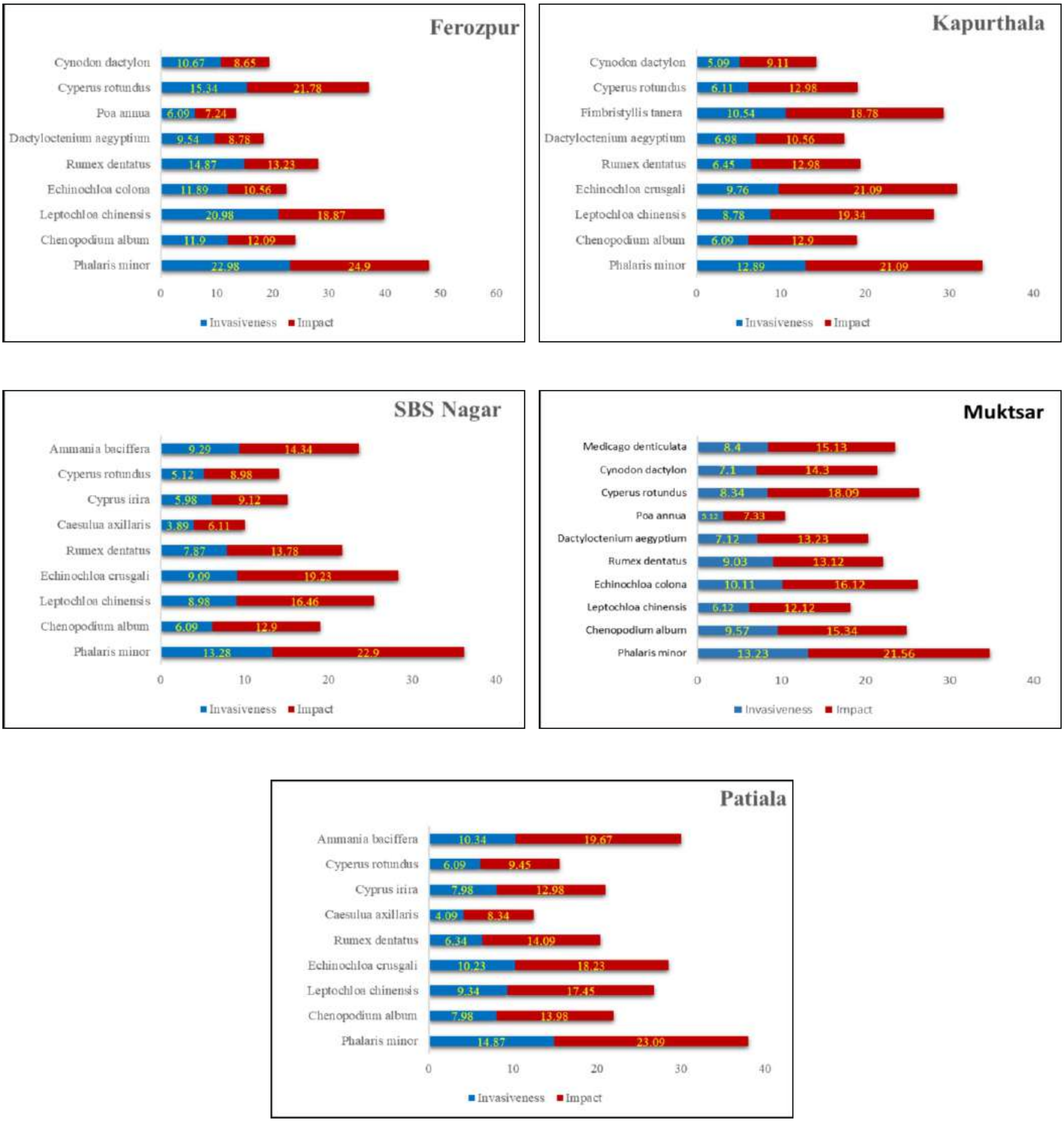


Figure: Weeds of National Importance in different districts of Punjab

Data on aquatic weed infestation

OUAT, Bhubaneswar

Centre conducted survey to find the aquatic weed infestation in different water bodies in Khorda district of Odisha. These water bodies were namely Kantilo (pond), Balabhadrapur Canal, Pond in Damanbhumi and Gop, Delanga, Puri. These water bodies were mainly infested with *Pennisetum glaucum, Eichhornia crassipes*, *Colocasia esculenta*, *Azolla microphylla* etc.

Perennial pond of Gop, Delanga, Puri

PAU, Ludhiana

Centre investigated the aquatic weed infestation in two Ramsar sites: Harike (Zira, Tarn Taran Sahib, 1800 ha) and Kanjli (Kapurthala, 490 ha) during June 2024. Both sites were infested with *Eichhornia crassipes, Hydrilla verticillata* and ferns.

Parthenium hysterophorus infestation was observed in three districts: Ludhiana (38% of non-cropped area), Tarn Taran (42% of non-cropped area), and Sangrur (36% of non-cropped area), with traces in cropped areas in all districts.

WP-3 Fate of herbicide residues in different agroecosystems

WP 3.1 Assessment of herbicide residues under program WP-1.1 Weed management in selected major crops and cropping systems

Network centres: Ludhiana, Hyderabad, Coimbatore, Anand*, Hisar*, Bengaluru*, Thrissur*

Objective:

1. To estimate herbicide residues and persistence in major crops and cropping systems specific to the state

PAU, Ludhiana

Effect of tillage and paddy residue management, herbicide on weed management and productivity of Mustard in rice-mustard cropping system.

Pendimethalin and pyroxasulfone from soil and mustard samples were quantified using HPLC system with the LOD and LOQ of in soil 0.003 and 0.01 µg/g, respectively while from mustard it was 0.026 and 0.05 µg/g, respectively. The initial residues of pendimethalin ranged from 0.309 ± 0.078 to 0.409 ± 0.056 and 0.301 ± 0.045 to 0.403 ± 0.013 µg/g in conventional tillage (CT) and zero-tillage (ZT) treatments, respectively **(Figure 3.1.1)** while pyroxasulfone residues ranged from 0.034 ± 0.023 to 0.044 ± 0.011 and 0.024 ± 0.011 to 0.038 ± 0.023 µg/g at studied application rates. Residues decreased significantly with time and degradation of pyroxasulfone followed first order kinetics with R^2 > 0.98. The half-life for pyroxasulfone in CT and ZT treatments varied from 8.88 to 10.07 and 6.78 to 7.89 days, respectively. However, the R^2 obtained for pendimethalin using first order kinetics were low and dissipation followed biphasic kinetics **(Table 3.1.1)**. The half-life for pendimethalin in CT and ZT treatments varied from 16.63 to 23.10 and 14.34 to 21.67 days. The residues of pyroxasulfone and pendimethalin in soil (<0.01 µg/g) and mustard (<0.05 µg/g) at harvest were below detectable limit.

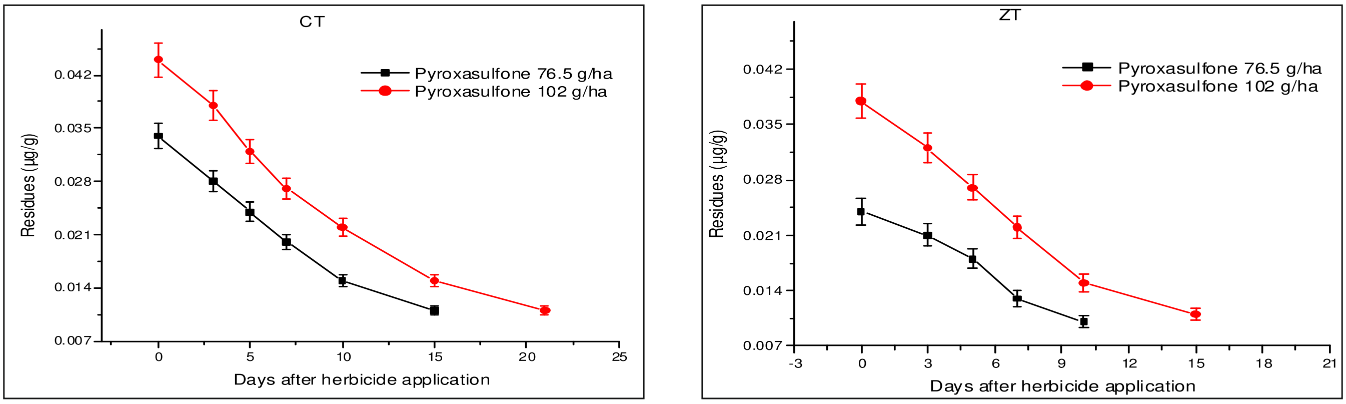


Figure 3.1.1 Residues of pyroxasulfone at studied application rates in CT and ZT treatments

Table 3.1.1 Half-lives (days) of pendimethalin and pyroxasulfone in CT and ZT-HS treatments at studied application rates

Treatments	Half-life (days)		Residues (µg/g) in CT and ZT at harvest in	
	CT	ZT-HS	Soil	Mustard
Pendimethalin 339 g/ha	16.63	14.34	<0.01	<0.05
Pendimethalin 500 g/ha	23.10	21.67	<0.01	<0.05
Pyroxasulfone 76.5 g/ha	8.88	6.78	<0.01	<0.05
Pyroxasulfone 102 g/ha	10.07	7.89	<0.01	<0.05

Conventional tillage (CT); Zero Tillage-Happy seeder (ZT-HS)

PJTSAU, Hyderabad

Residues of imazethapyr, topramezone and fomesafen in soil and chickpea samples in maize-chick-pea cropping system

For residue analysis, soil samples were collected at 4 hours after herbicide application and at harvest. Grain, and straw samples (rice and maize) were collected randomly at harvest time. Determination of fomesafen residues in chickpea grain was done by HPLC. At the time of harvest, the pendimethalin, imazethapyr, fomesafen, fluazifop and topramezone residues in soil, chickpea grain and plant were below the respective detection limits in chickpea grains and soil samples (**Table 3.1.2.**).

Table 3.1.2. Pendimethalin residues in soil with chickpea crop

Treatment	Days after herbicide application							
	0 day		30 day		60 day		Harvest	
	Pendimethalin	Imazethapyr	Pendimethalin	Imazethapyr	Pendimethalin	Imazethapyr	Pendimethalin	Imazethapyr
M_1S_3	0.457	0.134	0.134	0.019	0.056	ND	ND	ND
M_2S_3	0.484	0.135	0.135	ND	0.057	ND	ND	ND
M_3S_3	0.473	0.136	0.136	0.018	0.049	ND	ND	ND
M_4S_3	0.502	0.127	0.127	ND	0.056	ND	ND	ND
M_5S_3	0.494	0.128	0.128	ND	0.055	ND	ND	ND

TNAU, Coimbatore

Assessment of herbicide residues under program WP-1.1 Weed management in rice – black gram cropping system

During late *rabi* 2023-24, black gram (VBN 11) was grown as test crop, which received pendimethalin + imazethapyr 1.0 kg/ha as pre emergence herbicide and clodinafop–propargyl + acifluorfen sodium 185 g/ha as early post emergence herbicide to control weeds. Soil samples were collected from herbicide applied plots on 0,1,3,7,15, 30, 45 days after herbicide application (DAHA) and at harvest to find out the persistence and residue in soil. Black gram seed and haulm samples were collected at harvest and analysed for its residues. Residues of pendimethalin and imazethapyr were persisted up to 60 and 45 DAHA, respectively. Clodinafop propargyl + acifluorfen sodium 185 g/ha were persisted up to 10 and 45 DAHA respectively. The dissipation of all the herbicides were found to follow first order reaction kinetics (R^2>0.90) with the half-life ranging from 4.97 to 20.1 days. The residues of all the herbicides in soil, blackgram seed and haulm from different plots were below 0.01 mg/kg (**Table 3.1.3**).

Table 3.1.3. Persistence of different herbicides in blackgram soil (Late r*abi*, 2023-24) under rice- black gram cropping system

Herbicide	Residue (mg/kg)/ days											
	0 (2hr)	1	3	5	10	15	30	45	60	Harvest	r^2	$t^{1/2}$
Pendimethalin	0.489	0.412	0.377	0.336	0.274	0.215	0.157	0.074	0.034	<0.01	0.986	16.9
Imazethapyr	0.035	0.030	0.027	0.021	0.018	0.015	0.010	<0.01	<0.01	<0.01	0.915	20.1
Clodinafop–propargyl	0.038	0.035	0.030	0.018	0.010	<0.01	<0.01	NA	NA	NA	0.983	4.97
Acifluorfen sodium	0.075	0.070	0.066	0.059	0.050	0.040	0.026	0.014	<0.01	<0.01	0.994	19.1

During *Kharif* 2024, rice (CO(R) 55) was grown which received bensulfuron-methyl + pretilachlor 660 g/ha and pyrazosulfuron-ethyl 20 g/ha as pre emergence herbicides and bispyribac-sodium 25 g/ha and penoxsulam+ cyhalofop- butyl 135g/ha as post emergence herbicide to control weeds. Soil samples were collected from herbicide applied plots on 0,1,3,7,15, 30, 45, 60, 90 days after herbicide application and were subjected to residue analysis to find out their persistence in soil. Rice grain and straw samples were also collected at harvest and analysed for its residues.

Table 3.1.4. Persistence of different herbicides in rice soil (*Kharif* 24) in rice- black gram cropping system

Treatments	Herbicide	Residue (mg/kg)/ days								
		0 (2hr)	1	3	7	15	30	45	60	90
M1: Bensulfuron-methyl +pretilachlor 660 g/ha as PE *fb* HW at 40 DAT	BSM	0.041	0.037	0.032	0.026	0.015	0.010	BDL	BDL	NA
	Pretilachlor	0.322	0.301	0.255	0.201	0.172	0.139	0.037	BDL	BDL
M2: Bensulfuron-methyl + pretilachlor 660 g/ha as PE *fb* bispyribac- sodium 25 g/ha as PoE	BSM	0.039	0.036	0.031	0.026	0.014	0.010	BDL	BDL	NA
	Pretilachlor	0.310	0.281	0.235	0.194	0.162	0.125	0.034	BDL	BDL
	BPS	0.031	0.028	0.025	0.013	0.010	BDL	BDL	NA	NA
M3: Pyrazosulfuron-ethyl 20 g/ha as PE *fb* HW at 40 DAT	PSE	0.025	0.024	0.022	0.017	0.010	BDL	BDL	NA	NA
M4: Pyrazosulfuron-ethyl 20 g/ha as PE *fb* Penoxsulam+ cyhalofop- butyl 135g/ha as PoE	PSE	0.024	0.020	0.017	0.014	0.010	BDL	BDL	NA	NA
	Penoxsulam	0.032	0.030	0.028	0.025	0.012	0.010	BDL	BDL	NA
	Cyhalofop butyl	0.055	0.049	0.041	0.036	0.026	0.021	BDL	BDL	NA

Bensulfuron methyl, penoxsulam, cyhalofop butyl were persisted up to 30 DAHA. Pyrazosulfuron ethyl and bispyribac sodium were persisted up to 15 DAHA, while pretilachlor persisted up to 45 DAHA. The dissipation of all the herbicide were found to follow first order reaction kinetics (R^2>0.90) with the half-life of 11.0 to 12.0 days for pyrazosulfuron ethyl, 9.5 days for bispyribac sodium,14.3 days for cyhalofop-butyl, 16.5 days for penoxulum and 14.6 to 14.8 days for bensulfuron methyl and 16.3 to 16.7 days for pretilachlor. The residues of all the herbicides in grain and straw from different plots were below the detection limit (**Table 3.1.4**).

WP 3.2 Assessment of herbicide residues in the long-term experiments under program WP-1.2 Weed Management under conservation tillage-based cropping

Network centres: PAU Ludhiana, PJTSAU Hyderabad, TNAU Coimbatore, AAU Anand*, CCSHAU Hisar*, UAS Bengaluru*

1. To estimate herbicide persistence and residues in long-term conservation tillage-based cropping

PAU, Ludhiana

WP 1.2.1. Weed management in rice-wheat-legume cropping system under conservation tillage

Pendimethalin and bispyribac sodium from soil samples was quantified using HPLC system. The initial residues of pendimethalin in soil were 0.289 ± 0.12 and 0.255 ± 0.34 µg/g in recommended and integrated weed management treatments, respectively (Figure 3.4) while in bispyribac sodium, residues were 0.0232 ± 0.35 and 0.0211 ± 0.67 µg/g **(Figure 3.2.1 and 3.2.2)**. The residues of pendimethalin and bispyribac sodium decreased successively over time and degradation of pendimethalin and bispyribac sodium followed first order kinetics with R^2>0.98. DT_{50} of pendimethalin and bispyribac sodium in soil in different treatments were 44.19 and 11.39 and 35.90 and 8.65 days, respectively in recommended and integrated weed management treatments. The residues of pendimethalin and bispyribac sodium in soil (<0.01 µg/g) and rice (<0.05 µg/g) at harvest were below detectable limit.

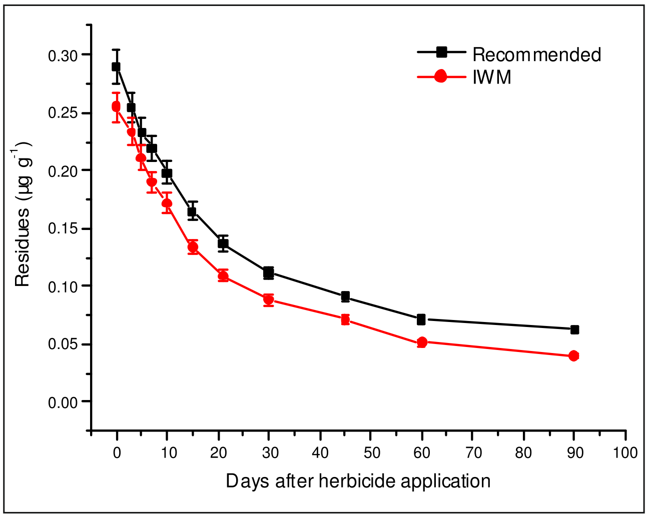


Figure 3.2.1 : Residues of pendimethalin in different treatments in rice

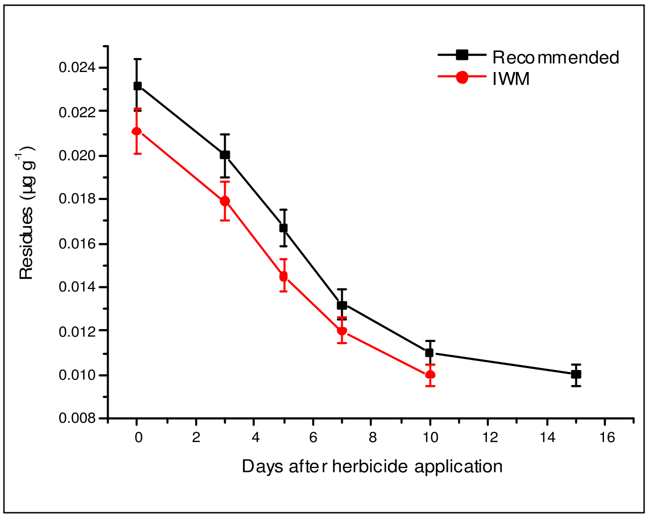


Figure 3.2.2 : Residues of bispyribac sodium in different treatments in rice

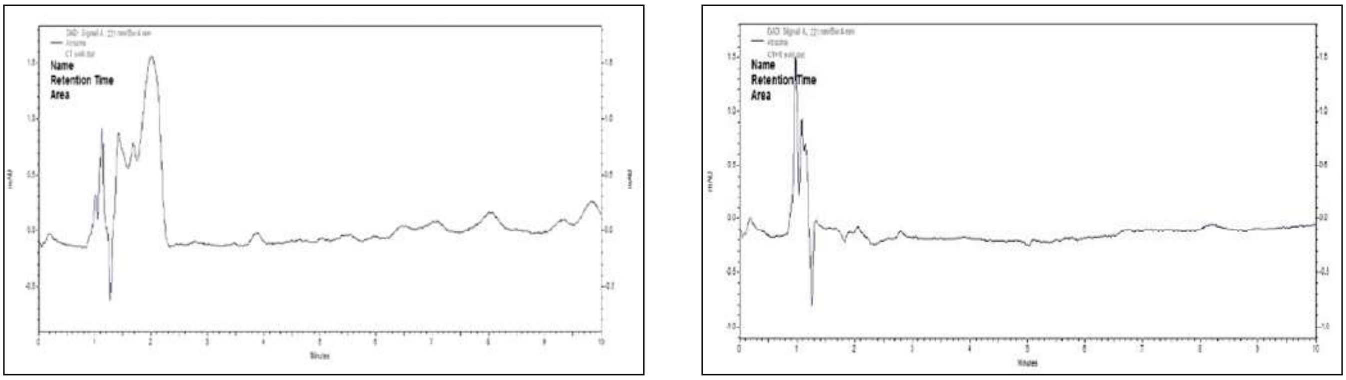
PJTSAU, Hyderabad

Herbicide residues in cotton- maize-green manure conservation agriculture experiment

