All India Coordinated Research Project on Weed Management

TECHNICAL PROGRAMME

2026-27 and 2027-28

ICAR-Directorate of Weed Research
Maharajpur, Adhartal, Jabalpur - 482004 (M.P.)

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: GBPUAT Pantnagar, OUAT Bhubaneswar, CCSHAU Hisar, CSKHPKV Palampur, UAS Bengaluru, BCKV Kalyani, AAU Anand, PAJANCOA & RI Puducherry**,** IGKV Raipur, and ICAR-DWR

Objectives:

1. To study the effect of different treatments on weed dynamics, weed growth, and productivity of rice.
2. To evaluate the effectiveness of herbicide combinations and herbicide–mechanical weed management approaches for controlling major weeds in dry DSR.
3. To monitor and assess the changes in weed flora under different treatments.

Treatments:

T1- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% (w/w) + cyhalofop-butyl 10.64% (w/w) EC (RM) 150 g/ha PoE (20-25 DAS).

T2- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron Methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (20-25 DAS).

T3- Triafamone 20% (w/w) + ethoxysulfuron 10% (w/w) WG (RM) 66.5 g/ha as EPoE (15 DAS) *fb* florpyrauxifen-benzyl 2.13% (w/w) + cyhalofop-butyl 10.64% (w/w) EC (RM) 150 g/ha PoE (25-30 DAS).

T4- Triafamone 20% (w/w) + ethoxysulfuron 10% (w/w) WG (RM) 66.5 g/ha as EPoE (15 DAS) *fb* bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (25-30 DAS).

T5- Pendimethalin 30% (w/w) EC 1000 g/ha as PE *fb* florpyrauxifen-benzyl 1.31% (w/w) + penoxsulam 2.1% (w/w) OD (RM) 43 g/ha as PoE (20-25 DAS).

T6- Quinclorac 25% (w/w) SC 250 g/ha as EPoE (15 DAS) *fb* bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (25-30 DAS).

T7- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* quinclorac 25% (w/w) SC + fenoxaprop-p-ethyl 6.7% (w/w) EC + pyrazosulfuron-ethyl 10% (w/w) WP (200+60+20) (Tank-mix) g/ha as PoE (20-25 DAS) or fenoxapro+ethoxysulfuron 60+18 g/ha (TM).

T8- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* Single-Row Rotary Weeder/Ambika Weeder/Low Land Weeder at 30 DAS

T9- Weedy check

T10-HT rice (SAVA 134) sequential application of imazethapyr 10% SL 100 g/ha (12-14 DAS) *fb* 28-30 DAS

(Note: PE-Pre-emergence; EPoE-Early post-emergence; PoE-Post-emergence; RM-Ready-mix; *fb*-Followed by)

Experimental details:

Design: RBD, Replication: Three

Observations:

1. Phytosociological study of major weeds at 40 and 60 DAS
2. Weed dry weight at 40 and 60 DAS
3. Weed control efficiency at 40 and 60 DAS
4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield attributes and yields
7. Economics

*** Assessment of herbicide residual effect in succeeding crops**

*** Seed rate and variety specific to the area for DSR will be used.**

Hypothesis:

Different weed management treatments, including herbicide combinations and herbicide–mechanical approach will significantly influence weed dynamics, weed suppression, and rice productivity, leading to improved weed control and higher productivity in dry DSR.

Outputs:

- Identification of effective and sustainable weed management strategies for effective control of major weeds in dry DSR.
- Generation of information on weed dynamics, weed flora shifts, and crop responses under different weed management treatments.

Outcome:

- Recommendation of efficient and economically viable weed management practices for enhancing rice productivity, profitability, and sustainability in dry DSR ecology.

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

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

Objectives:

1. To evaluate the impact of different weed management treatments on weed dynamics, weed growth, and productivity of rice.
2. To evaluate the effectiveness of herbicide combinations and herbicide–mechanical weed management approaches for controlling major weeds in puddled wet DSR.
3. To monitor and assess changes in weed flora composition under different weed management treatments.