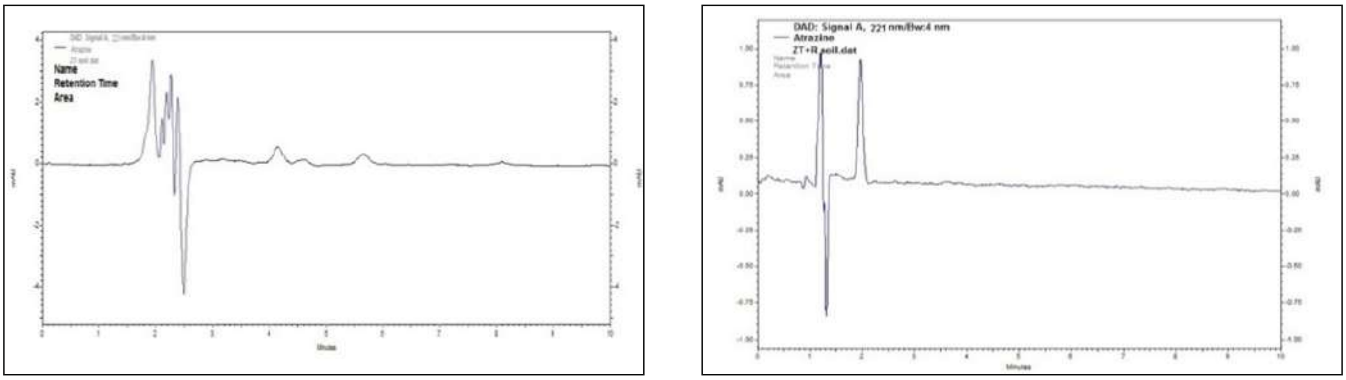
A field study was initiated at College farm, Rajendranagar, Hyderabad on conservation agriculture in cotton–maize–*Sesbania* green manure (summer) cropping system to study the influence of herbicides on soil properties and also to assess the carryover of the herbicide residues. Diuron, pyrithiobac sodium, quizalofop-p-ethyl herbicides were applied to the cotton crop. The impact of herbicides on soil enzyme activity and the microbial population was assessed after herbicide application, flowering stage and harvest of the crop. Along with the herbicide persistence, the impact of tillage and weed management practices on soils properties was also initiated. Atrazine 50%WP was applied 1000g/ha as preemergence spray 24 hours after sowing using a spray volume of 500 litres/ha. Atrazine residues were determined on GC-FTD. At 4 hours after herbicide application, initial residues of atrazine varied from 0.411 to 0.432 µg/g in the soil samples. In the soil sample, and maize grain/ plant samples collected at harvest, the atrazine residues were below the detection limit of 0.05 µg/g in all the soil samples. No significant changes in soil physico-chemical properties were recorded as impacted by different tillage and weed management options were noticed after the maize crop harvest. The interaction of tillage and weed management practices was also non-significant.

TNAU, Coimbatore

Herbicide persistence and residues in long-term conservation tillage based cotton- baby corn cropping system were undertaken. During Late *rabi* 2023-24 baby corn (G5417) was grown which received atrazine 500g/ha + pendimethalin 450g/ha as pre emergence herbicide at 2DAS and topramezone 25.2 g/ha as post emergence herbicide at 20DAS to control weeds. Soil samples were collected from herbicide applied plots at 0,1,3,7,15, 30, 45 days after herbicide application and at harvest and were subjected to residue analysis to find out their persistence and residue in soil as influenced by the tillage and residue management practices. were analysed by HPLC. The results showed that zero tillage with residue and conservation tillage with residue plots were recorded lower residues when compared to conventional and zero tillage plots. The dissipation of all the herbicide molecule were found to follow first order reaction kinetics ($R^2 > 0.90$) with the half-life of 16.0-17.2 days for atrazine 0.5 kg/ha, 17.2 - 18.1 days for atrazine 1.0 kg/ha, 15.3 – 16.2 days for pendimethalin, 16.7 – 20.1 days for topramezone irrespective of tillage practices. Residues of pendimethalin, topramezone and atrazine in soil and baby corn fingers from different plots were below the level of quantification limit irrespective of the tillage practices **(Fig.3.2.3)**. Whereas, application of atrazine at 1.0 kg/ha recorded residues of 0.028 to 0.040 mg/kg in soil and 0.019 to 0.032 mg/kg in babycorn fingers at first harvest.



Conservation tillage **Conservation tillage + Residue**



Zero tillage **Conservation tillage + Residue**

Fig. 3.2.3 Chromatograms of atrazine (0.5 kg/ha) residue at harvest under different tillage systems

CCSHAU, Hisar

Maize samples of *kharif* 2023 were analyzed for harvest time residue by GC-MSMS while residues of tembotrione and pyroxasulfone from WP1.2.3. Weed management under conservation tillage system on maize based cropping system experiment. Residues of atrazine, tembotrione and pyroxasulfone were below the limit of quantification (0.01 mg/kg) in all the samples of maize grains, straw and soil. Samples of mustard seeds, straw and soil were collected at the time of harvest for determination of pendimethalin residues. Pendimethalin residues in treatment (CT, CT+R, ZT and ZT+R) were above 0.01 mg/kg in all the samples of mustard seeds and straw.

WP 3.3 Assessment of herbicide residues in high value crops

Network Centers: PAU Ludhiana, PJTSAU Hyderabad, TNAU Coimbatore, AAU Anand*, CCSHAU Hisar*, UAS Bengaluru

At Ludhiana, field experiment was conducted at farmer's field at village *Akalgarh* (75°38'50.80'' 30°45'8.28'') to estimate the residues of metribuzin applied at 250 mL/acre to potato. Metribuzin residues from soil samples were quantified using HPLC with The LOD and LOQ of metribuzin were 0.003 and 0.01 µg/g, respectively while in potato LOD and LOQ were 0.0167 and 0.05 µg/g, respectively. The initial residue of metribuzin was 0.432 µg/g in soil. With increase in time, the residues of metribuzin decreased. The degradation half-life of metribuzin with R^2>0.97 was 18.98 days. The residues of metribuzin in soil and potato at harvest were below detectable limit (<0.01 µg/g).

At PJTSAU, Hyderabad, pendimethalin residues in soil and beetroot tubers from tomato-beetroot and water melon cropping system were analyzed by Gas Chromatograph equipped with Electron capture detector with a LOQ of 0.05 mg/kg. Among the soil samples collected at harvest of the harvest, residues of pendimethalin were below 0.05

mg/kg in all samples. In all beetroot samples collected, pendimethalin residues were below0.05 mg/kg.

Soil samples and crop produce samples at harvest from the chilies and turmeric experiments conducted in various AICRP schemes in PJTAU and Horticulture University. Atrazine residues in soil samples and turmeric samples collected the time of harvest were found to be below the detection limit of 0.05 µg/g. Pendimethalin residues in the soil sample and chili fruit samples collected the time of harvest were below 0.05 µg/g.

At harvest cabbage head and post-harvest soil were collected from two locations of Coimbatore and analysed for residues. Pendimethalin residues in the soils were ranged from 0.464 to 0.489 µg/g at 0 DAHA and at harvest residues in the soil and cabbage head samples were below the quantification limit.

At AAU, Anand, herbicide residue of atrazine, pendimethalin or metribuzin observed in fresh rhizome of turmeric were not detected at harvest.

WP 3.4 Assessment of leaching potential of new herbicide molecules

Network Centers: PAU Ludhiana, CSKHPKV Palampur, PJTSAU Hyderabad and TNAU Coimbatore

Objective:

1. To estimate leaching potential of new herbicide molecules in the two different textured soils

At PAU, Ludhiana the leaching potential of topramezone was investigated in clay loam, loamy sand and sandy loam collected from Punjab Agricultural University, Ludhiana. Leaching studies were performed in polyvinyl chloride columns (60 cm long × 9.5 cm i.d.) and with commercial formulation of topramezone at 75 and 150 mL/ha. The soil columns were pre-moistened for a week before the application of the herbicide. In 150 and 300 mm simulated rainfall, a total of 1125 and 2250 mL of water was added to each column. The leachates collected after every 24 hours were swirled and a 5 mL sample in triplicate was taken from each for quantitative analysis. After the end of experiment, soil columns were longitudinally divided into six 10 cm equal sections and soil samples were taken from each section. Both soil and leachate samples were then analyzed to detect and quantify the residues of topramezone. Residues of topramezone were distributed in 20-60 cm, irrespective of type of soil and application rate of herbicide and predominantly present (22.1-26.5%) in the lower soil layers (50-60 cm) and leachate (49.1 and 70.1%) **(Figure 3.4.1 and 3.4.2)**. When rainfall equivalent to 300 mm was applied, topramezone leached comparatively more and residues varied from 0.017 to 0.021 µg/g at 50-60 cm (18.78-37.7%) and 0.022 to 0.059 µg/mL (61.11 to 79.1%) in leachates. The BTCs showed that leaching of topramezone was significantly higher at 300 mm (27.89 to 44.89%) rainfall as compared to 150 mm (17.8 to 25.1%) rainfall.

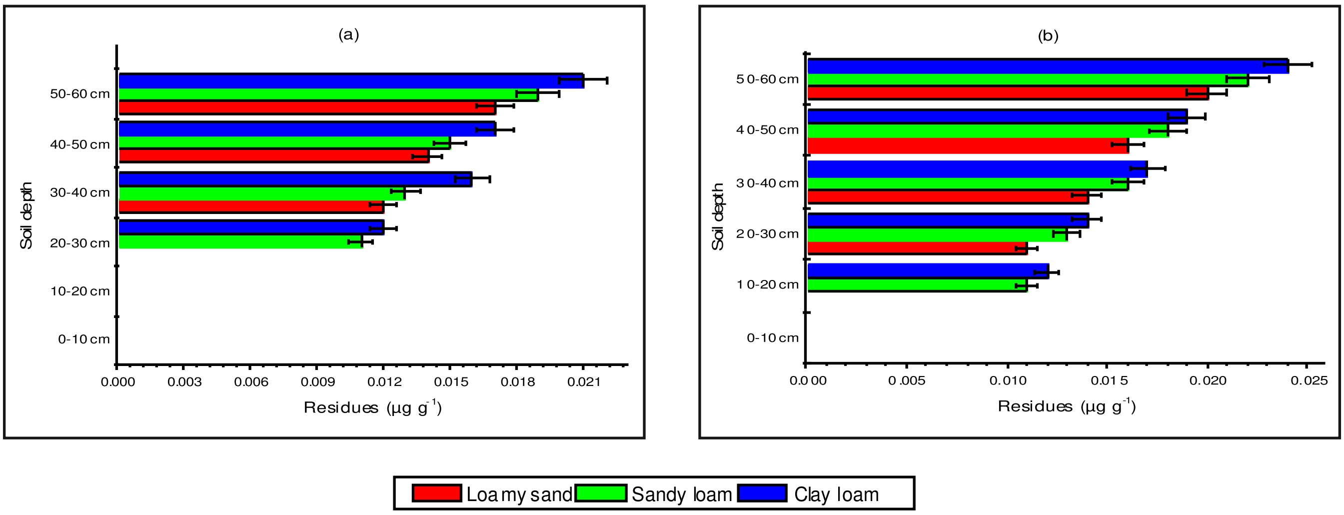


Figure 3.4.1: Residues of topramezone at (a) 75 mL/ha (b) 150 mL/ha in studied soils at 300 mm simulated rainfall

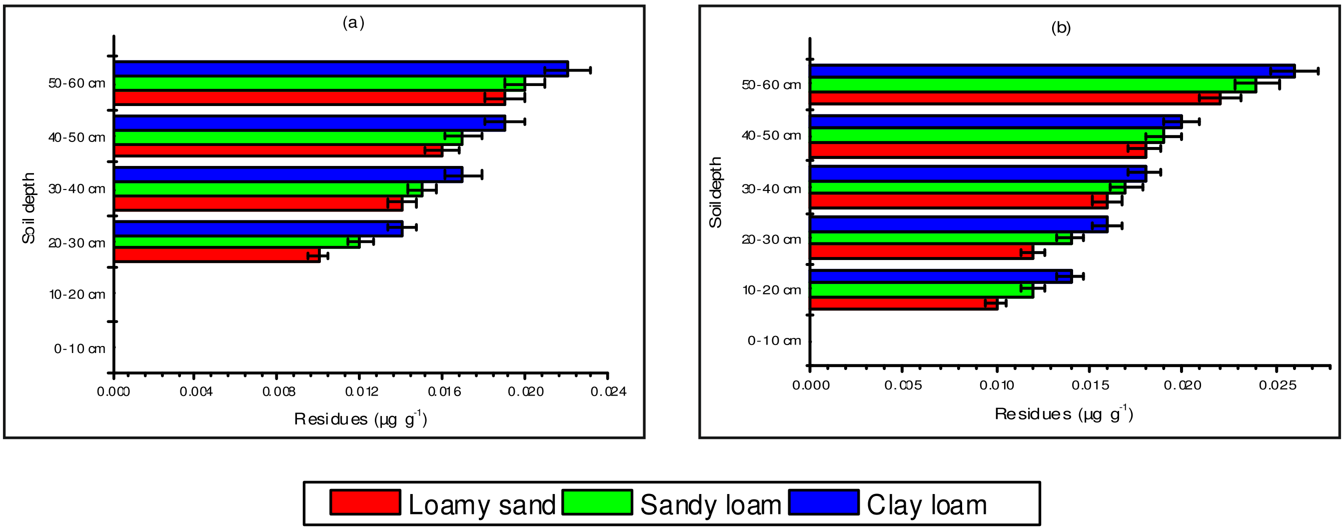


Figure 3.4.2 : Residues of topramezone at (a) 75 mL/ha (b) 150 mL/ha in studied soils at 300 mm simulated rainfall

WP 3.5 Assessment of herbicide residues at farmer fields

Network Centers: PAU Ludhiana, PJTSAU Hyderabad and TNAU Coimbatore

At PAU, Ludhiana, soil, water and crop samples were collected randomly at harvest from farmer's fields from Ludhiana, Moga, Kapurthala, Fazilka and Sangrur districts of Punjab in rice-wheat cropping system. Pretilachlor, butachlor, anilofos, bispyribac sodium, pendimethalin, penoxsulam, sulfosulfuron, metsulfuron-methyl, pinoxaden, clodinafop, mesosulfuron methyl + iodosulfuron methyl sodium were commonly used herbicide in these districts. Residues of these herbicides and some of their transformation products viz. their transformation products (TPs) viz 2-amino-4,6-dimethoxypyrimidine (ADMP), 4,6-dimethoxypyrimidine-2-yl-urea (DMPU), methyl 2-(aminosulfonyl) benzoate (MASB) and 2-amino-4-methoxy-6-methyl-1,3,5-triazine (AMMT) were analysed by HPLC. The residues of these herbicides in soil, water and crop produce samples collected at harvest were below detectable limits (<0.01 µg/g). (**Table 3.5.1.**)

Table 3.5.1. Residues of herbicides and dehydrogenase activity of soil in samples from farmer's field

S. No.	Farmers's name	Village and district	Herbicide sprayed	Residues at harvest (µg/g)
1.	Atma Singh	Bhari Mansa, Sangrur	Butachlor	<0.01
2.	Kulwant Singh	Deon, Bathinda	Butachlor	<0.01
3.	Dilbag Singh	Khirkian wala, Sri Muktsar Sahib	Bispyribac Sodium	<0.05
4.	Samarvir Singh	Thandewala, Sri Muktsar Sahib	Bispyribac Sodium	<0.05
5.	Satnam Singh	Barkandi, Sri Muktsar Sahib	Butachlor	<0.01
6.	Nirmal Singh	Thandewala, Sri Muktsar Sahib	Bispyribac Sodium	<0.05
7.	Avtar Singh	Akalgarh, Ludhiana	Pretilachlor	<0.01
8.	Gurpreet Singh	Cheema, Sangrur	Bispyribac Sodium	<0.05
9.	Ravinder Singh	Cheema, Sangrur	Pretilachlor	<0.01
10.	Sandeep Singh	Akalgarh, Ludhiana	Bispyribac Sodium	<0.05
11.	Sukhwinder Singh	Barkandi, Sri Muktsar Sahib	Metsulfuron methyl	<0.01

Table contd...

12.	Manpreet Singh	Deon, Bathinda	Metsulfuron methyl	<0.01
13.	Surinder Singh	Akalgarh, Ludhiana	Metsulfuron methyl	<0.01
14.	Lakhwinder Singh	Sarainaga, Sri Muktsar Sahib	Clodinafop propargyl	<0.01
15.	Satwinder Singh	Chibranaali, Muktsar	Clodinafop propargyl	<0.01
16.	Lakha Singh	Cheema, Sangrur	Metsulfuron methyl	<0.01
17.	Major Singh	Deon, Bathinda	Metsulfuron methyl	<0.01
18.	Arshdeep Singh	Akalgarh, Ludhiana	Sulfosulfuron	<0.01
19.	Tarsem Singh	Ferozpur	Butachlor	<0.01
20.	Harpal Singh	Barkandi, Sri Muktsar Sahib	Mesosulfuron methyl	<0.02

The harvest samples of summer moong, urd bean and *Kharif* moong were collected from Research Farm, PAU, Ludhiana, and residues of imazethapyr across various treatments were determined. When imazethapyr 10% SL was applied at 100 g/ha at 25 days after sowing (DAS), the residue levels ranged from 0.018 to 0.02 µg/g in summer urd bean, summer moong and *Kharif* moong . For treatments with imazethapyr 10% SL at 75 g/ha applied at both 15 DAS and 25 DAS, residue levels were below the detectable limit of <0.01 µg/g in all crop. In contrast, a higher dosage of 150 g/ha applied at 25 DAS resulted in increased residue levels ranging from 0.038 to of 0.045 µg/g in summer moong, urd bean and i moong. For pre-emergence applications of imazethapyr 10% SL, treatments with 50 g/ha and 75 g/ha showed residue levels below the detectable limit (<0.01 µg/g) in all crop types. However, the highest dosage of 150 g/ha applied as pre-emergence resulted in residue levels ranging from 0.021 to of 0.031 µg/g in summer moong, urd bean and *Kharif* moong **(Table 3.5.2.)**. At higher application rates, residue levels declined during post-harvest storage, and were below the detectable limit (<0.01 µg/g) within 18 days.

Table 3.5.2. Harvest time residues of imazethapyr in crop produce

Treatment	**Residue (µg/g)**		
	Summer moong	**Summer urd bean**	**Kharif moong**
Imazethapyr 10%SL 50 g/ha at 15 DAS	<0.01	<0.01	<0.01
Imazethapyr 10%SL 50 g/ha at 25 DAS	<0.01	<0.01	<0.01
Imazethapyr 10%SL 100 g/ha at 25 DAS	0.019	0.02	0.018
Imazethapyr 10%SL 75 g/ha at 15 DAS	<0.01	<0.01	<0.01
Imazethapyr 10%SL 75 g/ha at 25 DAS	<0.01	<0.01	<0.01
Imazethapyr 10%SL 150 g/ha at 25 DAS	0.042	0.038	0.045
Imazethapyr 10%SL 50 g/ha as pre-emergence	<0.01	<0.01	<0.01
Imazethapyr 10%SL 75 g/ha as pre-emergence	<0.01	<0.01	<0.01
Imazethapyr 10%SL 150 g/ha as pre-emergence	0.031	0.021	0.026

At PJTSAU, Hyderabad, rice plant and grain samples were collected at the time of harvest for analysis of pretilachlor, penoxsulam cyhalofop butyl and bispyribac sodium in different parts of Nalgonda district. Results indicated that the final grain samples of rice collected from the farmers field the residues of pretilachlor, penoxsulam cyhalofop butyl and bispyribac sodium were below the respective detection limits**.**

At TNAU, Coimbatore**,** the data on herbicides residue level in the soil and plant parts collected from different farmer's field. None of the applied herbicides were detected in the different plant matrices and soil. This showed that they have been degraded from the soil before the harvest of the crop.(**Table 3.5.3.)**

Table 3.5.3. Herbicides residue in soil and crop produce from farmer's field

Location	Crop	Herbicide	Herbicide dose	Soil (µg/g)	Grain/ fruit (µg/g)
Mr. Moorthy Ikkarai Pooluvampatti	Maize	Tembotrione	120g/ha	BDL	BDL
Mr. Nanjukutti Vadakkuthottam Devarayapuram	Brinjal	Quizalofop ethyl	50g /ha	BDL	BDL
Mr. S.R. Palanisamy SRP Thottam Nallurvayal	Rice	Bispyribac sodium	25g /ha	BDL	BDL
Mr. Ramesh Mundanthurai	Black gram	Pendimethalin + Imazethapyr	1.0kg/ha	BDL	BDL
Mr. Nagarajan Kembanur	Maize	Atrazine	500g/ha	BDL	BDL
		Tembotrione	120g/ha	BDL	BDL
R. Vijay Viraliyur	Tomato	Oxyfluorfen	250g/ha	BDL	BDL
Mr. Thangaraj Sennanur	Cauliflower	Metolachlor	1kg/ha	BDL	BDL

Herbicides residue in soil and ground water sample from farmer's field

The soil and ground water samples were collected from farmer's field, where herbicides are being continuously used more than 10 years for weed control. None of the applied herbicides were detected in the soil and water of all the locations. This showed that they have been degraded from the soil before the harvest of the crop (**Table 3.5.4.**).

Table 3.5.4. Herbicides residue in soil and ground water sample from farmer's field

Name of the farmer and address	Crop	Herbicide used	Soil (µg/g)	Ground water Open well / b orewell (µg/g)
Mr. Thangavel	Maize	Atrazine 625 g/ha	BDL	BDL
Madhampatti	Onion	Oxyfluorfen 0.20 kg /ha	BDL	BDL
	Cauliflower	Metolachlor 1.0kg/ha	BDL	BDL
Mr. M. Sukumar	Maize	2,4 D 1.0kg/ha	BDL	BDL
	Brinjal	Pendimethalin 0.75 kg /ha	BDL	BDL
Mr. Arunachalam	Bhendi	Quizalofop ethyl 50g/ha	BDL	BDL
Kuppanur	Cauliflower	Metolachlor1.0 kg/ha	BDL	BDL
	Tomato	Oxyfluorfen 0.25 kg /ha	BDL	BDL
Mr. Dhamodharasamy	Brinjal	Quizalofop ethyl50g/ha	BDL	BDL
	Groundnut	Pendimethalin 1kg/ha	BDL	BDL
	Tomato	Oxyfluorfen 0.25 kg /ha	BDL	BDL
	Maize	Atrazine 0.5kg/ha	BDL	BDL
Mr. Duraisamy	Cabbage	Metolachlor1.0 kg/ha	BDL	BDL
Karadimadai	Black gram	Pendimethalin +	BDL	BDL
		Imazethapyr 1.0 kg/ha	BDL	BDL
	Maize	Atrazine 0.5 kg/ha,	BDL	BDL
		Tembotrione120g /ha	BDL	BDL
Mr. Raju	Onion	Oxyfluorfen 200 g /ha	BDL	BDL
Palayathottam	Maize	Tembotrione 120g/ha	BDL	BDL
Veerakeralam	Bhendi	Pendimethalin 1 kg /ha	BDL	BDL

Field experiments were conducted in farmers' fields at different places in Thrissur district having different soil types from September to December 2024. Soil samples were collected at 0(2hr), 10, 20, 30, 60 days after application of herbicides and at harvest. As the sampling interval increased to 10 days and beyond, herbicide degradation occurred. Cyhalofop butyl residues were 0.372 and 0.268 ppm, respectively, after 2 hours and 10 days of spraying. Residue levels of bispyribac sodium was below quantification levels at all the sampling intervals (**Table 3.5.5.**).

Table 3.5.5. Herbicide residues in Kozhakully - Sandy clay loam soil at different sampling intervals

Days after spraying (DAS)		Herbicide residue (ppm) after spraying of		
		Cyhalofop butyl	**Penoxsulam**	**Bispyribac**
0 DAS	Control	-	-	-
	Cyhalofop + Penoxsulam	0.372	-	
	Bispyribac	-	-	BDL
10 DAS	Control	-	-	-
	Cyhalofop + Penoxsulam	0.268	-	-
	Bispyribac	-	-	BDL
20 DAS	Control	-	-	-
	Cyhalofop + Penoxsulam	0.064	-	-
	Bispyribac	-		BDL
30 DAS	Control	-	-	-
	Cyhalofop + Penoxsulam	0.022	-	-
	Bispyribac	-	-	BDL
60 DAS	Control	-	-	-
	Cyhalofop + Penoxsulam	-	-	-
	Bispyribac	-	-	BDL

Impact of combination of pendimethalin and pyroxasulfone on acute and sub-acute toxicity on *Eisenia fetida*

The artificial soil test method was used for assessing the acute toxicity and sub-acute toxicity on *Eisenia fetida* exposed to pyroxasulfone, pendimethalin and their combination in 14-day exposure at PAU, Ludhiana. Based on LC_{50} values, pyroxasulfone demonstrated low toxicity to *E. fetida* with LC_{50} of 611.4 mg/kg on day 14 as compared to pendimethalin which exhibited LC_{50} of 430.3 mg/kg whereas the combined treatment exhibited the highest toxicity with LC_{50} of 301.3 mg/kg. These acute toxicity test results indicate that the toxicity of pyroxasulfone, pendimethalin and their combination with *E. fetida* was relatively low, with the toxicity ranked in decreasing order as combined treatment > pendimethalin > pyroxasulfone. During the sub-acute toxicity test, the effects of pendimethalin, pyroxasulfone and their combinations on key oxidative stress biomarkers including antioxidant enzymes (SOD, POD, CAT and GST) and MDA content in earthworms were evaluated over a 28-day exposure period.

Antioxidant enzymes, crucial components of the antioxidant defence system, exhibited a significant initial decline till 21 days followed by a gradual increase at day 28, with the magnitude of changes correlating with both exposure duration and herbicide concentrations. This herbicide-induced stress in these enzymes corroborated with increase in MDA content across all the treatments. Among the four enzymes, GST demonstrated the highest overall sensitivity and inhibition throughout the exposure period. These antioxidant enzyme activities revealed a hierarchical pattern of sensitivity, with the combination treatment eliciting the most pronounced effects, followed by pendimethalin alone and then pyroxasulfone.

Furthermore, the results of docking studies of pyroxasulfone, pendimethalin and their combination with these enzymes also demonstrated enhanced binding interactions under combination treatment compared to individual herbicide exposure, suggesting potential synergistic toxic effects. IBRv2 indices were determined to evaluate the individual and combined toxicity levels of pyroxasulfone and pendimethalin on oxidative stress biomarkers of earthworms comprehensively and star plots of the different treatments with varying exposure periods are presented in **(Figure 3.7 and 3.8)**. Among the five oxidative stress indicators, GST exhibited the largest IBRv2 values, establishing it as the most sensitive biomarker.

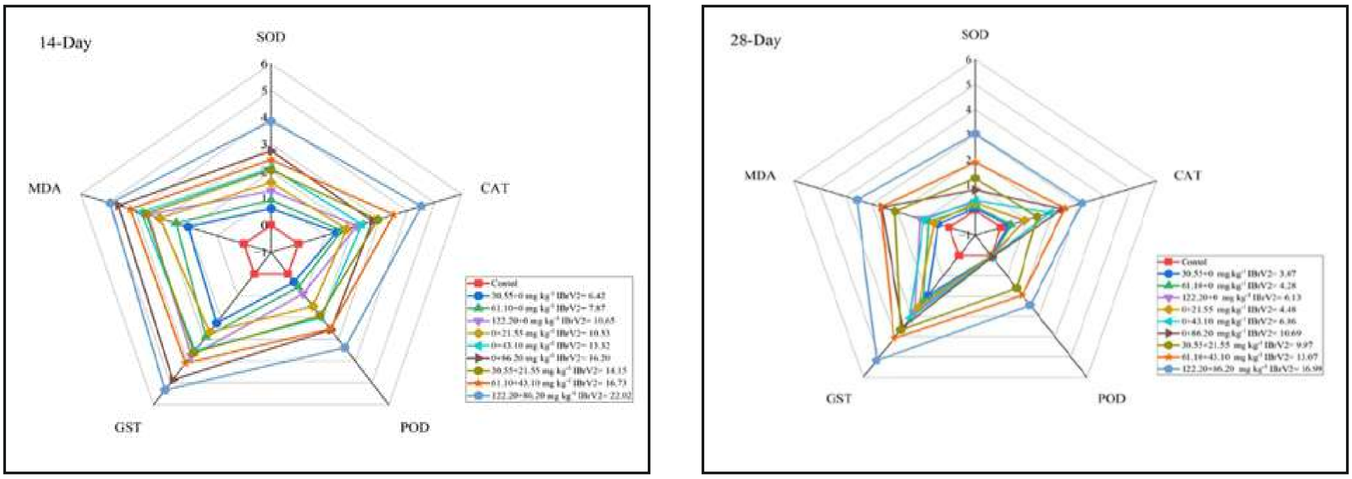
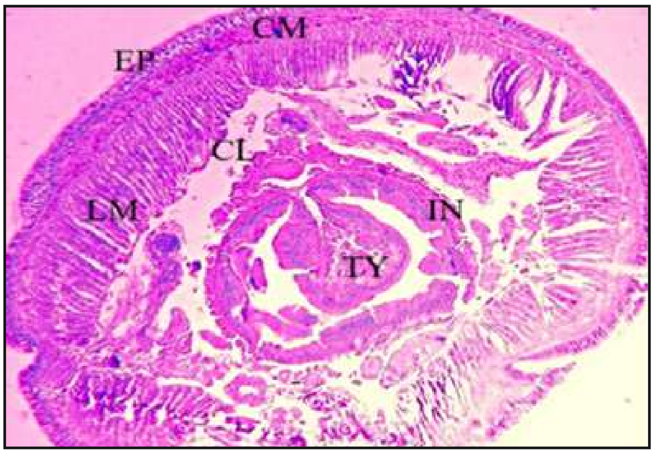
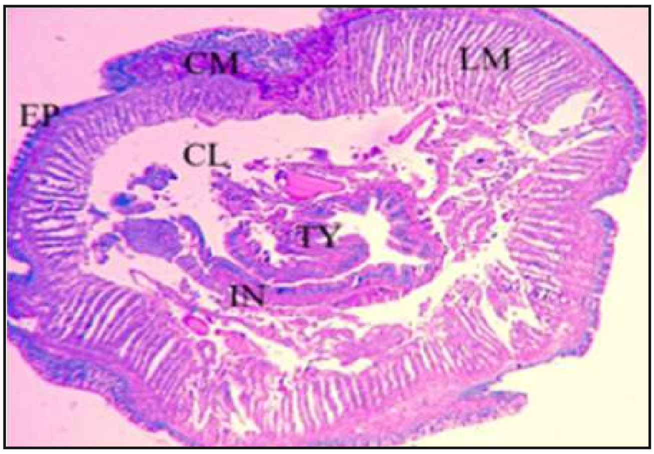


Figure 3.5.1 : Effects of pyroxasulfone, pendimethalin and their combination on oxidative stress markers in *E. fetida* at 14 and 28 days

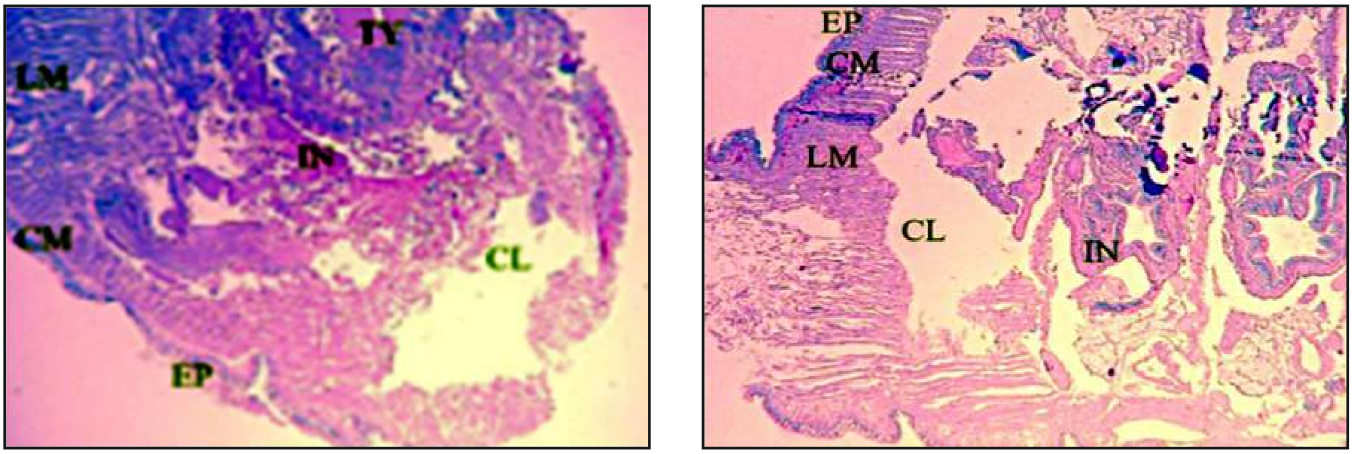
Additionally, the study also investigates the effects of pyroxasulfone, pendimethalin and their combination on the histopathology of *E. fetida* to examine the tissue damage **(Figure 3.5.2).** While control treatment specimens maintained normal histological features characterized by intact epidermis (EP), circular muscles (CM), longitudinal muscles (LM), regularly arranged intestinal columnar cells and clear chloragogenous tissue structure throughout the study, herbicide treated groups showed the most severe histopathological alterations, including complete disruption of musculature, extensive tissue disintegration, demolished intestinal integrity and widespread cellular pyknosis, indicating a synergistic toxic effect that exceeded the impact of either herbicide alone.



Control



Pyroxasulfone



Pendimethalin **Combination**

Figure 3.8: Effects of pyroxasulfone, pendimethalin and their combination on histopathological changes in *E. fetida*

WP 4 Demonstration and impact assessment of weed management technologies

WP 4.1: On- Farm Research trials

TNAU, Coimbatore

During *rabi* 2023-24, five OFR trials were conducted on blackgram to evaluate different weed management practices. As a short-duration pulse crop, blackgram is highly sensitive to weed competition, particularly during the early growth stages. The presence of weeds not only reduces the availability of essential resources such as nutrients, water and light but also leads to significant yield losses, ranging from 30% to 80%, depending on the weed intensity, duration of competition, and management practices. The critical weed-free period for blackgram is 15-30 DAS during which weed interference can drastically affect crop growth and yield. Effective weed management is vital to minimize yield losses and optimize blackgram productivity. Farmers often rely on manual weeding as the primary method of weed control, but it is labor-intensive and costly making it less practical for large-scale or resource-limited conditions. Herbicide application, either alone or in combination with manual weeding, has proven to be a more efficient and cost-effective solution. The results of research trials indicated that the major weed species observed in blackgram fields were *Digera arvensis*, *Boerhaavia diffusa*, *Cyperus rotundus*, *Acalypha indica*, *Trianthema portulacastrum* and *Amaranthus viridis*. Among the weed management practices, EPoE application of clodinafop propargyl 8% + sodium acifluorfen 16.5% EC 245 g/ha recorded lesser total weed density and dry weight at 30 DAS and it was followed by pendimethalin 30% + imazethapyr 2% EC 1.0 kg/ha as PE *fb* HW at 30-35 DAS.

PAU, Ludhiana

Three OFR trials on weed management in DSR were conducted during *Kharif* 2024. The treatment, pendimethalin @ 750 g/ha+pyrazosulfuron ethyl TM @ 25 g/ha (PE) (TM) *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE provided effective control of broad-spectrum weeds and provided an early weed free environment to DSR at early stages in tar wattar DSR. However, penoxsulam 1% + pendimethalin 24% (25%SE) RM at 625 g/ha (PE) *fb* anilofos 375 g/ha at first irrigation by broadcasting method also provided second highest yield at all locations. The centre also conducted five OFR trials on weed management in wheat with tank-mixture of pinoxaden + metribuzin at 225 g/ha which was compared with ready mixture of clodinafop + metribuzin 174 g/ha (standard). Tank-mixture of pinoxaden+metribuzin recorded effective control of *P. minor* and provided similar weed control and wheat grain yield to ready mixture of clodinafop+metribuzin at all locations.

CCSHAU, Hisar

The efficacy of different pre-emergence herbicides followed by post-emergence herbicides and post-emergence herbicide against resistant populations of *P. minor* were assessed at farmers' fields at five locations in Fatehabad and Jind districts. Application of pre-emergence pyroxasulfone + pendimethalin (TM) at (127.5 + 1500 g/ha) followed by PoE application of metribuzin just after irrigation followed by pinoxaden + metribuzin provided 92.6% control of *P. minor* resulting more effective tillers/m^2 (352.0) and grain yield of wheat (6.32 t/ha) followed by sequential application of pyroxasulfone + pendimethalin (TM) at (127.5 + 1500 g/ha) *fb* pinoxaden + metribuzin 50 g/ha (5.98 t/ha). Alone application of pinoxaden + metribuzin provided 56.0% control of *P. minor* with grain yield 5.26 t/ha. Further three OFR trials on greengram in the Hisar district and the major weeds infested the crop at farmers' fields were *D. aegyptium, D. arvensis, Eragrostis* sp., *Digitaria* sp. and *Cyperus rotundus*. Application of propaquizafop + imazethapyr (50 +75 g/ha) as post-emergence provide effective control of these weeds resulting in nearly 40% higher seed yield as compared to pendimethalin 1000g/ha as PRE. Two hand weeding resulted in higher seed yield of green gram as compared alone herbicide application. Higher benefit-cost ratio (1.32) was obtained with application of propaquizafop + imazethapyr (50+ 75 g/ha) as compared to pendimethalin while minimum under weed free.

AAU, Anand

Two OFR trials were conducted on groundnut during the *kharif* 2024 with treatments viz. pendimethalin 30% + imazethapyr 2% EC 800 g a.i./ha (RM) (T_1), propaquizafop 2.5% + imazethapyr 3.75% w/w ME 125 g a.i./ha (RM) (T_2) and farmers' practice (IC *fb* HW at 20 and 40 DAS) (T_3). The results indicated that T_2 was the most effective in controlling weeds, resulting in a net return of Rs. 77,099/ha, a benefit-cost ratio of 2.10, and the lowest weed dry weight at harvest (114.8 g/m²).