Treatments:

T1- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* florpyrauxifen-benzyl 2.13% (w/w) + cyhalofop-butyl 10.64% (w/w) EC (RM) 150 g/ha PoE (25-30 DAS).

T2- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (25-30 DAS).

T3- Bensulfuron methyl 0.6% (w/w) + pretilachlor 6% (w/w) GR 660 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% (w/w) + cyhalofop-butyl 10.64% (w/w) EC (RM) 150 g/ha PoE (25-30 DAS).

T4- Bensulfuron methyl 0.6% (w/w) + pretilachlor 6% (w/w) GR 660 g/ha as PE *fb* bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (25-30 DAS).

T5- Triafamone 20% (w/w) + ethoxysulfuron 10% (w/w) WG (RM) 66.5 g/ha as EPoE (15 DAS) *fb* bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (30-35 DAS)

T6- Triafamone 20% (w/w) + ethoxysulfuron 10% (w/w) WG (RM) 66.5 g/ha as EPoE (15 DAS) *fb* florpyrauxifen-benzyl 1.31% (w/w) + penoxsulam 2.1% (w/w) OD (RM) 43 g/ha as PoE (30-35 DAS)

T7- Bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (25 DAS)

T8- Pretilachlor 30.0% (w/w) + pyrazosulfuron ethyl 0.75% (w/w) WG (RM) 615 g/ha PE *fb* Single-Row Rotary Weeder/Ambika Weeder/Low Land Weeder at 30-35 DAS

T9- Weedy check

(Note: PE-Pre-emergence; EPoE-Early post-emergence; PoE-Post-emergence; RM-Ready-mix; *fb*-Followed by)

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

Experimental details:

Design: RBD, **Replication:** Three

Observations:

1. Phytosociological study of major weeds at 40 and 60 DAS
2. Weed dry weight at 40 and 60 DAS
3. Weed control efficiency at 40 and 60 DAS
4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield attributes and yields
7. Economics

*** Assessment of herbicide residual effect in succeeding crops**

*** Seed rate and variety specific to the area for DSR will be used.**

Hypothesis:

Different weed management treatments, including herbicide combinations and herbicide–mechanical approach, will significantly influence weed dynamics, weed suppression, and rice productivity leading to improved weed control and higher productivity in puddled wet DSR.

Outputs:

- Identification of effective and sustainable weed management strategies for controlling major weeds in puddled wet DSR.
- Generation of information on weed dynamics, weed flora shifts, and crop responses under different weed management treatments.

Outcome:

- Recommendation of efficient and economically viable weed management practices for enhancing rice productivity, profitability, and sustainability in puddled wet DSR ecology.

WP 1.1.3 Comparative bio-efficacy assessment of pre- and post-emergence herbicides in pulses

WP 1.1.3.1 Sustainable management of major weeds in Pigeonpea

Network Centres: RVSKVV Gwalior, PDKV, Akola and BAUT Banda

Objectives:

1. To evaluate the efficacy of herbicides against weeds in *kharif* Pigeon pea
2. To study the effect of herbicides on growth and yield of *kharif* Pigeon pea
3. To evaluate herbicide residues in seed, stover and soil

Treatments:

Herbicide	**Dose (g/ha)**	**Application time**
Pendimethalin 38.7% CS *fb* imazethapyr 10% SL	677.25 *fb* 75	PE *fb* PoE
Pendimethalin 38.7% CS *fb* propaquizafop 2.5% + imazethapyr 3.75% w/w ME	677.25 *fb* 125	PE *fb* PoE
Pendimethalin 38.7% CS *fb* quizalofop ethyl 7.5% + imazethapyr 15% w/w EC	677.25*fb* 32.81+65.62 5	PE *fb* PoE
Pendimethalin 38.7% CS *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL	677.25 *fb* 250	PE *fb* PoE
Pendimethalin 38.7% CS *fb* HW	677.25	PE *fb* 45 DAS
Pendimethalin 30%+ imazethapyr 2% EC *fb* imazethapyr 10% SL	900+60 *fb* 75	PE *fb* PoE
Pendimethalin 30%+ imazethapyr 2% EC *fb* propaquizafop 2.5% + imazethapyr 3.75% w/w ME	900+60 *fb* 125	PE *fb* PoE
Pendimethalin 30%+ imazethapyr 2% EC *fb* quizalofop ethyl 7.5% + imazethapyr 15% w/w EC	900+60*fb* 32.81+65.62 5	PE *fb* PoE
Pendimethalin 30%+ imazethapyr 2% EC *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL	677.25 *fb* 250	PE *fb* PoE
Pendimethalin 30%+ imazethapyr 2% EC *fb* HW	900+60	PE *fb* 45 DAS
Metamifop 8% + imazethapyr 4% + imazamox 3% W/W ME	80+40+30	PoE
Hand weeding		25 and 50 DAS
Weedy control		

Experimental Details
Design: RBD, Replication: Three

Observations:
1. Phytosociological study of weed flora at 30 and 60 DAS
2. Weed dry weight at 30 and 60 DAS
3. Weed control efficiency at 30 and 60 DAS
4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield and yield attributes
7. Economics

WP 1.1.3.2 Sustainable management of major weeds in *kharif* greengram
Network Centres: AAU Anand, BCKV Kalyani, MPUAT Udaipur, SKNU Jobner and ANGRAU Guntur

Objectives:
1. To evaluate the efficacy of herbicides against weeds in *kharif* greengram
2. To study the effect of herbicides on growth and yield of *kharif* greengram
3. To evaluate herbicide residues in seed, stover and soil

Treatments:

Herbicide	**Dose (g/ha)**	**Application time**
Pendimethalin 38.7% CS	677.25	PE
Pendimethalin 30%+ imazethapyr 2% EC	900+60	PE
Sodium acifluorfen 16.5% + clodinafop propargyl 8%	165+80	PoE
Haloxyfop-R Methyl 12.8 % + imazethapyr 10 % (w/w) ME	105.6 + 82.5	PoE
Quizalofop ethyl 7.5% + imazethapyr 15% w/w EC	32.81+65.62 5	PoE
Fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL	250	PoE
Fomesafen 16.8% w/w + propaquizafop 5.2% w/w ME	210+65	PoE
Propaquizafop 2.5% + imazethapyr 3.75% w/w ME	125	PoE
HW at 20 and 40 DAS		
Weedy check		

Experimental Details
Design: RBD, Replication: Three

Observations:
1. Phytosociological study of weed flora at 30 and 60 DAS
2. Weed dry weight at 30 and 60 DAS
3. Weed control efficiency at 30 and 60 DAS
4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield and yield attributes
7. Economics

WP 1.1.3.3 Sustainable management of major weeds in blackgram
Network Centres: AAU Jorhat, TNAU Coimbatore, MPUAT Udaipur, CSKHPKV Palampur and ANGRAU Guntur (*Kharif*) and OUAT, Bhubaneshwar (Summer)

Objectives:
1. To evaluate the efficacy of herbicides against weeds in *kharif* Blackgram
2. To study the effect of herbicides on growth and yield of *kharif* Blackgram
3. To evaluate herbicide residues in seed, stover and soil

Treatments:

Herbicide	Dose (g/ha)	Application time
Pendimethalin 38.7% CS	677.25	PE
Pendimethalin 30%+ imazethapyr 2% EC	900+60	PE
Sodium acifluorfen 16.5% + clodinafop propargyl 8%	165+80	PoE
Haloxyfop-R Methyl 12.8 % + imazethapyr 10 % (w/w) ME	105.6 + 82.5	PoE
Quizalofop ethyl 7.5% + imazethapyr 15% w/w EC	32.81+65.625	PoE
Fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL	250	PoE
Fomesafen 16.8% w/w + propaquizafop 5.2% w/w ME	210+65	PoE
HW at 20 and 40 DAS		
Weedy check		

Experimental Details

Design: RBD, Replication: Three

Observations:

1. Phytosociological study of weed flora at 30 and 60 DAS
2. Weed dry weight at 30 and 60 DAS
3. Weed control efficiency at 30 and 60 DAS
4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield and yield attributes
7. Economics

WP 1.1.3.4 Sustainable management of major weeds in chickpea

Network centres: SKNAU Jobner, IGKV Raipur, RVSKVV Gwalior, MPUAT Udaipur, BCKV Kalyani, BUAT Banda and ANGRAU Guntur

Objectives:

1. To evaluate the bio-efficacy of herbicides on weeds in chickpea
2. To study the effect of herbicide on growth and yield of chickpea
3. To study the effect of different herbicide on soil microbial population.