RVSKVV-Gwalior

Two OFR trials on on pearl millet in farmers' field during *Kharif* 2024. Atrazine+mesotrione (RM) 656 g/ha as PoE and atrazine 750 g/ha (PE) *fb* 2,4-D EE 500 g/ha PoE were tested and compared with farmer's practices where farmer was not applied any herbicide. The dominant weeds on farmer's field were *Cyperus rotundus, Echinochloa crusgalli, Setaria glauca, Phyllanthus niruri, Commelina benghalensis* and *Digera arvensis.* The results indicated that, both the combinations of weed management practices suppress the weed flora and resulted higher seed yield over farmer's practices. The maximum yield of 2.7 t/ha was obtained with the application of atrazine+mesotrione (RM) 656 g/ha as PoE which was 24.20% higher over farmer's practice. Further, two OFR trials were conducted on wheat during *rabi* 2023-24. The combinations of sulfosulfuron+metsulfuron (0.03+0.002) kg/ha PoE (25-30 DAS) and clodinafop+ metsulfuron (0.06+0.004) kg/ha PoE (25-30 DAS) were tested for chemical weed control and compared with farmer's practices at two locations of Gwalior district. The dominant weeds on farmer's fields were consisted of *Cyperus rotundus, Phalaris minor, Anagallis arvensis, Convolvulus arvensis, Chenopodium album* and *Spergula arvensis* etc. The results of the trials showed that both the combination of herbicides *i.e.* clodinafop+metsulfuron (0.06+0.004) kg/ha PoE (25-30 DAS) and Sulfosulfuron + metsulfuron (0.03+0.002) kg/ha PoE (25-30 DAS) resulted higher yield over farmer practice. The highest yield 4.29 t/ha, net return Rs. 65580/ha and BC ratio (3.28) were recorded in Clodinafop+ metsulfuron (0.06+0.004) kg/ha PoE (25-30 DAS), which was 20.27% higher over farmer's practice (no herbicide applied).

The centre also carried out two OFR trials on chickpea during *rabi* 2023-24. The combinations of Pendimethalin + imazethapyr (RM) 750 g/ha as PE and Pendimethalin 750 g/ha as PE were tested for chemical weed control and compared with farmer's practices at two locations of Gwalior district. The dominant weeds on farmer's fields were consisted of *Cyperus rotundus, Phalaris minor, Anagallis arvensis, Convolvulus arvensis, Chenopodium album, Medicago hispida*and *Spergula arvensis* etc. The findings of the trials indicated that the application of herbicides *i.e.* pendimethalin + imazethapyr (RM) 750 g/ha as PE and pendimethalin 750 g/ha as PE resulted higher yield over farmer practice. The highest yield 1.56 t/ha, net return Rs. 50300/ha and BC ratio (2.82) were recorded in Pendimethalin + imazethapyr (RM) 750 g/ha as PE, which was 30.98% higher over farmer's practice (no herbicide applied).

CSKHPKV, Palampur

Four OFR trials on garden pea, five on transplanted rice, and five on soybean were undertaken. The results were encouraging across all trials and it was revealed that in garden pea, pre–emergence application of pendimethalin 38.7 CS @ 678 g/ha resulted in highest green pod yield which was 17.5 % higher than the yield obtained with farmers' practice. Pre-emergence application of imazethapyr 80 g/ha also increased the yield by 12.3 %. In rice, pre-emergence application of pyrazosulfuron 20 g/ha followed by post – emergence application of bispyribac sodium 25 g/ha recorded highest grain yield and increased the grain yield by 35.9 % over farmers' practice. Post emergence application of bispyribac sodium also showed higher yield than pre–emergence application of Butachlor 1.5 t/ha. In soybean, post emergence application of tank mix of quizalofop ethyl 60 g/ha and chlorimuron ethyl 4 g/ha gave effective control of weeds and resulted in highest seed yield which was 31.5 % higher than the yield obtained in control where only one hand weeding was done. Imazethapyr, applied as post emergence spray, also increased the seed yield of soybean by 13.9 %.

MPUAT, Udaipur

Two On-Farm Research (OFR) trials were conducted to evaluate the efficacy of broad-spectrum weed control in wheat using premix applications of three herbicides: carfentrazone + sulfosulfuron (245 g/ha), pinoxaden + metsulfuron (40 + 4 g/ha), and sulfosulfuron + metsulfuron (30 + 2 g/ha), applied at 30 DAS (days after sowing). The trials were carried out in Tarawat and Netawala villages, Tehsil Vallabhnagar, Udaipur. The farmer's fields were heavily infested with Phalaris minor among monocot weeds, while *Chenopodium album*, *Chenopodium murale*, *Convolvulus arvensis*, *Fumaria parviflora*, *Malva parviflora*, and *Melilotus indica* were predominant among dicot weeds. Both farmers were highly impressed with the weed control performance of the herbicides. The application of the ready-mix herbicide carfentrazone + sulfosulfuron (245 g/ha) at 30 DAS resulted in the lowest weed density and weed dry matter, significantly outperforming the farmers' practice. This treatment increased wheat grain yield by 20.21% compared to the yield under farmers' practice (3.65 t/ha). Further, two OFR trials on soybean to evaluate and compare weed management strategies. The treatments were Post-emergence (PoE) application of aciflurofen + clodinafop propargyl at 245 g/ha., Tank mix application of imazethapyr + propaquizafop (125 g/ha) at 21 DAS and Imazethapyr (75 g/ha) followed by one hand weeding at 35 DAS (farmers' practice). The results showed that the tank mix application of imazethapyr + propaquizafop (125 g/ha) at 21 DAS was the most effective in reducing weed density and dry matter. This treatment recorded the highest seed yield (1.7 t/ha) and haulm yield (2.4t/ha), representing a significant improvement over the farmers' practice. Additionally, the maximum economic returns achieved with the tank mix application of imazethapyr + propaquizafop.

The centre also conducted two OFR trials on weed management in maize to evaluate the effectiveness of post-emergence herbicides, tembotrione and topramezone, in combination with atrazine. The results revealed that the minimum weed density and weed biomass were recorded with the early post-emergence (EPoE) application of atrazine + topramezone (500+25.2 g/ha), followed by atrazine + tembotrione (500 + 120 g/ha), applied at the 3-4 leaf stage (20 DAS). While mild phyto-toxicity symptoms were observed initially, the maize crop recovered after a few days. The major broadleaf weeds observed in the trials were *Trianthema portulacastrum* and *Digera arvensis*. The grassy weeds included *Echinochloa colona, Commelina benghalensis*, and *Cyperus rotundus*. Additionally, *Parthenium hysterophorus* was identified as a problematic perennial weed in both cropped and non-cropped fields. The highest grain and straw yield of maize was achieved with the application of atrazine + topramezone (500 + 25.2 g/ha) at the 3-4 leaf stage (15 DAS), resulting in a 12.75% increase in grain yield compared to the farmers' practice of applying atrazine followed by intercultural operations at 35 DAS.

OUAT, Bhubaneswar

Four OFR trials on transplanted rice were conducted during *rabi* 2023-24 at Nayagarh and Jagatsinghpur districts. Maximum yield of 5.2 t/ha was recorded in the plot applied with Pendimethalin + penoxulam (RM) *fb* Fenoxaprof + ethoxysulfuron TM 625 g *fb* 67 g+18 g/ha. A net saving of Rs. 4000-5000/ ha was obtained in the plots treated with herbicides. Further, four OFR trials on rice were conducted in Nimakana tehsil, Jagatsinghpur area during *Kharif* 2024 and the findings indicated that the highest yield was obtained from the plots applied with pendimethalin + penoxulam (RM) *fb* fenoxaprof+ethoxysulfuron TM 625 g g/ha (4.5 t/ha) followed by pretilachlor *fb* penoxulam + cyhalofop butyl (RM) 750g/ha *fb* 135 g/ha. (4.3 t/ha). The saving in weeding cost over farmers practice was in the tune of Rs 4000 to Rs 5000/ ha.

PDKV, Akola

Two OFR trials on soybean were conducted in farmers' fields in which two weed management technologies were compared with farmer's practice (1 Hoeing and 2 Hand weeding). Higher yield of soybean was recorded with application of propaquizafop 2.5% + imazethapyr 3.75% (RM) compared to both post-emergence application of imazethapyr 10% SL and farmer's practice with a B-C ratio of 2.01. Further, two OFR trials on cotton were conducted with three treatments viz. Pendimethalin 30 EC as PE @ 1.00 kg a.i./ha *fb* directed spray (by using protective shield) of Paraquat 24 SL @ 0.50 kg a.i./ha at 45 days after sowing (T_1), Pyrithiobac Sodium 10% EC @ 62.5 g/ha(T_2) and Farmer practice (2 Hoeing 10 days interval and 2 Hand weeding) (T_3). The results indicated that application of pre-emergence herbicides pendimethalin *fb* directed spray of paraquat out yielded over alone application of pyrithiobac as post-emergence herbicides. This might be due to management of wider weed spectrum with sequential application of pre-emergence pendimethalin *fb* directed application of paraquat dichloride. Higher gross monetary return was reported in farmers practice; however, higher net monetary return and B-C ratio were reported by application of pre-emergence pendimethalin *fb* directed application of paraquat dichloride.

GBPUAT, Pantnagar

Five on-farm research trials were conducted on wheat crop at farmer's field during *Rabi* season of 2023-2024. The area of each treatment was 2000 m^2 and the wheat varieties were BL-953 & PBW-154 & HD-2967.

Trial comprised of clodinafop propargyl 15% + metsulfuron methyl 1% WP (60+4 g/ha) and clodinafop propargyl + metribuzin 175 g/ha (54+120 g/ha check) 30 DAS were applied in improved technology. Sulfosulfuron 25g/ha 30 DAS) were applied as farmer's technology. The major weeds infested the weedy check plots were *Phalaris minor, Medicago denticulata, Rumex acetosella, Solanum nigrum, Melilotus indica, Anagallis arvensis, Coronopus didymus & Chenopodium album.* The reduction in grain yield due to uncontrolled weeds in weedy plots was 27.83%. An average increase in grain yield due to adoption of improved technology was 10.7% higher than farmer's technology. Among the weed management treatments, higher weed control efficiency was recorded with improved technology (83.5% and 77.5%, respectively) over farmer's technology (70.4%). Application of Clodinafop propargyl 15% + metsulfuron methyl 1% WP 60+4 g/ha recorded highest grain yield (4.75 t/ha), net returns (Rs. 64791.70/ha) and benefit cost ratio (2.46) followed by clodinafop propargyl + metribuzin (54+120 g/ha) 175 g/ha at 35 DAS which attained grain yield 4.62 t/ha, net returns (Rs. 61746.60/ha) & benefit cost ratio (2.39) which were higher over farmer's technology (4.10 t/ha). The lowest values of these parameters were recorded with weedy check Seven OFR trials were conducted at different locations of farmer's field in Nainital district during *Kharif* season 2024 to evaluate the performance of different herbicidal treatments. The trial was consisted of penoxsulam 0.97 % + butachlor 38.8 % SE 820 g/ha (PE), penoxsulam 1.02 % + cyhalofop-butyl 1.1 % OD, 135 g/ha (PoE) under improved technology, whereas, pretilachlor 50% EC 750 g/ha (PE) was applied as farmer's technology and weedy check was executed to estimate the yield loss caused by weeds. The plot size of each treatment was 2000 m^2 and rice varieties PR-13, Sarbati & HKR-47 were transplated. The major weeds infested the weedy plots were *Echinochloa colona, Panicum maximum, Digitaria sanguinalis, Leptochloa chinensis, Ammannia baccifera, Commelina benghalensis, Cyperus rotundus* and *Cyperus iria.* The reduction in grain yield due to uncontrolled weeds was 27.2% in weedy check plot while an increase in grain yield with improved technology was 45.0% over farmer's technology. Among different weed management treatments, highest grain yield (4.63 t/ha), net returns (Rs. 61219.0/ha) and benefit cost ratio (2.35) was achieved with - penoxsulam 0.97%+ butachlor 38.8% SE 820 g/ha (PE) followed by penoxsulam + cyhalofop-butyl 135 g/ha (PoE) which attained higher values of yield and economics parameter than farmer's technology.

Two sets of OFR trials on soybean were conducted at farmer's field during *Kharif* season of 2024 in Nainital district. The area of each treatment was 2000 m^2 and soybean variety PS-21 was sown. The trial comprised of sodium acefluorfen 16.5%+ clodinafop proparzyl 8% EC 165+80 g/ha (POE), fluazifop-p-butyl 11.1% w/w+ fomesafen 11.1% w/w SL 250 g/ha (POE) under improved technology whereas pretilachlor 50 EC 750g/ha PE under farmer's technology. For evaluation of yield losses caused by uncontrolled weeds an untreated plot was kept at each location. The major weeds infested in weedy check plots were *Dactyloctenium aegyptium, Eleusine indica, Digitaria sanguinalis, Trianthema monogyna, Mollugo pentaphylla, Celosia argentea, Alternanthera sessilis, Digera arvensis* and *Cyperus rotundus*. Reduction in average grain yield of soybean due to weeds in weedy check plots was 26.6% in comparison to recommended practice. An increase in grain yield with improved technology was found 36.4 %. The highest grain yield (1.6 t/ha), net return (Rs. 46124.86/ha) and benefit cost ratio (2.42) were recorded with Sodium acefluorfen 16.5%+ clodinafop propargyl 8% EC 165+80 g/ha (2-4 leaf stage) followed by fluazifop-p-butyl 11.1% w/w+ fomesafen 11.1% w/w SL 250 g/ha 20 DAS which recorded higher values of these parameters compared to farmer's technology (Imazethapyr 10% SL 100g/ha POE)

Two OFR trials on maize were conducted at farmer's field during *Kharif* season of 2024 in Nainital district. The area of each treatment was 2,000 m², and the maize variety PHB 30 B50 was sown. The treatments comprised of atrazine 500 g/ha + topramezone 25.2 g/ha (TM) and atrazine 500 g/ha + tembotrione 120 g/ha (TM) under recommended technology, whereas, tembotrione 120 g/ha was executed under farmer's technology. For evaluation of yield losses caused by uncontrolled weeds an untreated plot was kept at each location. The major weeds infested the field in weedy check plots were *Digitaria sanguinalis, Echinochloa colona, Eleusine indica, Panicum maximum, Celosia argentea, Trianthema monogyna* and *Cyperus rotundus.* The reduction in cob yield due to uncontrolled weeds was recorded 31.6% in weedy check plot while an increase in cob yield with atrazine 500 g/ha + topramezone 25.2 g/ha (TM) (20 DAS) and atrazine 500 g/ha + tembotrione 120 g/ha (TM) (20 DAS) was 3.7% over farmer's technology. Among different weed management treatments, highest cob grain yield (6.0 t/ha), net return (Rs. 94561.65/ha) and benefit cost ratio (3.43) were achieved with atrazine 500 g/ha+ topramezone 25.2 g/ha (TM) which was followed by atrazine 500 g/ha+ tembotrione 120 g/ha (TM) which attained highest values compared to farmer's technology. The lowest value of above-mentioned parameters was noticed in weedy check.

Two OFR trials on sugarcane were conducted at farmers' field during *Spring* season of 2024 in Nainital district. The area of each treatment was 2000 m^2 and the sugarcane variety Co-0238 was planted. The treatments were comprised of ametryne 80 WDG 2.0 kg/ha PE and mesotrione 2.27 % + atrazine 22.7 % SC 875 g/ha PE under improved technology, whereas 2,4-D dimethyle amine salt 58 % SL 2.5 kg/ha at 30 DAS was farmer's technology. For evaluation of yield losses caused by uncontrolled weeds an untreated plot was kept at each location. Pre-emergence herbicide was applied by using 700 litres of water/ha with flat fan nozzle. The major weeds infested the field in weedy check plots were *Sorghum halepense*, *Digitaria sanguinalis, Eleusine indica, Alternanthera sessilis, Ipomoea* spp, *Parthenium hysterophorus, Ageratum conyzoides,* and *Cyperus rotundus.* The reduction in cane yield due to uncontrolled weeds was 28.4% in weedy check plot while an increase in grain yield with ametryne 80 WDG 2.0 kg/ha (PE) and mesotrione 2.27 % + atrazine 22.7 % SC 875 g/ha (PE) was 39.4% over farmer's technology. Among different weed management treatments, highest grain yield (99.55 t/ha), net return (Rs. 273233.0/ha) and benefit cost ratio (4.03) were achieved with Ametryne 80 WDG 2.0 kg/ha PE.

IGKV, Raipur

Five OFR trials were conducted at farmers' field of Village Tor, Block Dharsiwa, District Raipur, Chhattisgarh on impact assessment of weed management technologies in direct seeded rice. The treatment comprises of T_1 : Application of pyrazosulfuron 20 g/ ha PE at 0-7 DAS *fb* bispyibac-Na 25 g/ ha at 20 DAS, T_2 : Application of pyrazosulfuron 20 g/ha PE *fb* penoxsulam + cyhalofop-butyl 135 g ha^{-1} at 25 DAS and was compared with T_3 : Farmer's practice (bispyribac-Na 25g/ha at 20 DAS). The data collected from farmers' field revealed that the highest average grain yield was obtained under T_2 (application of pyrazosulfuron 20 g ha^{-1} PE *fb* penoxsulam + cyhalofop-butyl 135 g/ha at 25 DAS) followed by T_1 (pyrazosulfuron 20 g ha^{-1} PE at 0-7 DAS *fb* bispyibac-Na 25 g/ha at 20 DAS) with 5.60 t/ha and 5.47 t/ha, respectively, which was 14.37 % and 11.72 % more than the farmers practice i.e T_3 (bispyribac-Na 25g ha^{-1} at 20 DAS). As per economics was concerned, the highest average benefit cost ratio was also obtained with T1 (3.19), followed by T2 (3.06) and the lowest was obtained with farmers practice T3 (2.82).

BCKV, Kalyani

Four OFR trials on Maize were conducted in Nadia district. Dominated weed flora in the study area was comprised of *Cynodon dactylon, Setariaglauca, Echinochloa colona among grasses, Cyperus rotundus* among sedges and *Chenopodium album, Ageratum conyzoides, Alternanthera phyloxeroides, Euphorbia hirta, Phyllanthus niruri, Physalis minima, Tridax procumbens etc.* among broad leaved weeds. The highest cob length and cob girth of about 18.93cm and 15.53 cm was measured with topramezone+atrazine (25.2+500 g/ha) EPoE *fb* IC + HW at 40DAS and was followed by tembotrione +atrazine (120+500 g/ha) EPoE*fb*IC + HW at 40DAS. The highest grain yield of about 6.88 t/ha was produced under topramezone+atrazine (25.2+500 g/ha) EPoE *fb* IC + HW at 40DAS and it was followed by tembotrione +atrazine (120+500 g/ha) EPoE *fb* IC + HW at 40DAS with a grain yield of about 6.62 t/ha. Farmers' practice (HW at 20 and 40DAS) produced grain yield of about 6.48 t/ha. Plots receiving the treatment topramezone+atrazine (25.2+500 g/ha) EPoE *fb* IC + HW at 40DAS produced highest stover yield of about 10.47 t/ha and was followed by the treatment tembotrione +atrazine (120+500 g/ha) EPoE *fb* IC + HW at 40DAS producing 10.35 t/ha of stover yield. The lowest stover yield of about 10.21 t/ha was observed under farmers' practice (HW at 20 and 40DAS). The highest benefit-cost ratio of about 2.25 was obtained with the application of topramezone+atrazine (25.2+500 g/ha) EPoE *fb* IC + HW at 40 DAS and was followed by tembotrione +atrazine (120+500 g/ha) EPoE *fb* IC + HW at 40DAS with a value of 2.13.

The centre also conducted four OFR trials on lentil in farmers' field during *rabi* 2023-24. Predominant grassy weeds recorded were *Cynodon dactylon, Digitaria sanguinalis* and *Eleusine indica,* Predominant sedges were *Cyperus rotundus. Cyperus difformis. Physalis minima, Chenopodium album, Solanum xanthocarpum, Parthenium hysterophorus* and *Euphorbia hirta* were the broad-leaved weeds. The results of different treatments revealed that the highest number of pods/plant (107.22) was recorded in pendimethalin 30EC 1000g/ha PE at 3 DAS *fb* quizalofop-ethyl 5EC 50g/ha at 25 DAS and was followed by pendimethalin30EC 720 g/ha PE at 3 DAS *fb* imazethapyr 10SL 30g/ha at 25 DAS with a value of 103.42. The maximum number of seeds/pod (1.76) was observed in pendimethalin 30EC 1000g/ha PE at 3 DAS *fb* quizalofop-ethyl 5EC 50g/ha at 25 DAS and was closely followed by treatment pendimethalin 30 EC 720 g/ha PE at 3 DAS *fb* imazethapyr 10SL 30g/ha at 25 DAS with a value of 1.71. Farmers' practice (Hand Weeding at 20 DAS) recorded the lowest number of seeds per pod with a value of 1.67. The highest seed index (20.52 g) was obtained in pendimethalin 30EC 1000g/ha PE at 3 DAS *fb* quizalofop-ethyl 5EC 50 g/ha at 25 DAS and the lowest seed index (20.41 g) was recorded in Farmers' practice (Hand Weeding at 20 DAS). The data on net returns and benefit-cost ratio revealed that the highest net return (Rs. 94185/ha) and B-C ratio (3.58) was recorded for the treatment pendimethalin 30 EC 1000 g/ha PE at 3 DAS *fb* quizalofop-ethyl 5EC 50 g/ha at 25 DAS and was followed by treatment having pendimethalin 30 EC 720 g/ha PE at 3 DAS *fb* imazethapyr 10 SL 30 g/ha at 25 DAS.