Treatments:

Herbicide	Dose (g/ha)	Application time
Pendimethalin 38.7% CS	677.25	PE
Pendimethalin 30%+ imazethapyr 2% EC	900+60	PE
Metribuzin 70% WP	350	PE
Oxyfluorfen 23.5% EC	250	PE
Metolachlor 50%EC	1000	PE
Topramezone 336 g/l w/v SC	20.16	PoE
Sodium acifluorfen 16.5% + clodinafop propargyl 8%	132+64	PoE
Pendimethalin 38.7% CS *fb* HW	677.25	PE *fb* 30 DAS
Pendimethalin 30%+ imazethapyr 2% EC fb HW	900+60	PE *fb* 30 DAS
Metribuzin 70% WP *fb* HW	350	PE *fb* 30 DAS
Oxyfluorfen 23.5% EC *fb* HW	250	PE *fb* 30 DAS
Metolachlor 50%EC *fb* HW	1000	PE *fb* 30 DAS
Hand weeding		20 and 40 DAS
Weedy check		

Experimental Details

Design: RBD, Replication: Three

Observations:

1. Phytosociological study of weed flora at 30 and 60 DAS
2. Weed dry weight at 30 and 60 DAS
3. Weed control efficiency at 30 and 60 DAS

4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield and yield attributes
7. Economics

WP 1.1.3.5 Sustainable management of major weeds in *Rabi* lentil
Centres: GBPUAT, Pantnager

Objectives:
1. To evaluate the efficacy of herbicides against weeds in *rabi* lentil
2. To study the effect of herbicides on growth and yield of *rabi* lentil

Treatments:

Herbicide	**Dose (g/ha)**	**Application time**
Pendimethalin 38.7% CS	677.25	PE
Pendimethalin 30%+ imazethapyr 2% EC	900+60	PE
Metribuzin 70% WP (varietal sensitive)	250	PE
Metolachlor 50%EC	1000	PE
Pendimethalin 35% + metribuzin 3.5% w/w SE	875 +87.5	PE
Pendimethalin 38.7% CS *fb* HW	677.25	PE *fb* 30 DAS
Pendimethalin 30%+ imazethapyr 2% EC *fb* HW	900+60	PE *fb* 30 DAS
Metribuzin 70% WP *fb* HW	250	PE *fb* 30 DAS
Metolachlor 50% EC *fb* HW	1000	PE *fb* 30 DAS
Weedy check		

Experimental Details
Design: RBD, Replication: Three

Observations:
1. Phytosociological study of weed flora at 30 and 60 DAS
2. Weed dry weight at 30 and 60 DAS
3. Weed control efficiency at 30 and 60 DAS
4. Soil moisture content (0-5 cm and 5-10 cm) at the time of herbicide application
5. Dehydrogenase activity at different intervals after application of herbicides (15 and 30 days after application of herbicide and 0 day before application of herbicide)
6. Yield and yield attributes
7. Economics

WP 1.1.3.6 Effect of integrated weed management practices on weed dynamics and yield of Horse gram (*Macrotyloma uniflorum* L.)
Centre: UAS, Bengaluru

Horse gram (*Macrotyloma uniflorum*) is a highly drought-resistant and nutrient-dense legume that plays an important role in climate-resilient agriculture, particularly in arid and semi-arid regions. It is considered a low-input, fast-growing crop that effectively fills the gap between main cropping seasons, especially when delayed monsoon rains hinder the sowing of major crops. Due to its resilience and adaptability, horse gram serves as an important contingency crop under rainfed conditions. Horse gram is also recognized as a highly nutritious pulse and is often referred to as a "superfood" because of its rich nutritional composition. The grains contain high protein content ranging from 17.9–25.3%, along with substantial amounts of iron and the highest calcium content among pulses. These nutritional qualities make it valuable both for human consumption and livestock feeding. The crop exhibits remarkable adaptability to diverse soil and climatic conditions. It grows well in a wide range of soils including loams, black cotton soils, clayey paddy soils, sandy and shallow soils, stony uplands, and even cleaned rough forest lands. Its ability to tolerate limited rainfall and fluctuating temperatures enables successful cultivation across different agroecological regions of India. Horse gram is cultivated both as a sole crop and in association with other crops under mixed and intercropping systems. In India, horse gram was cultivated over an area of 2.65