WP 4.2: Front Line Demonstrations

TNAU, Coimbatore

Five FLDs were carried out in groundnut with the application of quizalofop ethyl 5% + imazethapyr 10% EC 100 g/ha (EPOE) *fb* HW at 40 DAS as improved technology and 2 Hand weeding at 20 and 40 DAS as farmers' practice. Major weed species recorded in groundnut fields were *Chloris barbata, Cyperus rotundus, Amaranthus viridis, Trianthema portulacastrum, Phyllanthus niruri* and *Commelina benghalensis.* Across all five locations, the lowest total weed density and weed dry weight were observed with the improved technology. Furthermore, the FLD results revealed that the early post-emergence (EPoE) application of quizalofop ethyl 5% EC + imazethapyr 10% SL (TM) (50 + 50 g/ha) *fb* HW at 40 DAS provided broad-spectrum weed control, higher pod yield (20.4–28.3% increase), and improved economic returns in groundnut.

RVSKVV, Gwalior

Two FLDs were conducted on pearl millet at farmers' field with the application of atrazine 500 g/ha *fb* 2,4-D 500 g/ha EPoE (15 DAS) as improved technology and compared with farmers' Practice. The results showed that the improved technology resulted in a 24.52% higher yield over the farmers' practice, with a benefit-cost ratio of 2.55. Further, four FLDs were conducted on wheat with the application of clodinafop+metsulfuron (0.06+0.004) kg/ha PoE (25-30 DAS as improved technology and compared with farmers' practice. The dominant weeds on farmer's fields were consisted of *Cyperus rotundus, Phalaris minor, Anagallis arvensis, Convolvulus arvensis, Chenopodium album* and *Spergula arvensis* etc. The data revealed that improved technology provided around 23.11% higher yield over farmers' practice with a B-C ratio of 3.23. The centre also conducted three FLDs on chickpea during *rabi* 2023-24. Application of pendimethalin + imazethapyr (RM) 750 g/ha as PE was taken as the improved technology. The dominant weeds on farmers' fields consisted of *Cyperus rotundus, Phalaris minor, Anagallis arvensis, Convolvulus arvensis, Chenopodium album, Medicago hispida* and *Spergula arvensis*. The results of the demonstrations indicated that the improved technology resulted in a 25.29% higher yield, with a B-C ratio of 2.74, compared to the farmers' practice.

CSKHPKV, Palampur

Six demonstrations were conducted on wheat during *rabi* 2023-24. The application of clodinafop 60 g/ha + MSM 4 g/ha (PoE) was taken as the improved technology, which resulted in a 19% yield increase over the farmers' practice (HW twice at 20 and 40 DAS). Further, three demonstrations were conducted on transplanted rice during *kharif* 2024. The application of butachlor 1.0 kg/ha (PE) *fb* bispyribac sodium 25 g/ha (PoE) was taken as the improved technology, which resulted in a 10.8% yield increase over the farmers' practice (HW twice at 20 and 40 DAT). The centre also conducted four FLDs on maize during *kharif* 2024. The improved technology, tembotrione 120 g/ha+atrazine 500 g/ha (PoE), led to a 15.5% yield increase over the farmers' practice (hoeing at 20 days after sowing (DAS) + earthing up at 45 DAS).

PAU, Ludhiana

Five FLDs were conducted during *rabi* 2023-24. Pre-plant application of pyroxasulfone 127.5 g/ha in wheat sown with happy seeder under ZT (+R) as an improved technology provided similar weed control and grain yield to recommended post-emergence herbicides clodinafop 9%+metribuzine 20% (174 g/ha), which was taken as farmers' practice. This offers an additional option for herbicide application at sowing in the case of wheat sown with a Happy Seeder. The *Phalaris minor* control was 92-95% with the improved technology, compared to 88-89% with the farmers' practice. The grain yield ranged from 5.6 to 5.9 t/ha under improved technology, whereas it was 5.1 to 5.4 t/ha under farmers' practice. Additionally, the centre also conducted five FLDs in *Tar-Wattar* DSR using Lucky Seed Drill with press wheels. penoxsulam 1%+pendimethalin 24% (RM) at 625 g/ha (PE) was taken as improved technology and pendimethalin @ 750 g/ha+pyrazosulfuron ethyl @ 25 g/ha (TM) PE was taken as farmers' practice. The data revealed that both treatments provided almost similar levels of weed control and grain yield, although the yield was slightly higher in the case of improved technology.

PJTSAU, Hyderabad

Five FLDs were conducted in rice during *Kharif* 2023 to popularize the integrated weed management technology in Nalgonda district. The results showed that the improved technology, involving the post-emergence application of florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC at 150 g/ha as PoE *fb* hand weeding at 40 DAT, was comparable to the farmers' practice (triafamone 20% (44 g/ha) + ethoxysulfuron 10% WG (22.5 g/ha) as PoE *fb* hand weeding at 40 DAT) but resulted in a slightly higher yield and benefit-cost ratio (2.36 vs. 2.31).

SKUAST, Jammu

Five FLDs on weed management in maize fields were conducted during *Kharif* 2024 in the Jammu region. The application of tembotrione (100 g/ha) + atrazine (25.2+500 g/ha) at 15-20 DAS was taken as the improved technology and compared with the farmers' practice of atrazine (1.0 kg/ha). The results indicated that plots treated with the improved technology recorded the lowest weed density, higher grain yield, and a superior benefit-cost ratio compared to the farmers' practice. The yield increase ranged from 10% to 24%, with the B-C ratio varying between 2.01 and 2.45 across different locations.

IGKV, Raipur

Sixteen FLDs were conducted on weed management in direct-seeded rice during *Kharif* 2024 in Kabirdham district. The improved technology involved the pre-emergence application of pyrazosulfuron (20 g/ha) at 0-7 DAS, followed by bispyribac-Na at 20 DAS. The farmers' practice consisted of the application of bispyribac-Na (25 g/ha) at 20 DAS. The average grain yield under the farmers' practice was 4.70 t/ha, whereas the improved technology resulted in an average yield of 5.52 t/ha, reflecting a 17.50% increase. The average benefit-cost ratio was noticeably higher (3.58) under the improved technology compared to the farmers' practice.

AAU, Anand

Five FLDs were conducted in soybean during *Kharif* 2024 with the application of propaquizafop 2.5% + imazethapyr 3.75% w/w ME (RM) 125 g a.i./ha 125 g a.i./ha (20 DAS) as improved technology and IC *fb* HW at 20 & 40 DAS as farmers' practice. The overall performance of the technology demonstrated was accepted by the farmers. The technology found effective for the management of weeds in soybean with higher benefit cost ratio of 1.91 compared to farmers practice (IC+HW at 20 and 40 DAS) B:C 1.75. Further, five FLDs were conducted in *rabi* maize with the application of Application of atrazine 50% WP + topramezone 336 g/l w/v SC (TM) 500+25.2 g a.i./ha PoE (15-20 DAS) and compared with Farmer's practice (IC *fb* HW at 20 & 40 DAS). The results indicated that the technology was more effective compared to farmers practice in *rabi* maize with higher B-C ratio (2.40).

The centre also conducted five FLDs in summer groundnut in 2024 by taking Fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% (RM) 250 g a.i./ha EPoE (10-15 DAS) *fb* IC+HW at 40 DAS as improved technology and compared with Farmer's practice (IC *fb* HW at 20 and 40 DAS). It was found that the technology has provided higher net return and B-C ratio (3.16) as compared to farmer's practice. Additionally, five demonstrations were conducted in wheat also wherein sulfosulfuron 75% + metsulfuron 5% WG (RM) 32 g a.i./ha PoE was the technology transferred and which was compared with farmers Practice (metsulfuron 20% WP 4 g a.i./ha).

The results indicated that the technology recorded higher WCE and gave higher yield, net return and B:C (2.42) as compared to farmers practice.

PDKV, Akola

Twenty FLDs were conducted on weed management in soybean. The improved technology involved the pre-emergence application of diclosulam 84% WDG, while the farmers' practice consisted of one hoeing and two hand weeding. The farmers' practice recorded a higher grain yield and gross monetary return compared to the improved technology. However, the benefit-cost ratio was comparable between the two (1.78 vs. 1.89), as the cost of cultivation was significantly higher in the farmers' practice than in the improved technology.

GBPUAT, Pantnagar

Eight FLDs were conducted at farmers' field during *Rabi* 2023-24 in U.S. Nagar district to demonstrate the competitive bio-efficacy of herbicides at farmers' field. The experiment comprised of clodinafop propargyl + metribuzin 175 g/ha (54+120 g/ha) at 30 DAS was executed under improved technology, whereas sulfosulfuron + MSM (30 g+2 g/ha) ready mix applied at 30 DAS farmer's technology. These two treatments were compared with weedy check for yield loss estimation. The area of each front-line demonstration was 4000m^2, and wheat varieties HD-2967, PBW 154, PBW 34, DBW-303 and UP-2425 were seeded. The major weeds infested the weedy plots were *Phalaris Minor, Medicago denticulata, Melilotus indica, Lathyrus aphaca, Solanum nigrum, Rumex acetosella, Fumaria parviflora, Anagallis arvensis, Coronopus didymus & Chenopodium album.* The reduction in grain yield due to uncontrolled weeds in weedy plots was 32.8%. An average increase in grain yield due to adoption of improved technology was 29.0 % higher than farmers' technology. The higher grain yield (4.64 t/ha), net return (Rs. 62261.70/ha) and benefit cost ratio (2.40) were recorded with improved technology. Further, to compare the performance of improved vis-a-vis farmers' technology in transplanted rice, seven front line demonstrations were conducted at farmers' field in U.S. Nagar district during *Kharif* season 2024. The trial comprised of cyhalofop butyl + penoxsulam 135 g/ha at 25 DAS applied as improved technology, whereas pretilachlor 50 % EC 750 g/ha (PE) was applied under farmers' technology within 3 days of transplanting. These two treatments were compared with weedy check for yield loss estimation. The area of each demonstration was 4000m^2 and rice variety Sarbati, Pusa basmati, PR-312 & Narendra veer 207 were transplanted in the trial. The major weeds infested the weedy check plots were *Echinochloa colona, Leptochloa chinensis, Digitaria sanguinalis, Panicum maximum, Ammannia baccifera, Commelina benghalesis, Cyperus rotundus, Cyperus iria* and *Fimbristylis miliacea*. The reduction in grain yield due to uncontrolled weeds in weedy plots was 26.3 %. An increase of 26.8% higher grain yields was recorded with improved technology over farmer's technology. The highest grain yield of (5.0t/ha), net return Rs. (98792.0/ha) and benefit cost ratio (2.49) was recorded with improved technology.

The centre also conducted two FLDs on soybean during *Kharif* 2024 in Nainital district. The area of each front-line demonstration was 4000m^2 and soybean variety PS-21 was seeded. The trial comprised of fluazifop-p-butyl 11.1% w/w+ fomesafen 11.1% w/w SL 250 g/ha (POE) under improved technology and imazethapyr 10% SL 100g/ha (POE) executed under as farmer's technology which were evaluated to find out the better efficacy on weeds and yield of soybean. The major weeds found in demonstration area were *Dactyloctenium aegyptium, Eleusine indica, Digitaria sanguinalis, Trianthema monogyna, Celosia argentea, Alternanthera sessilis, Mollugo pentaphylla, Digera arvensis* and *Cyperus rotundus*. The reduction in grain yield due to uncontrolled weeds in weedy plots was 26.7%. An increase of 7.10% higher grain yields was recorded with improved technology over farmer's technology. The highest weed control efficiency of (79.83%), grain yield (1.5 t/ha), net return (Rs. 41232.90/ha) and benefit cost ratio (2.28) was recorded with improved technology. Additionally, two FLDs on maize were conducted at farmers' field during *Kharif* 2024 in Nainital district. Topramezone 25.2 g/ha (PoE) was applied improved technology and atrazine 500 g/ha (PE) was taken as farmer's technology to compare the better efficacy of herbicides on weeds and yield of maize. The major weeds observed in demonstration field were *Digitaria sanguinalis, Eleusine indica, Echinochloa colona, Trianthema monogyna, Celosia argentea* and *Cyperus rotundus.* The reduction in grain yield due to uncontrolled weeds in weedy plots was 19.6%. An increase of 13.3% higher grain yield was recorded in improved technology as compared to farmer's technology. The highest weed control efficiency (78.4%), grain yield (5.10 t/ha), net return (Rs. 75802.58/ha) and benefit cost ratio (3.01) was recorded with improved technology. Three FLDs on sugarcane also were undertaken by the centre during *Spring* season of 2024 in Nainital district. The treatments were comprised of Ametryne 80 WDG 2.0 kg/ha PE improved technology, whereas 2,4-D Di methyl amine salt 58%SL 2.5 kg/ha 30 DAP was taken as the farmer's technology. For evaluation of yield losses caused by uncontrolled weeds an untreated plot was kept at each location. Post-emergence herbicide was applied by using 500 liters of water/ha with flat fan nozzle. The major weeds infested the field in weedy check plots were *Sorghum halepense*, *Digitaria sanguinalis, Eleusine indica, Alternanthera sessilis, Parthenium hysterophorus, Ageratum conyzoides, Ipomoea* spp and *Cyperus rotundus.* The reduction in grain yield due to uncontrolled weeds was 26.4% in weedy check plot while 6.3% increase in yield with the improved technology was observed. Among different weed management treatments, highest cane yield (100.20 t/ha), net returns Rs. (275605.00/ha) and benefit cost ratio (4.06) were achieved with the improved technology.

OUAT, Bhubaneswar

Ten FLDs on weed management in transplanted rice were conducted during *kharif* 2024. Application of Pretilachlor *fb* Bispyribac Sodium (750 g/ha *fb* 25 g/ha) was taken as improved technology, while one manual weeding at 25 DAT was considered as farmers' practice. The highest yield (4.5 t/ha) was obtained in the plots where the improved technology was applied, resulting in a 28.5% increase over the farmers' practice. The benefit-cost ratio of the demonstrated technology was 2.78, whereas it was 1.54 in the farmers' practice.

CCSHAU, Hisar

Two frontline demonstrations on integrated weed management in sugarcane were conducted in Karnal district. The application of pre-emergence sulfentrazone + clomazone (700 + 750 g/ha) was taken as the improved technology, while atrazine (2000 g/ha) represented the farmer's practice. The findings of the demonstrations indicated that the improved technology resulted in a cane yield of 41.05 t/ha, which was 7.3% higher compared to atrazine application.

MPUAT, Udaipur

Five demonstrations were conducted on weed management in maize during *Kharif* 2024. The data reveal that the maximum grain and straw yield was obtained with the application of atrazine *fb* topramezone 500 g/ha as PE + 25.2 g/ha at 3-4 leaf stage (15 DAS) by increasing about 17 percent over farmers practice in respect of grain yield of maize. Further, five FLDs were conducted on weed management in soybean with the application of imazethapyr + propaquizafop 125 g/ha PoE at 21 DAS (Tank mix). The improved technology resulted in higher seed yield (719 kg/ha) and haulm yield (574 kg/ha) compared to the farmer's practice. The centre also conducted five FLDs on broad spectrum weed control in wheat with premix application of sulfosulfuron+metsulfuron (30 + 2 g/ha) at 30 DAS; and five FLDs on mesosulfuron+idosulfuron methyl sodium -14.4 g/ha at 30 DAS. The farmers' field was infested with *Phalaris minor* among the monocots *Chenopodium album, Malwa parviflora, Spergula arvensis, Melilotus indica, Chenopodium murale& Convolvulus arvensis* were observed among dicots. Application of premix application of sulfosulfuron+metsulfuron (30+2 g/ha) at 30 DAS was recorded minimum weed density and weed dry matter as compared to farmers' practice with increased wheat grain yield by 15.09 per cent over farmers' practice. Whereas, application of ready-mix herbicide mesosulfuron + idosulfuron methyl sodium - 14.4 g/ha at 35 DAS was recorded minimum weed density and weed dry matter as compared to farmers' practice with increased wheat grain yield by 16.97 per cent over farmers' practice.

UAS, Bengaluru

Three FLDs each on Kodo millet and Foxtail millet were conducted during *Kharif* 2024 in Ramnagara district. The demonstrations evaluated the application of a post-emergence herbicide (metsulfuron methyl + chlorimuron ethyl 20% WP @ 4 g a.i/ha) as the improved technology. The farmers' practice involved one intercultural operation and hand weeding at 20 and 40 DAS. The results showed a 3.33% increase in yield over the farmers' practice in Kodo millet, with a B-C ratio of 1.32. In Foxtail millet, the yield increase was recorded at 5.93%, with a B-C ratio of 2.38. The beneficiaries were satisfied with the cost-effectiveness of weed management practices and the savings in weeding costs compared to the farmers' practice. The use of herbicides proved to be more effective in managing complex weed flora in these millet crops.

Table 4.2.1 Extension activities undertaken by coordinating centres

Sl. No.	Centre Name	Training imparted	Radio talk	TV programme	Kisan Mela/ Kisan Day	Handout/ folders/ pamphlets	Bulletins/ booklet	Training Participated	OFR	FLD	Parthenium awareness
1	PAU, Ludhiana	7	-	-	-	-	-	1	8	10	-
2	UAS, Bengaluru	6	-	2	-	-	-	14	2	6	√
3	RVSKVV, Gwalior	2	1	1	1	-	-	0	6	9	√
4	GBPUAT, Pantnagar	2	-	-	-	-	-	1	5	15	√
5	CSKHPKV, Palampur	9	-	-	-	-	-	1			√
6	AAU, Jorhat	-	-	-	-	-	-	-	-	-	-
7	AAU, Anand	5	3	-	-	-	-	1	1	4	√
8	TNAU, Coimbatore	1	1	-	-	-	-	2	5	5	√
9	KAU, Thrissur	27	-	-	-	-	-	4			√
10	OUAT, Bhubaneshwar	1	-	2	-	-	-		4	12	√
11	PJTSAU, Hyderabad	1		6	-	3		13	0	10	√
12	CCSHAU, Hisar	2	3	-	-	-	-	-	1	3	√
13	IGKV, Raipur	5	2		2	-	-		5	16	√
14	PDKV, Akola	2	-	-	-	-		9	8	30	√
15	BCKV, Kalyani	-	-	-	-	-	2				√
16	MPUAT, Udaipur	6	-	-	-	-	-	-			√
17	SKUAST, Jammu	-	-	-	-	-	-	-		55	√
	Total	**76**	**10**	**11**	**3**	**3**	**2**	**46**	**45**	**175**	

WP 4.3: Impact assessment of weed management technologies

AAU, Anand

Weed management technologies developed over the past seven years have been successfully demonstrated in farmers' fields. Additionally, awareness programs and training sessions on weed management have played a crucial role in promoting the adoption of these technologies across different crops. A survey conducted among farmers in the Anand district revealed that the weed management technology clodinafop propargyl 15% + metsulfuron methyl 1% WP in wheat has been adopted across 2,000 hectares, benefiting approximately 40% of the district's wheat growers. This adoption has resulted in an average yield increase of 360 kg/ha and a cost saving of ₹ 4,882 per hectare. Further, another survey conducted in the Dahod district revealed that the weed management technology propaquizafop 2.5% + imazethapyr 3.75% w/w ME in soybean has been adopted by 30% of the farmers in the district. This technology has resulted in a yield increase of 260 kg/ha and a cost saving of Rs. 10,980 per hectare.