lakh hectares with a production of 0.166 million tones and productivity of 627 kg/ha during 2022–2023. Although horse gram is cultivated across almost all states of India, nearly 90–95% of the total cultivation is concentrated in five major states, namely Odisha, Tamil Nadu, Karnataka, Maharashtra, and Andhra Pradesh. In Karnataka, the crop occupied about 1.08 lakh hectares with a production of 0.66 lakh tones and productivity of 611 kg/ha. Major horse gram growing districts of Karnataka are Chamrajnagara, Koppal, Mandya, Mysore, Haveri, Tumkur and Ramnagara.

Weed infestation is one of the major constraints in horse gram cultivation, as weeds compete with the crop for essential resources such as light, water, nutrients, and space, thereby affecting crop growth and development throughout the season. If left uncontrolled, weeds can cause yield losses ranging from 30 to 60 per cent. Major weeds commonly observed in the horse gram field includes *Rottboellia cochinchinensis* (Itch grass), *Fimbristylis spp.* (Sedges), *Commelina benghalensis* (Benghal dayflower), *Celosia argentea* (Woolflower), *Cyperus rotundus* (Nut sedge), *Digitaria sanguinalis* (Crabgrass), *Murdannia nudiflora* (Doveweed), *Parthenium hysterophorus* (Congress grass), *Cynodon dactylon* (Bermuda grass) and *Leucas aspera.* Therefore, effective weed management practices are essential to minimize yield reduction and ensure successful crop production. Integrated weed management strategies involving cultural practices such as crop rotation, mulching, and intercropping, along with mechanical methods like manual weeding and the use of suitable weed control implements, can effectively suppress weed growth. In addition, the judicious and need-based application of herbicides can further enhance weed control efficiency while minimizing environmental risks. Hence, a holistic and integrated approach to weed management is necessary for sustainable and profitable horse gram cultivation.

Objective: To study effect of integrated weed management practices in Horse gram

Treatments:

T_1	One stale seedbed (pre-sowing irrigation + shallow tillage)
T_2	Inter-cultivation at 25 DAS using power weeder
T_3	Pendimethalin 30% EC + Imazethapyr 2% EC @ 800 g/ha as PE
T_4	Stale seed bed *fb* Quizalofop-ethyl 7.5% + Imazethapyr 15% EC @ 32.81 + 65.63 g/ha as PoE at 20 DAS
T_5	Pendimethalin 30% EC + Imazethapyr 2% EC @ 800 g/ha as PE followed by inter-cultivation using power weeder at 35 DAS
T_6	Hand weeding at 30 DAS
T_7	Weedy Check

Experimental details:

Design: RCBD Replication: 3 Gross plot size: 5m × 4 m

Observations:

1. Weed density, fresh weight and dry weight at 0, 20 and 30 for pre-emergence and before spray and 30 days after herbicide spray for post emergence
2. Dehydrogenase enzyme activity initial and 15 days after herbicide spray
3. Growth observations (Plant height, Number of branches and SPAD readings) at 20, 40 and 60 DAS
4. Weed control efficiency
5. Yield attributes (Pod length, Number of pods and Number of seeds/pod) and yield at harvest
6. Economics

Output

- Data generated on weed dynamics, weed density, weed dry weight, and weed control efficiency under different weed management practices.
- Comparative evaluation of cultural, mechanical, and chemical weed management methods in horse gram.
- Assessment of crop growth, yield attributes, grain yield, and economics under integrated weed management practices.
- Identification of effective and economical integrated weed management strategy for horse gram cultivation.

Outcome

- Reduction in weed infestation and crop-weed competition in horse gram.
- Improvement in crop growth, productivity, and profitability through effective weed management.
- Reduced dependence on repeated manual weeding and improved labor-use efficiency.
- Promotion of integrated and sustainable weed management practices in pulse-based cropping systems.
- Enhanced adoption of climate-resilient and eco-friendly weed management approaches among farmers.

WP 1.1.4 Comparative evaluation of drone and knapsack-based herbicide application for weed dynamics, weed control efficiency, and crop performance in different crops.

Hypothesis

Herbicide application through drone spraying technology can achieve weed control efficiency comparable to or better than conventional knapsack spraying by improving spray uniformity, reducing labour and water requirement, and influencing weed dynamics and weed growth across different crops.

Objectives:

1. To compare the efficacy of drone-based and conventional knapsack-based herbicide application on weed dynamics, weed biomass, weed control efficiency, and crop performance in different crops.
2. To compare operational efficiency of drone and knapsack spraying in terms of labour requirement, water use, time efficiency, and economics of weed management.

Outputs:

- Comparative dataset on weed dynamics, weed biomass, weed control efficiency, and crop performance under drone and knapsack-based herbicide application across the crops.
- Database on operational efficiency parameters including spray coverage, water saving, labour saving, time efficiency, and cost of operation.
- Standardized protocol for drone-based herbicide application recommendations for different crops.

Outcome:

- Scientifically validated recommendations on comparative effectiveness of drone- and knapsack-based herbicide application for efficient and economically viable weed management to enhance crop productivity and sustainability in diverse crops.

Salient Recommendations

1. All centres must strictly adhere to the Standard Operating Procedures (SOPs) prescribed by ICAR-DWR**,** including spray parameters:
   - Drone spraying height: 2.0 m above crop canopy
   - Spray volume for drone application: 25 L/ha
   - Knapsack sprayer: 375 L/ha for early post-emergence (EPoE)/post-emergence (PoE) applications
   - Pre-emergence herbicide application: 500 L/ha
   - Power sprayer: 250 L/ha
2. Weed observations (weed density, and dry matter accumulation) should be recorded at 20 and 30 days after spraying in experiments involving pre-emergence herbicides.
3. For post-emergence herbicide treatments, weed observations should be recorded before spraying and only at 20 days after spraying.
4. Soil dehydrogenase activity should be measured prior to treatment imposition and at 15 days after herbicide application to assess microbial activity changes.
5. In all drone-based experiments, centres must clearly mention the nozzle specifications used for herbicide application.
6. Analyse droplet size with the use of droplet size testing papers.
7. Measurement of weed control efficiency.
8. Measurement of yield attributes and yields.

9. Economic analysis.
10. Recommended crop spacing for individual crops must be maintained.
11. Experimental plots should be sufficiently large to facilitate spraying herbicides through drone.
12. Phytotoxicity observations should be recorded, particularly in over-sprayed/excess spray zones**,** and weed observations should also be taken from turning points/corners where spray coverage may be inadequate or absent.
13. No succeeding or residual crop should be grown in drone-based herbicide experiments.
14. Sequential herbicide applications must involve different herbicide molecules/modes of action**;** a pre-emergence herbicide should not be repeated or used again as a post-emergence herbicide treatment**.**

WP 1.1.4.1. Weed management in maize

Network Centres: PJTSAU Hyderabad, TNAU Coimbatore, and BCKV Kalyani (*Kharif*), and IGKV Raipur (*Rabi*)

Sr. No.	Treatment
1.	Atrazine 50% (w/w) WP + tembotrione 34.4% (w/w) SC (TM) (500+120) g/ha as EPoE (2-3 leaf stage of weeds) through drone
2.	Atrazine 50% (w/w) WP + topramezone 33.6% (w/w) SC (500 + 25.2) (TM) g/ha as EPoE (2-3 leaf stage of weeds) through drone
3.	Atrazine 22.7% (w/w) + mesotrione 2.27% SC (RM) 875 g/ha as PoE (2-3 leaf stage of weeds) through drone
4.	Atrazine 50% (w/w) WP + tembotrione 34.4% (w/w) SC (TM) (500+120) g/ha as EPoE (2-3 leaf stage of weeds) through knapsack sprayer
5.	Atrazine 50% (w/w) WP + topramezone 33.6% (w/w) SC (TM) g/ha as EPoE (2-3 leaf stage of weeds) through knapsack sprayer
6.	Atrazine 22.7% (w/w) + mesotrione 2.27% SC (RM) 875 g/ha as PoE (2-3 leaf stage of weeds) through knapsack sprayer
7.	Weedy check