In the Chotaudepur district, 30% of farmers have adopted the early post-emergence (10–15 DAS) application of imazethapyr 100 g/ha, followed by IC + HW at 40 DAS in summer groundnut, covering an area of 1,200 hectares. The yield increase due to this technology was about 4.1 q/ha, and the cost savings in weed management was around Rs. 5,374 per hectare. Additionally, in the same district, 45% of cotton farmers have adopted pendimethalin 900 g/ha, followed by IC + HW at 30 and 60 DAS, covering 76,300 hectares. This practice has led to a yield increase of 1.24 quintals per hectare and a cost savings of Rs. 4,128 per hectare. Another survey among maize farmers in Chotaudepur showed that 10% of the farmers have adopted the weed management technology atrazine 500 g a.i./ha + topramezone 25.2 g a.i./ha, covering approximately 2,600 hectares. This adoption has resulted in a yield increase of 3 quintals per hectare and a cost saving of Rs. 6,859 per hectare.

GBPUAT, Pantnagar

The centre has developed and disseminated several weed management technologies across different crops, which have been adopted by farmers in significant numbers. In wheat, the technology "carfentrazone ethyl 40% DF @ 20 g/ha OR 2,4-D DMA salt 58% SL @ 0.5–0.75 kg/ha OR 2,4-D Ethyl ester 38% EC @ 0.5 kg/ha" was adopted by 20% of farmers, covering 22,000 ha of cropped area. This resulted in a cost saving of Rs. 4,276/ha in weed management and a yield increase of 25 q/ha. In rice, the technology "butachlor 50% EC *fb* bispyribac Sodium 10% SC" was adopted by around 20% of farmers, covering 42,000 ha. It led to a yield increase of 2.8 t/ha and a cost saving of Rs. 3,100/ha.

In soybean, "imazethapyr 10% SL" was adopted by about 25% of farmers, covering 875 ha, resulting in a yield increase of 13 q/ha. In maize, the technology "tembotrione 34.4% SC" was adopted over 20,000 ha, showing a yield increase of 2.7 t/ha and weed management cost savings of Rs. 2,000/ha. In sugarcane, "atrazine 50% WP *fb* one hand weeding OR one hoeing" was adopted on 20,500 ha, demonstrating a yield increase of 4.20 t/ha and a cost saving of Rs. 3,500/ha in weed management.

CCSHAU, Hisar

The weed management technology in wheat, "pyroxasulfone and pyroxasulfone + pendimethalin," recommended by the centre, has been widely adopted by farmers in the district. The approximate area coverage of this technology was 0.6 mha, and nearly 70% of wheat-growing farmers adopted it, realizing an increase of around 700 kg/ha in yield. It was also assessed through partial budgeting that the application of pyroxasulfone leads to a benefit of Rs. 15,000 per hectare compared to the post-emergence application of clodinafop.

OUAT, Bhubaneswar

A study on the 'Impact analysis of weed management technologies' was carried out in coastal districts by surveying 250 farmers. One additional application of the post-emergence herbicide bispyribac Na 0.02 kg/ha at 25 DAS provided a 13–18% increase in yield with an average cost saving of Rs. 2,500 per hectare. The approximate area covered by this technology in these districts was 16,650 hectares, and approximately 9% of rice growers adopted it to control weeds in rice. The cost of the product and the ineffectiveness of the herbicide against perennial weeds were the major constraints that hindered adoption. Another survey conducted in a western district in Odisha among 200 farmers revealed that the application of (RM) bensulfuron methyl+pretilachlor 0.66 kg/ha as a pre-emergence (0–2 DAT) treatment in rice resulted in a yield increase of 18–20%, with an average cost saving of Rs. 3,000 per hectare. The approximate area coverage of this technology in these districts was 8,650 hectares, and around 32% of farmers adopted the technology.

AAU, Thrissur

A study was conducted to assess the impact of weed management technologies adopted by farmers in Kerala. Data were collected using a pre-tested questionnaire from farmers in the districts of Thrissur, Ernakulam, Malappuram, and Palakkad. The survey gathered information on various aspects, including socio-economic status, landholding size, cultivation practices, linkages with formal institutions, access to weed management technologies from different agencies, economic implications, and constraints in adoption. Analysis of the data revealed that the majority of respondents (80%) were aged between 50 and 75 years, while 15% were younger than 50. Only 5% of farmers involved in agriculture were above 75 years of age. Additionally, 82% of the respondents engaged in farming were men, while 18% were women. Regarding landholding size, 55% of the respondents were marginal farmers (owning less than 1 hectare of land), 25% were small farmers, 15% were medium farmers, and 5% were large farmers.

The management method recommended for *Salvinia* in rice fields was adopted by 25% of farmers, covering approximately 20 hectares of cultivated area. This management practice resulted in a cost saving of about Rs. 2,000 in weed control and a yield increase of 2.6 t/ha. Another recommended technology was for the management of *Limnocharis* in rice fields. Around 35% of farmers adopted this practice, covering an area of 30 hectares. The cost saving in weed management was approximately Rs. 25,000, with a yield increase of about 1.8 t/ha. The management of *Isachne* in rice fields was another technology recommended by the center, adopted by 30% of rice growers in these districts, covering around 25 hectares. This practice resulted in a yield increase of about 2.8 t/ha and a cost saving of approximately Rs. 10,000/ha. The use of a combination herbicide (penoxsulam+butachlor) for weed management in transplanted rice was another technology disseminated among farmers. Around 75% of farmers adopted this practice, covering an area of 7,000 hectares. The cost saving was approximately Rs. 10,000, and the yield increase was around 1.6 t/ha. Liming for the management of aquatic weeds in rice fields was another important technology demonstrated and disseminated by the centre. Around 15% of farmers adopted this practice, covering an area of 20 hectares. The cost saving in weed management was approximately Rs. 20,000/ha, with a yield increase of around 0.5 t/ha. The major constraints farmers faced in adopting these weed management technologies included labour unavailability, staggered and localized infestation in fields, and the lack of good-quality liming material in the market.

MPUAT, Udaipur

The center surveyed seven districts *viz.* Udaipur, Rajsamand, Dungarpur, Banswara, Chittorgarh, Pratapgarh, and Bhilwara to assess the impact of nine weed management technologies developed and disseminated by the centre. The key findings of the study indicated that the technology involving the post-emergence application of carfentrazone-ethyl+sulfosulfuron (premix) at 45 g/ha at 35 DAS in wheat led to a 40% increase in yield. Approximately 25–30% of farmers in the district adopted this technology, covering an area of 500 hectares. Furthermore, the Stale Seed Bed technique followed by plastic mulch (25 microns) at sowing for organic weed management in fennel was adopted by around 10% of farmers, covering approximately 100 hectares. This technology resulted in a 71% yield increase compared to unweeded plots. Similarly, soil solarization with plastic mulch at sowing in organically grown sweet corn proved highly effective in reducing weed populations and maximizing green cob yield. The technology was adopted by about 10% of farmers, covering around 300 hectares, leading to a 66% yield increase over unweeded plots.

PAU, Ludhiana

The centre assessed the impact of the technology “Pre-emergence application of a ready mix of pendimethalin 40% + metribuzin 8% at 1080 g/ha in wheat” and found that it resulted in a yield increase of

0.9 q/ha and a cost saving of approximately Rs. 2,138/ha in weed management. Additionally, the centre disseminated the "surface seeder" technology among farmers, which led to a cost saving of Rs. 1,500/ha in weed management, although it did not show any yield improvement over conventional practice.

RVSKVV, Gwalior

The centre conducted a survey with the help of KVKs to assess the impact of weed management technologies released by the centre. For data collection, visits were made to various villages across the following 17 districts of Madhya Pradesh: Gwalior, Bhind, Morena, Datia, Shivpuri, Sheopur, Guna, Ashoknagar, Dewas, Khandwa, Alirajpur, Jhabua, Mandsaur, Neemuch, Ratlam, Dhar, and Agar Malwa. During the data collection, group discussions were also held with farmers to gather information regarding the adoption of the released technologies. The technology "oxyfluorfen 0.23 kg/ha PE" in mustard was adopted by 8% of the farmers, covering 13% of the cropped area. The technology "atrazine 500 g/ha PE *fb* 2,4-D 500 g/ha PoE" in pearl millet was adopted by around 34% of the farmers, covering 38% of the cropped area. Similarly, in greengram, the technology "imazethapyr + imazamox (RM) 80 g/ha PoE" was adopted by about 20% of the farmers, covering 24% of the cropped area, while "pendimethalin + imazethapyr 750 g/ha" was adopted by 10% of the farmers, covering around 12% of the cropped area.

SKUAST, Jammu

Weed management technologies in different crops have been disseminated among farmers over the years and have been adopted by a considerable number of them. For instance, the technology "tembotrione 100 g/ha + atrazine 500 g/ha at 15–20 DAS" in maize was adopted by 19% of farmers, covering an area of 70,000 ha. In wheat, "clodinafop-propargyl + metsulfuron (60 + 4 g/ha) at 30–35 DAS" was taken up by 13% of farmers, covering a cropped area of 1,55,000 hectares. Similarly, in rice, the technology "triafamone + ethoxysulfuron 66.5 g/ha at 25 DAT" was adopted by 22% of farmers, spread across 31,000 ha of cropped area. In DSR, the technology "pendimethalin 1000 g/ha (PRE) *fb* bispyribac-sodium 25 g/ha" was adopted by 22% of farmers, covering an area of 500 ha.

TNAU, Coimbatore

The impact of the weed management technology "PE application of oxyfluorfen 23.5 EC @ 0.25 kg/ha + hand weeding at 30–35 DAP" in onion was assessed through surveys and discussions with farmers. Data was collected from a sample of 150 farmer respondents in the Dharapuram and Pongalur blocks of Tiruppur district. Farmers reported that the adoption of this technology effectively controlled weeds during the early stages of the crop, thereby reducing the need for intensive manual weeding later. This led to significant savings in labour costs and contributed to increased net returns. The technology was found to be a practical and viable option for weed management in onion cultivation. It covered approximately 6.7% of the cropped area. Adoption of this technology resulted in a cost saving of Rs. 18,865/ha in weed management and an increase in onion yield by about 2.9 t/ha.

4. RECOMMENDATIONS FOR PACKAGE OF PRACTICES

AAU,Anand

- In DSR, application of pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g a.i./ha as PE *fb* florpyrauxifenbenzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g a.i./ha PoE (25 DAS), pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g a.i./ha as PE *fb* bispyribac-sodium 38% + chlorimuron ethyl 2.5%+ metsulfuron methyl 2.5% (w/w) WG 43 g a.i./ha (RM) PoE (25 DAS), penoxsulam 1% + pendimethalin 24% SE (RM) 625 g a.i./ha as PE *fb* fenoxaprop-ethyl 6.7% EC 67 g a.i./ha + ethoxysulfuron 15% WDG (RM) 18 g a.i./ha (tank-mix) as PoE (25 DAS) and florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g a.i./ha PoE (18-20 DAS) were found effective for weed management with higher net returns.
- Soil solarization *fb* hand weeding + straw mulch 5 t/ha at 20 DAS + HW at 50 and 75 DAS, soil solarization *fb* plastic mulch at sowing *fb* HW at 50 and 75 DAS, stale seed bed preparation *fb* plastic mulch at sowing *fb* HW at 75 DAS and stale seed bed preparation *fb* hand weeding + straw mulch 5 t/ha at 20 DAS *fb* hand weeding at 50 and 75 DAS recorded higher weed control efficiency and sweet corn equivalent green cob as well as green fodder yield.
- Application of pendimethalin 30% EC 500 g a.i./ha at 10 DAS and pendimethalin 30%+imazethapyr 2% EC 640 g a.i./ha at 10 DAS were found effective for *Cuscuta* management in Lucerne with higher green fodder production.
- In chickpea, twice interculturing *fb* hand weeding at 20 and 40 DAS, topramezone 336 g/l w/v SC 20 g a.i./ha PoE *fb* HW at 40 DAS, topramezone 336 g/l w/v SC 20 g a.i./ha EPoE *fb* HW at 30 DAS, topramezone 336 g/l w/v SC 15 g a.i./ha PoE *fb* HW at 40 DAS and pendimethalin 30% EC 500 g a.i./ha + oxyfluorfen 23.5% EC 120 g a.i./ha PE (TM) *fb* HW at 40 DAS found effective for weed management with higher net returns and B:C.
- In *kharif* groundnut, twice interculturing *fb* hand weeding at 20 and 40 DAS, quizalofop ethyl 7.5% + imazethapyr 15% w/w EC (RM) 90 g a.i./ha *fb* IC + HW at 40 DAS, propaquizafop 2.5% + imazethapyr 3.75% w/w ME (RM) 125 g a.i./ha *fb* IC + HW at 40 DAS and diclosulam 84% WDG + pendimethalin 30% EC (tank mix) 25.2+500 g a.i./ha *fb* IC + HW at 40 DAS were found effective for weed management with higher B:C.
- In *kharif* blackgram, IC *fb* HW at 20 and 40 DAS, propaquizafop 2.5% + imazethapyr 3.75% w/w ME 125 g a.i./ha PoE, quizalofop ethyl 7.5% + imazethapyr 15% w/w EC 112.5 g a.i./ha PoE, sodium acifluorfen 16.5% + clodinafop propargyl 8% EC 245 g a.i./ha PoE and pendimethalin 30%+imazethapyr 2% EC 800 g a.i./ha PE (RM) were found effective for weed management with higher net returns.

- In rice nursery, application of pretilachlor 30.0% + pyrazosulfuron-ethyl 0.75% WG (RM) 600 + 15 g a.i./ha PE, penoxsulam 1.02 % + cyhalofop-butyl 5.1% OD 120 g a.i./ha PoE, triafamone 20% + ethoxysulfuron l0% WG 44 + 22.5 g a.i./ha PoE and oxadiargyl 80% WP 90 g a.i./ha PE were found effective for the management of complex weed flora with higher net returns.
- Farmers' Practice (IC *fb* HW at 20 and 40 DAS) higher yield but benefit cost ratio was observed higher under application of propaquizafop 2.5% + imazethapyr 3.75% w/w ME 125 g a.i./ha (RM) in groundnut OFT.
- Application of propaquizafop 2.5% + imazethapyr 3.75% w/w ME (RM) 125 g a.i./ha (20 DAS) and farmers practice (IC *fb* HW at 20 and 40 DAS) were equally effective for management of weeds in soybean FLD.
- In *Rabi* maize, application of atrazine 50% WP + topramezone 336 g/l w/v SC (TM) 500+25.2 g a.i./ha PoE (15-20 DAS) found equally effective as farmers practice (IC+HW at 20 and 40 DAS).
- In summer groundnut, application of fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% (RM) 250 g a.i./ha EPoE (10-15 DAS) *fb* IC+HW at 40 DAS found equally effective as farmers practice (IC+HW at 20 and 40 DAS) with higher B:C (3.15).
- In wheat, application of sulfosulfuron 75% + metsulfuron 5% WG (RM) 32 g a.i./ha PoE recorded higher WCE and gave higher yield, net return and B:C as compared to farmers practice metsulfuron 20% WP 4 g a.i./ha (2.31).

CSKHPKV, Palampur

- Application of tembotrione 120 g / ha as PoE along with surfactant (1000 ml / ha) at 2-3 leaf stage of weeds in maize can be adopted for effective weed management in maize.
- Application of topramezone 25.2 g / ha along with atrazine 750 g/ha at 2-3 leaf stage of weeds in maize can be adopted for effective weed management in maize.
- In transplanted rice application of pretilachlor 800 g / ha along with safener at 4 days after transplanting gave effective control of weeds.
- In case of wet direct-seeded rice pretilachlor 800 g / ha along with safener at 2 days after sowing gave effective control of weeds.

GBPUAT, Pantnagar

- Weed management in dry direct-seeded rice (DSR), highest grain yield (5.1 t/ha) achieved under pretilachlor 30.0% + pyrazosulfuron ethyl 0.75% WG 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (25 DAS).
- Comparative assessment of bio-efficacy of herbicides applied through drone and knapsack sprayer/power sprayer in transplanted rice, highest grain yield (5.3t/ha) achieved under application of florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC (RM) 150 g/ha.
- Weed management in rice-wheat-legume cropping system under establishment method highest wheat grain yield (4.9 t/ha) achieved with DSR (CT+R)-wheat (CT+R)- GM (CT+R) Among weed

management treatments clodinafop+ metsulfuron 64 g/ha (30 DAS) *fb* HW (45 DAS) recorded highest grain yield (5.3 t/ha).

- In direct-seeded rice, grain yield (3.7 t/ha) achieved with DSR (CT+R)-wheat (CT+R)- GM (CT+R). Among weed management treatments both treatments pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 67.5 g/ha (20 DAS) and pendimethalin 678 g/ha (2 DAS) *fb* bispyribac sodium 25 g/ha (20 DAS) *fb* hand weeding (40 DAS) *fb* weed seed harvest recorded highest grain yield (4.1 t/ha).
- Weed management in organically grown rice-based cropping system Rice–Veg. Pea- Sweet corn in organically grown veg-pea during 2023-24 the highest pod yield (8.13 t/ha) was obtained with transplanted rice establishment method, whereas in weed management, highest pod yield (7.83t/ha) was recorded under MW (one pass of conoweeder at 25 DAT) *fb* one HW (45 DAS).
- Under comparison of natural, organic and conventional farming of weed management in rice-veg. pea- sweet corn cropping system, the highest veg-pea, sweet corn and grain yield of rice (7.8 t/ha), (16.9t/ha) and rice (4.1 t/ha) respectivily was achieved with conventional farming followed by organic farming followed by natural farming.
- Management of resistant *Phalaris minor* and other weeds with new herbicide combination highest wheat grain yield (5.7 t/ha) achieved with conventional tillage (without residue) under tillage and residue management. Among weed management treatments pinoxaden at 50 g+metribuzin at 175 g/ha (PoE) recorded highest wheat grain yield (6.3 t/ha).
- Weed management in transplanted finger millet, highest grain yield (1.79 t/ha) achieved under pretilachlor + bensulfuron 600g/ha (PE) followed by other treatment.

IGKVV, Raipur

- Paddy straw mulch 5 t/ha or keeping the field with stale seed bed *fb* HW at 20 and 40 Days after planting are capable to produce profitable tomato yield with highest B:C even more than black polythene mulch (20 μ thickness).

MPUAT, Udaipur

- Application of pre-emergence spray of oxadiargyl 6 EC at 75 g/ha followed by post-emergence quizalofop-ethyl 5EC at 40 g/ha for effective weed control in till crop.
- Application of oxadiargyl 50 g/ha PoE (25 DAS) *fb* HW at 50 DAS gave maximum seed yield with minimum weed density in Isabgol.
- Post–emergence application of carfentrazone-ethyl + sulfosulfuron (Premix) at 45 g /ha at 35 DAS in wheat.
- Application of imazethapyr 10+ propaquizafop 10 (Tank Mix) 60+75 g/ha *fb* IC + Hand Weeding at 40 days after sowing for weed management in groundnut.

PAU, Ludhiana

- Post emergence application of Novixid 3.25 OD (florpyrauxifen-benzyl 12.5 g/L + penoxsulam 20 g/L) at 1250 ml/ha at 20-25 days after transplanting of rice provides effective control of weeds and gain higher net return.

- Post emergence application of Eketsu 43% WG (bispyribac sodium 38% + metsulfuron methyl 2.5% + chlorimuron ethyl 2.5%) at 100 g/ha provides effective weed control in direct seeded and transplanted rice.
- Post-emergence application of imazethapyr 10 SL @ 300 ml per acre at 20-25 days after sowing of summer mungbean gave effective weed control in summer moongbean.
- Post emergence application of Novlect 12 EC (florpyrauxifen-benzyL 20g/L + cyhalofop 100g/L in direct seeded rice provided effective control of weeds and higher yield as compared to Nominee Gold at 250 ml/ha.
- Pre-emergence application of PEPE 25% SE (ready mix of penoxsulam 1% + pendimethalin 24%) in direct seeded rice provided effective weed control and grain yield as compared to Stomp 30 EC (pendimethalin) at 1.0 l/a.