Experimental details:
Design: RBD, Replication: Three

WP 1.1.4.2 Weed management in wheat

Network Centres: AAU Anand, GBPUAT Pantnager, SKUAST Jammu and CSKHPKV Palampur

Sr. No.	Treatment
1.	Sulfosulfuron 75% (w/w) + metsulfuron methyl 5% (w/w) WG (30+2) g/ha as PoE (30-35 DAS) through drone
2.	Bixlozone 50% (w/w) + metribuzin 10% (w/w) WG (750+150) g/ha as PoE (30-35 DAS) through drone
3.	Clodinafop propargyl 9% (w/w) + metribuzin 20% (w/w) WP (54+120) g/ha as PoE (30-35 DAS) through drone
4.	Sulfosulfuron 75% (w/w) + metsulfuron methyl 5% (w/w) WG (30+2) g/ha as PoE (30-35 DAS) through knapsack sprayer
5.	Bixlozone 50% (w/w) + metribuzin 10% (w/w) WG (750+150) g/ha as PoE (30-35 DAS) through knapsack sprayer
6.	Clodinafop propargyl 9% (w/w) + metribuzin 20% (w/w) WP (54+120) g/ha as PoE (30-35 DAS) through knapsack sprayer
7.	Weedy check

Experimental details:
Design: RBD, Replication: Three

WP 1.1.4.3 Weed management in soybean

Network Centres: PDKV Akola, MPUAT Udaipur, and CSKHPKV Palampur

Sr. No.	Treatment
1.	Diclosulam 0.9% (w/w) + pendimethalin 35% (w/w) SE (RM) 897.5 g/ha as PE (0-3 DAS) through drone
2.	Quizalofop ethyl 7.5% (w/w) + imazethapyr 15% (w/w) EC (RM) 98.435 g/ha as PoE (15-20 DAS) through drone
3.	Diclosulam 0.9% (w/w) + pendimethalin 35% (w/w) SE (RM) 897.5 g/ha as PE (0-3 DAS) through knapsack sprayer
4.	Quizalofop ethyl 7.5% (w/w) + imazethapyr 15% (w/w) EC (RM) 98.435 g/ha as PoE (15-20 DAS) through knapsack sprayer
5.	Weedy check

Experimental details:

Design: RBD, Replication: Four

WP 1.1.4.4 Weed management in transplanted rice

Network Centre: GBPUAT Pantnagar, AAU Jorhat, SKUAST Jammu, KAU Kerala, BCKV Kalyani, OUAT Bhubaneswar and BAU Sabour

Sr.	Treatment
1.	Florpyrauxifen-benzyl 2.13% (w/w) + cyhalofop-butyl 10.64% (w/w) EC (RM) 150 g/ha at 25-30 DAT through drone
2.	Triafamone 20% (w/w) + ethoxysulfuron 10% (w/w) WG (RM) 66.5 g/ha at 25-30 DAT through drone
3.	Bispyribac-sodium 15% (w/w) + metsulfuron-methyl 2.4% (w/w) + chlorimuron ethyl 3.6% (w/w) OD (RM) (26.25 + 4.2 + 6.3) g/ha at 25-30 DAT through drone
4.	Florpyrauxifen-benzyl 2.13% (w/w) + cyhalofop-butyl 10.64% (w/w) EC (RM) 150 g/ha at 25-30 DAT through knapsack sprayer
5.	Triafamone 20% (w/w) + ethoxysulfuron 10% (w/w) WG (RM) 66.50 g/ha at 25-30 DAT through knapsack sprayer
6.	Bispyribac-sodium 15% (w/w) + metsulfuron-methyl 2.4% (w/w) + chlorimuron ethyl 3.6% (w/w) OD (RM) (26.25 + 4.2 + 6.3) g/ha at 25-30 DAT through knapsack sprayer
7.	Weedy check