SKUAST, Jammu

- Clodinafop-propargyl + metsulfuron (60 + 4 g/ha) and sulfosulfuron + carfentrazone 25+20 g/ha at 30 DAS were found most suitable for weed management in conventional and zero- till wheat.

TNAU, Coimbatore

- PE application of pyrazosulfuron-ethyl 10 WP 20 g/ha *fb* penoxsulam 1.02 + cyhalofop butyl 5.1 OD 135 g/ha at 25 DAT for *kharif* season in transplanted rice has been recorded higher WCE and BC Ratio.
- Under transplanted rice, PE application of bensulfuron-methyl 0.6% + pretilachlor 6% GR 660 g/ha *fb* bispyribac sodium 10 SC 25 g/ha at 30 DAT for *rabi* season was found lower weed density and higher net return.
- In groundnut, EPoE application of imazethapyr 10 SL + quizalofop-ethyl 5 EC (TM) (50+50) g/ha *fb* hand weeding 30 - 35 DAP was suitable option to control different weed flora.
- Application of glyphosate 15 g, ammonium sulphate 20 g and 2ml soap solution or glyphosate 10 g and 2,4 D sodium salt 8 g per litre of water have been found effective control on rosette stage of parthenium in non-cropped area.
- Pre-emergence application of pretilachlor 50 EC 0.75 kg/ha *fb* EPoE application of penoxsulam 1.02% + cyhalofop butyl 5.1% OD 135 g/ha or bispyribac sodium 10 SC 25 g/ha was effective management of *Leptochloa chinensis* in direct wet-seeded rice.
- Application of glyphosate 41 SL 30 or 40 ml or its combination with 2,4 - D Na salt 80 WP 10g / Litre of water *was* effective management *Prosopis juliflora* in non-cropped areas.

BCKV, Kalyani

- Pretilachlor 750 g/ha as pre-emergence *fb* bispyribac-Na 25 g/ha as post emergence at 25 DAT was more effective weed management in transplanted rice rice.
- Oxyfluorfen 150 g/ha pre-plant incorporation *fb* quizalofop 50 g/ha at 30 DAT was suitable option for weed control in cabbage.
- Application pendimethalin 0.75 kg/ha at 0-3 DAS *fb* quizalofop ethyl 50 g/ha at 20 DAS was effectively control for weed in cowpea.

- In maize, application of topramezone+ atrazine (25.2+500) g/ha EPoE *fb* IC + HW at 40DAS has been found best in respect to weed management and crop yield.
- Use of Nail weeder- 1st at 5-6 DAE and 2nd at 15 DAE + one hand weeding (within the row) at 25 DAE can be a very good option of weed management in jute.
- Lowest weed pressure, higher yield of sugarcane, and benefit-cost ratio are possible with the application of atrazine 2.0 kg/ha *fb* metsulfuron + carfentrazone (RM) 25 g/ha PE *fb* PoE-60 DAP.

OUAT, Bhubaneswar

- In maize, application of atrazine 1kg/ha at 2 DAS *fb* tembotrione 120 g/ha at 20 DAS & 1 HW at 40 DAS is highly effective in controlling the mixed flora of weeds under ZT system.

PDKV, Akola

- Application of imazethapyr + imazamox 0.070 kg/ha PoE 15 DAS was the most effective herbicide for controlling the weed flora and getting higher yield and economic returns in soybean.
- In cotton, application of pendimethalin 1.00 kg/ha as a PE followed by directed spray (by using a protective shield) of non-selective herbicide paraquat 0.60 kg/ha at 45 days was controlling weeds with higher yield and monetary returns.
- In maize pre-emergence application of atrazine 0.50 kg/ha followed by post emergence application of tembotrione 0.120 kg/ha at 20DAS were the most remunerative and effective herbicides for controlling the weed flora and getting higher yield and economic returns.
- Post-emergence application of imazethapyr + imazomox 0.07 kg/ha 20 DAS was the most remunerative and effective herbicide for controlling the weed flora and getting higher yield and economic returns in groundnut.
- In turmeric pre-emergence application of pendimethalin 1 kg/ha or by metribuzin 0.7 kg/ha or atrazine 0.75 kg/ha (0-5 DAP) *fb* straw mulch 10 t/ha (10 DAP) *fb* one HW (75 DAP) is recommended for controlling weeds with higher yield and monetary returns.
- Post emergence application of clodinafop propargyl+ metsulfuron methyl 0.06 + 0.004 kg/ha or sulfosulfuron + metsulfuron Methyl 0.03 + 0.002 kg/ha at 35 DAS were the most remunerative and effective herbicides for controlling the weed flora and getting higher yield and economic returns in wheat.
- Post-emergence application of propaquizafop 0.050 kg + imazethapyr 0.075 kg/ha at 21 DAS or pre-emergence application of diclosulam 84% WDG 0.026 kg/ha was more effective weed management in soybean for higher seed yield and economic returns.

UAS, Bengaluru

- Post-emergence application of metsulfuron methyl + chlorimuron ethyl 20 WP at 4 g/ha effectively controlled weeds in Kodo millet.
- In soybean, application of diclosulam 84 WDG 22 g/ha as a (PE) and application of fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 150 g/ha as a (PoE) were found more effective to control complex weed flora.
- Application of sulfentrazone 28% + clomazone 30% WP (RM) @ 725 g/ha as a (PE) and sodium acifluorfen 16.5% + clodinafop propargyl 8% EC @ 245 g/ha as

(PoE) was effective in controlling weeds in soybean.

RVSKVV, Gwalior

- Application of atrazine (500 g/ha) PE with mechanical weeding at 30 DAS and atrazine + mesotrione (RM) PoE can contribute to decreasing narrow and broad-leaved weeds.
- Application of early post emergence atrazine + topramezone (tank mix) (750 + 25.2) g/ha, can contribute to decrease narrow and broad-leaved weeds and higher productivity and profitability of maize under maize- chickpea cropping.
- Pendimethalin + imazethapyr (RM) 750 g/ha as PE *fb* HW at 40 DAS was recorded higher WCE, productivity and profitability of chickpea under maize-chickpea cropping system.
- One hand weeding at 20 DAS *fb* straw mulch (5 t/ha) at 25 DAS, got profitable economically and increase the productivity and profitability of sweet corn in maize-based cropping system.
- Application of imazethapyr 40 g/ha after first cut *fb* imazethapyr 50 g/ha after last and EPoE application of pendimethalin 500 g/ha at 10 DAS can contribute to decrease *Cuscuta infestation* and provide higher productivity and profitability of berseem crop.

CCSHAU, Hisar

- In DSR, spray 1000 ml penoxsulam 1%+pendimethalin 24% (PE 25% SE) with water volume of 200 liter per acre in moisture soil (0-3 days after sowing).
- In the rice-wheat cropping system, super seeder may be used for paddy straw management by incorporating paddy straw in soil and simultaneous sowing of wheat in SMS equipped combine harvested paddy fields.

5. SCHEDULED CASTE SUB-PLAN (SCSP)

CSKHPKV, Palampur

Under the Scheduled Caste Sub Plan scheme, the centre conducted three awareness programmes during the period. These programmes were conducted in Sornu (Chamba), Bharog (Chamba) and Rajehar (Kangra) villages in the month of January and February 2024. Out of total farmers attended the programmes (40 farmers), 29 were the female farmers.

GBPUAT, Pantnagar

During the period, centre organized various training programme under the scheme for SC farmers. Details are given in **(Table 5.1)**. In these training programmes, issues related to weed management and general agronomical practices in different crops were discussed and accordingly solutions were provided to the farmers. In addition to this, various agricultural inputs such as sprayer, fertilizer and herbicide were also distributed among the farmers to motivate them for adoption of weed management technologies. Under the scheme, demonstration was also done on herbicide application through drone in farmers' fields of 80.5 acre areas.

Table 5.1

S. N.	Date	Village name	Name of Training programme	Participant No.	Beneficiaries	
					Male	Female
1	01.03.2024	Jaipur Bisa, Distt.-Nainital	Weed Management in *Kharif* crop	150	80	70
2.	19.03.2024	Prateetpur, Distt-Dehradun	Weed Management in major crops	100	60	40
3.	20.03.2024	Jaswa wala, Teliwala, & Dhanaura, Distt-Haridwar	Weed Management in major crops	100	65	35
4.	20.08.2024	Haripur bacchi, Halduchaur Distt-. Nainital	Weed management in Major/ *Kharif* crops	141	71	70
5.	21.08.2024	Parma, Halduchaur Distt. -Nainital	Weed management in Major/ *Kharif* crops	117	80	37
6.	22.12.2024	Rudrapur, Distt- U.S. Nagar	*Phalaris* and other weed Management in Wheat crop	60	60	-

In these training programmes, issues related to weed management and general agronomical practices in different crops were discussed and accordingly solutions were provided to the farmers. In addition to this, various agricultural inputs such as sprayer, fertilizer and herbicide were also distributed among the farmers to motivate them for adoption of weed management technologies. Under the scheme, demonstration was also done on herbicide application through drone in farmers' fields of 80.5 acre areas.

CCSHAU, Hisar

Under the scheme, centre organized one day training programme on "Cultivation of summer green gram" and also distributed herbicide and green gram seed to SC farmers of the villages Laloda and Ludas during March, 2024.

KAU, Thrissur

During the period, centre distributed agricultural inputs such as herbicide, pesticide and sprayers to the SC farmers of adopted villages under the scheme.

OUAT Bhubaneswar

Centre adopted two scheduled caste dominated villages viz. Morda, Jagatsinghpur & Denuan sahi, Nimapada, Puri under the scheme. In these villages, an agricultural input distribution programme was organized where sickle, herbicide (pendimethalin), spade and hoe were distributed to the SC farmers. One awareness cum training programme was also conducted for the farmers of these villages.

- Villages selected: (2 SC dominated),
- 70 farm families
- Activity: Distribution of farm implements mostly related to weed management:
  1. Sickle (Falcon),
  2. Pendimethalin,
  3. Spade (TATA),
  4. Hoe (Khurpi)
- Conducted awareness training programmes.

RVSKVV, Gwalior

Very poor and below poverty line SC farmers were selected as the beneficiaries of the scheme. Agricultural inputs such as seed (greengram, wheat & chickpea), fertilizers (NPK 12:32:16, Rhizobium, Urea & SSP) and herbicides (Pendimethalin + imazathaypr, clodinafop + metsulfuron and pendimethalin) for one acre area were distributed among 27 SC farmers and 13 spray pumps with battery were distributed among 13 farmers of different villages

6. LINKAGES AND COLLABORATION

Name of the centre	Linkages and collaboration Name of the institute	Nature of linkages and collaboration
CCSHAU, Hisar	• IRRI and many multinational companies. • State Department of Agriculture, Haryana.	• All the recommendations in pipe line are tested at farmers' fields by extension officers of KVK's and Department of Agriculture, Haryana
CSKHPKV, Palampur	• Department of Agriculture, HP • KVKs of CSKHPKV, Palampur • AICRP on Agrometeorology • NICRA – AICRPAM • Rainbow Agrosciences • Corteva Crop India Private Ltd • IFFCO	• Resource person for trainings and guidance on crop production and weed management • Resource person for crop production and weed management • Principal Investigator (till 31st March 2024) • Principal Investigator (till 31st March 2024) • Testing of glufosinate ammonium in tea • Testing of Saflufenacil in tea • Testing of herbicides in rice • Testing of tiafenacil in non – cropped areas • Testing of glufosinate ammonium in tea • Testing of nano fertilizers in different crops • Testing of bio stimulants in rice
GBPUAT, Pantnagar	• State Agriculture Universities • Member of advisory committee, Plant protection of district of U.S. Nagar /Industries • Member of Agromet advisory Services, GBPUA&T Pantnagar • Bayer crop science, Mumbai • Syngenta India Limited, Pune, Maharashtra • FMC • Anglo American India Pvt. Ltd. • PI industries Pvt Ltd. • UPL Pvt. Ltd.	• Advice on weed management • Research on weed management in different crop and cropping system
IGKVV, Raipur	• AICRP- IFS and NPOF • 20 Krishi Vigyan Kendra's • Department of Agriculture, Government of Chhattisgarh	• For Weed control advisory • Invited as technical expert to extend the Drone technology for weed control with herbicide with demonstration
KAU, Thrissur	• Department of Agriculture Development and Farmers Welfare, Kerala • Krishi Vigyan Kendras in various districts • Kerala State Landuse Board • Agricultural Research Station, Mannuthy, Rice Research Station, Vyttila, Cashew Research Station, Madakkathara, • Pesticide residue lab	• Identification of field problems, Transfer of technology/ TrainingsOFTs and FLDs, Beneficiary selection for SCSP Training • Transfer of technology/ Trainings, Farmers' field trialsand FLDs, Beneficiary selection for SCSP • Weed Atlas • Station trials, Transfer of technology and network trials • Herbicide residue studies • Alien Weeds, algal taxonomy, advanced analytical facilities

	• Kerala Forest Research Institute, Peechi • Kerala State Biodiversity Board	• Awareness programme
MPUAT, Udaipur	• AICRPs & AINPOF • Government and University • Private industries • Rajasthan College of Agriculture, Udaipur	• Organic weed management in sweet corn-Fennel cropping system. • Scientist of AICRP on IFS are associated for conducting Benchmark Survey, FLDs and OFR. • Syngenta India Ltd. Evaluation of Epivio Energy (product of natural origin) for use in Soybean as seed treatment for supporting plant growth & Yield Enhancement • Gharda Chemicals Pvt. Ltd., Dombivali, Dist Thane, (Mh) A New Herbicide molecule evaluation on cotton. • M/s ISK Biosciences India Pvt. Ltd, New Delhi Bio-efficacy of SL-950 6% OD in Maize crop against weeds and its effect on succeeding crop during upcoming Kharif (5.0 lakh) • I.S.K. Biosciences India Pvt. Ltd., New Delhi. A New Herbicide molecule evaluation on maize. • BAYER Crop Science Limited, Thane, Maharashtra, A New Herbicide molecule evaluation on wheat • UPL Pvt. Ltd. Mumbai: Discussion, Field visit and Research on New molecule evaluation on cotton, Soybean, sugarcane and funding source. • Gharda Chemicals Pvt. Ltd., Dombivali, Dist Thane, (Mh) A New Herbicide molecule evaluation on maize. • To conduct research trials and capacity building programme & other activities of college
PAU, Ludhiana	• AINP on Organic Farming (NPOF)	• Organically raised sugarcane-ratoon system trial
TNAU, Coimbatore	• AICRP-IFS • NOFRC, TNAU, Coimbatore	• Study of the weed dynamics in the on-Station IFS Research.
UAS, Bengaluru	• NBSS&LUP	• Getting information of soil profile for weed atlas preparation.
PJTSAU, Hyderabad	• ICAR-CRIDA • ICAR-IIRR • AICRP on Maize • AICRP on Groundnut • AICRP on Rice • AICRP-FIM • AICRP on IFS • NIPHM • MANAGE	• Evaluation of impact of elevated CO_2 and temperature on crop and weed interaction, dynamics and herbicide bio-efficacy • The microbial dynamics in CA systems and soil microbiome analysis • Herbicide application in maize with Drones • Palem in conducting trials on "herbicide application in groundnut with Drones • Identifying suitable nozzles to be used for application of herbicides with drones

		• IFS models developed by AICRP on IFS • IWM in various crops and cropping systems • IWM in crops and cropping systems, herbicide residues and ecological impact
OUAT, Bhubaneswar	• Directorate of Weed Research (ICAR), Jabalpur, M.P • Other AICRPs operating at the University • KVKs/RRTTS • Department of Agriculture, Govt. of Orissa • Public sectors like SAIL, HAL, NTPS, Indian Rare-earth Ltd, Chilika Development Authority • ICAR Institutes operating in the state (NRRI, IIWM, CIFA, CTCRI, CHESS, CIWA) • NGOs and farmers of different district of the state • DDA (Plant Protection)	• Exploring the laboratory facilities of NRRI, Cuttack for need based herbicide residue analysis. • Preparing Weed Atlas for the state • Conducting massive field demonstration in collaboration with the govt. departments • Exploring different weed management options in natural farming areas of tribal districts
PDKV, Akola	• State Department of Agriculture and ATMA • ZP and Panchayat Samiti • Akola Municipal Corporation • Central Salt and Marine Chemicals Research Institute, Bhavnagar, Gujarat	• Trainings, Group meetings, Field visit, Diagnostic Field Visits, Conference-Technology dissemination. • Trainings, Group meetings, Field visit & technical know-how • Parthenium awareness programme in all schools and colleges and control of water hyacinth and other perennial weeds • Evaluation of seaweed sap against pulses and funding source.
RVSKVV, Gwalior	• ICRISET, Hyderabad, • IARI, New Delhi, • CPRS, Gwalior, • IISS, Bhopal, • IJFRI, Jhansi, • KVKs of M.P. • Department of Agriculture and Farmer Welfare, M.P.	• Conducting massive field demonstration • IWM in various crops and cropping systems • To conduct research trials and capacity building programme & other activities of college
SKUAST, Jammu	• KVK, Jammu • Division of Vegetable Science • Pulse Research Sub-Station Samba	• Advice on weed management • Research on weed management

7. PUBLICATIONS

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Publication and students guided by the coordinating centres during 2024-25

Sl no.	Centre Name	Research Paper	Technical / Extension bulletins	Popular articles	Paper presented / seminars / symposia / Conferences	Books	Books Chapter	Lecture delivered during training	M.Sc.	Ph. D
1	PAU, Ludhiana	4	2	6	0	0	0	6	1	0
2	UAS, Bengaluru	2	0	0	0	0	0	0	3	1
3	RVSKVV, Gwalior	0	0	0	0	0	0	0	5	2
4	GBPUAT, Pantnagar	1	0	2	0	0	0	3	2	1
5	CSKHPKV, Palampur	4	0	0	2	0	0	0	16	3
6	AAU, Jorhat	0	0	0	0	0	0	0	0	0
7	AAU, Anand	5	0	2	4	0	2	9	0	0
8	TNAU, Coimbatore	8	0	0	0	0	0	1	6	5
9	KAU, Thrissur	0	5	3	4	1	2	0	3	0
10	OUAT, Bhubaneshwar	2	3	0	0	1	0	0	4	3
11	PJTSAU, Hyderabad	11	1	4	5	0	1	7	1	3
12	CCSHAU, Hisar	4	0	2	4	1	2	10	0	0
13	IGKV, Raipur	7	0	0	0	0	0	0	3	0
14	PDKV, Akola	3	0	0	0	0	0	0	2	0
15	BCKV, Kalyani	1	0	0	0	0	1	0	0	0
16	MPUAT, Udaipur	6	0	2	6	0	2	0	5	7
17	SKUAST, Jammu	1	12	0	0	1	5	11	0	0
	Total	59	23	21	25	4	15	47	51	25

8. AWARDS AND RECOGNITIONS

Centre Name	Awards and Recognitions	Venue and Date	Name of the Scientist
GBPUAT, Pantnagar	First position for Oral presentation of research paper entitled "Effect of Poly- 4 on Productivity and Oil Quality of Mustard (*Brassica juncea* L.)" in National conference on "Quality Seed Production: Backbone to the National Food Security.	March, 04-06, 2024 held at GBPUAT, Pantnagar	Dr. S.P. Singh
	"Faculty Excellence Award" in recognition to the noteworthy research contribution.	Year 2024 by GBPUA & T, Pantnagar	Dr. S. P. Singh
PJTSAU, Hyderabad	1st rank among the AICRP-WM centres, the XXXI Annual Review Meeting of All India Coordinated Research Project-Weed Management.	At Odisha University of Agricultural and Technology Bhubaneswar from 19th-21st June 2024	Dr. T. Ram Prakash Dr. B. Padmaja
MPUAT, Udaipur	Best Annual Report Award, the XXXI Annual Review Meeting of All India Coordinated Research Project-Weed Management.	At Odisha University of Agricultural and Technology Bhubaneswar from 19th-21st June 2024	Dr. Arvind Verma
KAU, Thrissur	Most responsive centre award, The XXXI Annual Review Meeting of All India Coordinated Research Project-Weed Management	At Odisha University of Agricultural and Technology, Bhubaneswar from 19th -21st June 2024	Dr. P Prameela Dr. Savitha Antony
PAU, Ludhiana	Outstanding centre for Research publication Award, the XXXI Annual Review Meeting of All India Coordinated Research Project-Weed Management	At Odisha University of Agricultural and Technology Bhubaneswar from 19th-21st June 2024	Dr Pervinder Kaur Dr Jasvir Singh Gill
OUAT, Bhubaneswar	Appreciation award, the XXXI Annual Review Meeting of All India Coordinated Research Project-Weed Management	At Odisha University of Agricultural and Technology Bhubaneswar from 19th-21st June 2024	Dr. R. Dash Dr. Md Abdul Alim
AAU, Anand	Best Oral Presentation Award, Technical Session 9 "*Management of parasitic, invasive and aquatic weeds*" in the ISWS Biennial Conference-2024 on Climate-smart Weed Management for Global Food Security	28-30 November, 2024, Banaras Hindu University, Varanasi, India.	Dr. V. J. Patel,
CCSHAU, Hisar	Best poster presentation award in the ISWS Biennial conference	28-30 November, 2024, Banaras Hindu University, Varanasi, India.	Dr. Paras Kamboj

9. RECOMMENDATIONS OF AICRP-WM ANNUAL REVIEW MEETING

Recommendations emerged out of the XXXI Annual Review Meeting of AICRP-Weed Management held during 19-21 June 2024 at OUAT, Bhubaneswar.

1. In factorial weed management experiments involving two or three factors, interaction effects on various parameters (at least yield) should be reported and presented.
2. In weed management experiments for cropping systems, crop-wise data should be reported in chronological order (rainy-winter-summer). System yield in terms of base/main crop equivalent yield should be reported, besides absolute yields of component crops.
3. In case of long-term concluded experiments, pooled analysis should be done. In case of long-term continuing experiments, current year and cumulative results should be reported.
4. The crop yield should be reported in term of kg/ha or t/ha instead of q/ha.
5. Extremely low yield data which does not represent standard crop, should not be reported.
6. Choice of design, factors and levels in each factor in factorial experiments should be statistically sound.
7. In herbicide resistance study, recommended and higher doses of the herbicide resisted should be tried along with new herbicides.
8. Use of plant extracts with allelopathic potential may be considered as a mean of weed management in organic farming.
9. Standard protocols on use of inputs for nutrient management and plant protection should be followed in experiments on organic/natural farming.
10. The assessment of weed biomass/weight and timing of post emergent herbicides/intercultural operations may be assessed/modified from the practical point of crop growth and operational perspective.
11. Crop residue incorporation should be quantified and analyze soil for initial fertility to monitor uptake and balance.
12. In the trials/experiments herbicidal dosages may be modified based on the response and regional relevance.
13. Treatments-wise residual analysis to be made for the trials/ treatments that have direct bearing/effect on soil and plant parts.
14. The proposed water volume for drone spraying was 40 L/ha hence, the house suggested to reduce the water volume in consultation with TNAU and suggested go for 25 L/ha.
15. In Knapsack sprayer both pre and post-emergence herbicides water volume was also decided, 500 L/ha and 375 L/ha respectively, precautions should be taken while spraying herbicides (i.e. Directed spray on weeds).
16. In Drone experiments, the house suggested to go for strip plot design.
17. The results are to be reported in the format provided online.
18. Proper documentation of the field (Geotagging) may be made and all the centers have to give the location details of front-line demonstrations and communicate to DWR.

10. STATUS OF EXPERIMENTS CONDUCTED

S.NO.	Centres	WP-1 Development of location Specific Sustainable Weed Management Practices	WP-2 Management of weed in non-cropped and aquatic area	WP-3 Fate of herbicides residues in Different Eco-Systems	WP-4 Demonstration and impact assessment of weed management technologies & SCSP	ST-Station Trails on Weed management	Total No. Number of Experiment
1.	PAU, Ludhiana	WP-1.2.1 WP-1.3.13 WP-1.5.1	WP-2.9	WP-3.1 WP-3.2 WP-3.3 WP-3.4 WP-3.5	WP-4.1 WP-4.2 WP-4.3	ST-1.1.11 * ST-1.1.12 * ST-1.1.13	15
2.	UAS, Bengaluru	WP-1.1.1 WP-1.2.3 WP-1.3.11 WP-1.5.1	WP-2.1 WP-2.6 WP-2.9	WP-3.1* WP-3.2* WP-3.3 *	WP-4.1 WP-4.2 WP-4.3	ST-1.1.23 ST-1.1.24	15
3.	RVSKVV, Gwalior	WP-1.1.4 WP -1.1.5 * WP -1.1.6 * WP -1.2.3 WP -1.3.10 WP -1.4.2 WP -1.5.1*	WP-2.8 WP-2.9	-	WP- 4.1 WP -4.2 WP -4.3	-	12
4.	GBPUA&T, Pantnagar	WP- 1.1.1 WP -1.1.4 WP -1.2.1 WP -1.3.2 WP -1.3.2 WP- 1.5.1* WP-1.5.2	WP-2.9	-	WP-4.1 WP-4.2 WP-4.3	ST- 1.1.9 *	11
5.	CSKHPKV, Palampur	WP -1.1.1 WP -1.2.4 WP -1.3.14 WP -1.5.1*	WP-2.6 WP-2.9	WP-3.4*	WP-4.1 WP-4.2 WP-4.3	-	10
6.	AAU, Jorhat	WP-1.1.2* WP-1.3.9* WP-1.4.6* WP-1.5.1*	WP-2.2* WP-2.3* WP-2.9*	-	WP-4.1 WP-4.2 WP-4.3.	ST-1.1.10* ST-1.1.16* ST-1.1.26*	13
7.	AAU, Anand	WP- 1.1.1 WP- 1.1.5* WP- 1.1.6 * WP- 1.3.1* WP- 1.4.2 WP- 1.5.1	WP- 2.6 WP- 2.8 WP- 2.9	WP- 3.1 WP- 3.2 WP- 3.3	WP-4.1 WP-4.2 WP- 4.3	ST- 1.1.4 ST- 1.1.5 ST- 1.1.6.	18
8.	TNAU, Coimbatore	WP-1.1.2 WP-1.1.4 WP-1.2.5 WP-1.3.8 WP-1.5.1*	WP-2.4 WP-2.9.	WP-3.1 WP-3.2 WP-3.3 WP-3.4 WP-3.5	WP-4.1 WP-4.2 WP-4.3	ST-1.1.21	16
9.	KAU, Thrissur	WP-1.3.4 WP-1.4.7 WP-1.5.1*	WP-2.5 WP-2.6 WP-2.9	WP-3.1*	WP-4.1 WP-4.2 WP-4.3	ST-1.1.17 * ST-1.1.18 ST-1.1.19	13

Table contd...

S.NO.	Centres	WP-1 Development of location Specific Sustainable Weed Management Practices	WP-2 Management of weed in non-cropped and aquatic area	WP-3 Fate of herbicides residues in Different Eco-Systems	WP-4 Demonstration and impact assessment of weed management technologies & SCSP	ST-Station Trails on Weed management	Total No. Number of Experiment
10.	OUAT, Bhubaneswar	WP-1.1.1 WP-1.1.2 WP-1.1.3* WP-1.2.2 WP-1.5.1*	WP-2.9		WP-4.1 WP-4.2 WP-4.3	ST-1.1.10 ST-11.25*	11
11.	PJTSAU, Hyderabad	WP-1.1.4 WP-1.1.5 * WP-1.2.3 WP-1.3.7 WP-1.4.1* WP-1.5.1* WP-1.5.4*	WP-2.6* WP-2.9	WP-3.1 WP-3.2 WP-3.3 WP-3.4* WP-3.5	WP-4.1 WP-4.2 WP-4.3	ST-1.1.15	18
12.	CCSHAU, Hisar	WP-1.1.1 WP-1.2.1 WP-1.2.3 WP-1.4.2 * WP-1.4.5 * WP-1.5.1* WP-1.5.5 WP-1.5.6	WP-2.7* WP-2.8* WP-2.9	WP-3.1 WP-3.2 WP-3.3	WP-4.1 WP-4.2 WP-4.3	ST-1.1.1 ST-1.1.2 ST-1.1.3	20
13.	IGKV, Raipur	WP-1.1.2 WP-1.1.3 WP-1.1.4 WP-1.2.2 WP-1.3.3 WP-1.4.3* WP-1.5.1* WP-1.5.3	WP-2.6* WP-2.7 WP-2.8 WP-2.9	-	WP-4.1 WP-4.2 WP-4.3	-	15
14.	PDKV, Akola	WP-1.1.4 WP-1.1.5 WP-1.2.4 WP-1.3.6 WP 1.5.1*	WP-2.7 * WP-2.8 WP-2.9	-	WP-4.1. WP-4.2 WP-4.3	ST-1.1.7	12
15.	BCKV, Kalyani	WP-1.1.1* WP-1.1.2 ST-1.1.15* ST-1.1.22 * WP-1.3.3 WP 1.5.1 *	WP-2.6* WP-2.8 WP-2.9	-	WP-4.1 WP-4.2 WP-4.3	-	12
16.	MPUAT, Udaipur	WP-1.1.4 WP-1.1.5* WP-1.1.6* WP-1.2.4 WP-1.3.5 WP-1.4.2* WP-1.4.4* WP 1.5.1*	WP-2.6 WP-2.8 WP-2.9	-	WP-4.1 WP-4.2 WP-4.3	ST-1.1.9* ST-1.1.20*	16
17.	SKUAST, Jammu	WP-1.1.4* WP-1.1.6* WP-1.2.1 WP-1.3.12 WP-1.5.1*	WP-2.6* WP-2.9	-	WP-4.1 WP-4.2 WP-4.3	ST-1.1.14	11

***Not Reported**

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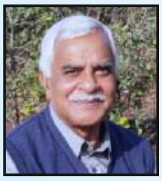

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12. STATUS OF SUBMISSION OF ANNUAL REPORT-2024

SI. No.	Centre's Name	Received	
		On or before due date (25.01.2025)	After due date
Regular Centres			
1.	PAU, Ludhiana	17 -01 -2025	-
2.	UAS, Bengaluru	15 -01 -2025	-
3.	RVSKVV, Gwalior	20 -01 -2025	-
4.	GBPUAT, Pantnagar	15 -01 -2025	-
5.	CSKHPKV, Palampur	20 -02 -2025	-
6.	AAU, Jorhat	-	-
7.	AAU, Anand	10 -01 -2025	-
8.	TNAU, Coimbatore	11 -01 -2025	-
9.	KAU, Thrissur	03 -01 -2025	-
10.	OUAT, Bhubaneshwar	15 -01 -2025	-
11.	PJTSAU, Hyderabad	23 -01 -2025	-
12.	CCSHAU, Hisar	31 -01 -2025	-
13.	IGKV, Raipur	14 -01 -2025	-
14.	PDKV, Akola	16 -01 -2025	-
15.	BCKV, Kalyani	21 -01 -2025	-
16.	MPUAT, Udaipur	-	11-02-2025
17.	SKUAST, Jammu	-	31-01-2025
Volunteer Centres			
1.	SKUAST, Kashmir	-	11-02-2025
2.	BAU, Sabour	-	10-02-2025
3.	PAJNCOA&RI Puducherry	16 -01 -2025	-
4.	UAS, Dharwad	-	31-01-2025
5.	BUAT, Banda	21 -01 -2025	-
6.	ANGRAU, Guntur	-	28-03-2025
7.	SKNAU, Jobner	-	03-03-2025

କୃଷି ଖବର

ଓୟୁଏଟିରେ ତୃଣକ ଗବେଷଣା ପ୍ରକଳ୍ପର ୩୧ତମ ଜାତୀୟ ସମୀକ୍ଷା ସଭା ଅନୁଷ୍ଠିତ

Tanushree Mahapatra Thursday, 20 June 2024 12:37 PM

31st National Review Meeting held at OUAT

Exhibition

Visit of Hon'ble Vice Chancellor with Randhir Sawarkar, MLA in Agrotech Exhibition on 27th -29th December 2023

WP 1.2.5 Weed management under conservation tilla system on cotton based cropping systems

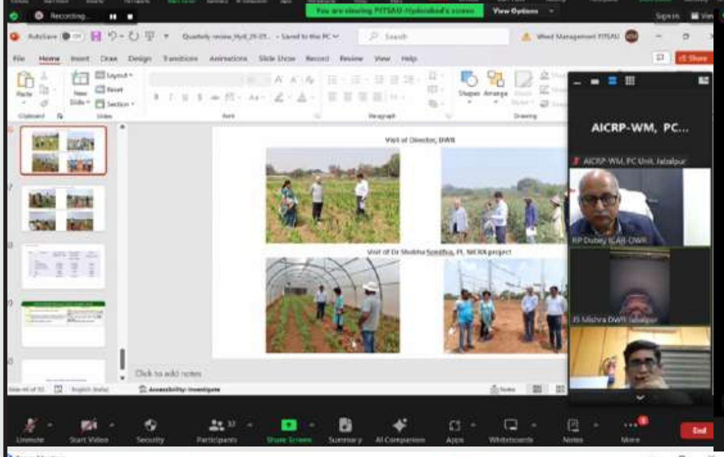
> Harvesting of cotton and sowing of sweet corn was done on 16-01-2024

WM 1.3. Weed Management Strategies in Organic Agriculture/ Natural Far

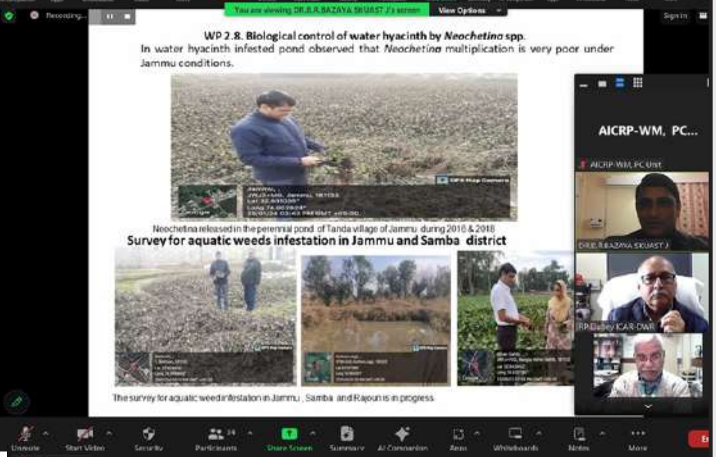
WM 1.3.1 Weed Management in Organically Grown Direct-Seeded Finger Millet – Pulse Croppi

Inference of the concluded experiment - Weed Management in Organically Grown Direct-Se Finger Millet

T₄ Control



Visit of Director, DWR



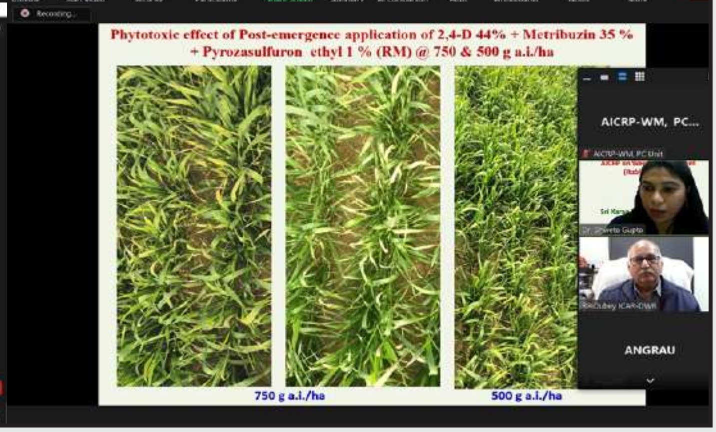
WP 2.8. Biological control of water hyacinth by *Neochetina* spp.

In water hyacinth infested pond observed that *Neochetina* multiplication is very poor under Jammu conditions.

Neochetina released in the perennial pond of Tanda village of Jammu during 2016 & 2018

Survey for aquatic weeds infestation in Jammu and Samba district

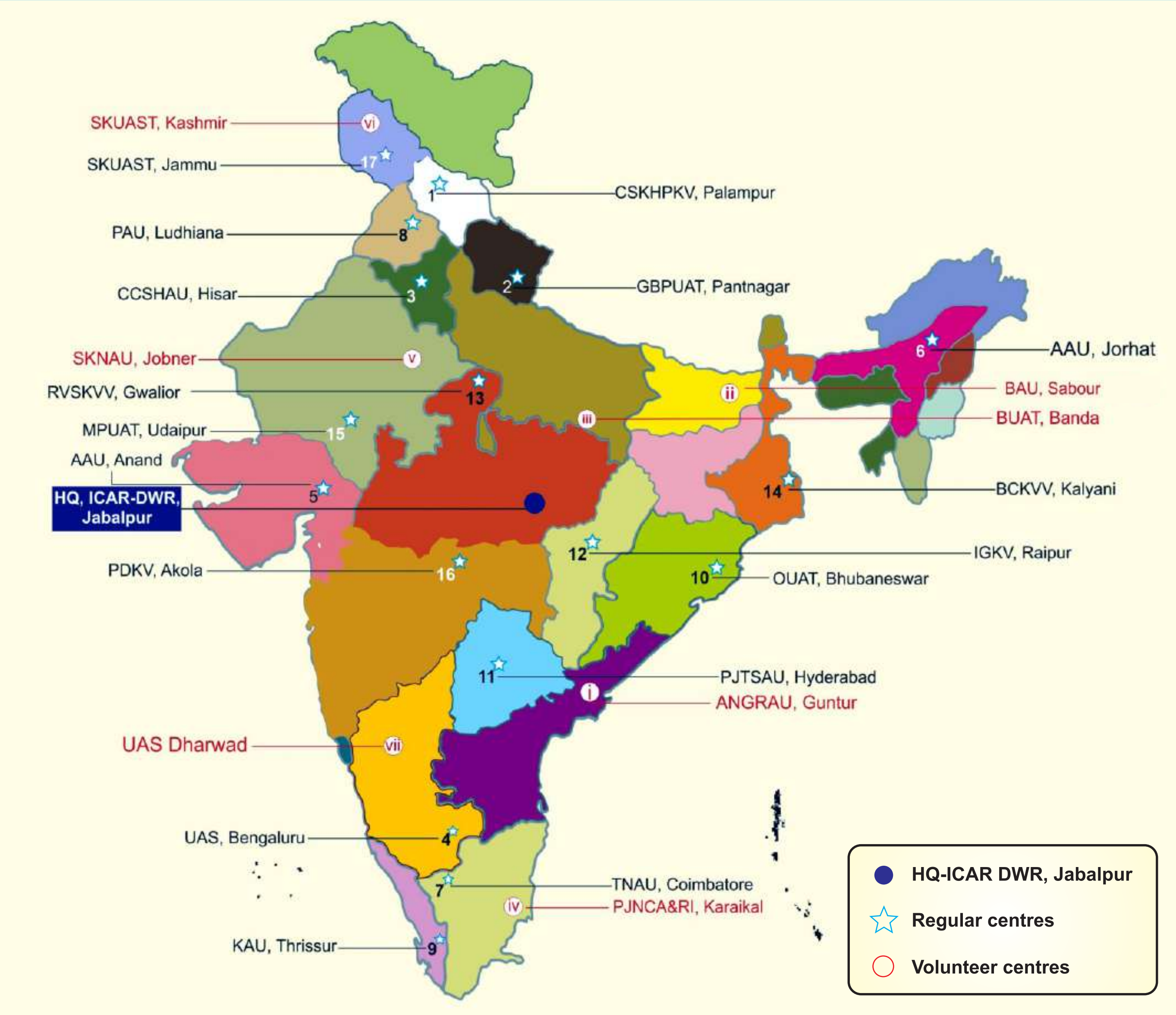
The survey for aquatic weed infestation in Jammu , Samba and Rajouri is in progress



Phytotoxic effect of Post-emergence application of 2,4-D 44% + Metribuzin 35 % + Pyrozasulfuron ethyl 1 % (RM) @ 750 & 500 g a.i./ha

750 g a.i./ha

500 g a.i./ha



भा.कृ.अनु.प.
ICAR

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किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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