Experimental details:

Design: RBD, Replication: Three

WP 1.1.4.5 Weed management in greengram

Network Centres: CCSHAU Hisar and PAU Ludhiana (Summer)

Sr. No.	Treatment
1.	Propaquizafop 2.50% (w/w) + imazethapyr 3.75% (w/w) ME (RM) 125 g/ha at 15-20 DAS through drone
2.	Fomesafen 11.1% (w/w) + fluzifop-p-butyl 11.1% (w/w) SL (RM) 250 g/ha at 15-20 DAS through drone
3.	Sodium acifluorfen 16.5% (w/w) + clodinafop propargyl 8% (w/w) EC (RM) 245 g/ha at 15-20 DAS through drone
4.	Propaquizafop 2.50% (w/w) + imazethapyr 3.75% (w/w) ME (RM) 125 g/ha at 15-20 DAS through knapsack sprayer
5.	Fomesafen 11.1% (w/w) + fluzifop-p-butyl 11.1% (w/w) SL (RM) 250 g/ha at 15-20 DAS through knapsack sprayer
6.	Sodium acifluorfen 16.5% (w/w) + clodinafop propargyl 8% (w/w) EC (RM) 245 g/ha at 15-20 DAS through knapsack sprayer
7.	Weedy check

Experimental details:
Design: RBD, Replication: Three

WP 1.1.4.6. Weed management in groundnut

Centres: AAU, Anand

Sr. No.	Treatments
1.	Propaquizafop 2.5 % (w/w)+ imazethapyr 3.75 % (w/w) ME (RM) 125 g/ha as PoE (15-20 DAS) through drone
2.	Fluazifop-p-butyl 11.1% (w/w) + fomesafen 11.1 % (w/w) SL (RM) 250 g/ha as PoE (20 DAS) through drone
3.	Sodium acifluorfen 16.5% (w/w) + clodinafop propargyl 8% (w/w) EC (RM) (165+80) g/ha as PoE (15-20 DAS) through drone
4.	Propaquizafop 2.5 % (w/w)+ imazethapyr 3.75 % (w/w) ME (RM) 125 g/ha as PoE (15-20 DAS) through knapsack sprayer
5.	Fluazifop-p-butyl 11.1% (w/w) + fomesafen 11.1 % (w/w) SL (RM) 250 g/ha as PoE (20 DAS) through knapsack sprayer
6.	Sodium acifluorfen 16.5% (w/w) + clodinafop propargyl 8% (w/w) EC (RM) (165+80) g/ha (RM) as PoE (15-20 DAS) through knapsack sprayer
7.	Weed check

Experimental details:
Design: RBD, Replication: Three

WP 1.1.4.7. Weed management in direct-seeded finger millet [*Eleusine coracana* (L.) *Gaertin.*]

Centre: UAS Bengaluru

Sr. No.	Treatment
1.	Pyrazosulfuran-ethyl 10% (w/w) WP 15 g/ha as PE through drone
2.	Bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (20-25 DAS) through drone
3.	Pyrazosulfuran-ethyl 10% (w/w) WP 15 g/ha as PE *fb* bispyribac sodium 10% (w/w) SC 20 g/ha as PoE (20-25 DAS) through drone
4.	Pyrazosulfuran-ethyl 10% (w/w) WP 15 g/ha as PE through knapsack sprayer
5.	Bispyribac-sodium 38% (w/w) + chlorimuron ethyl 2.5% (w/w) + metsulfuron methyl 2.5% (w/w) WG (RM) 43 g/ha as PoE (20-25 DAS) through knapsack sprayer
6.	Pyrazosulfuran-ethyl 10% (w/w) WP 15 g/ha as PE *fb* bispyribac sodium 10% (w/w) SC 20 g/ha as PoE (20-25 DAS) through knapsack sprayer
7.	Weedy check

Experimental details:
Design: RBD, Replication: Three

WP 1.1.4.8. Weed management in soybean+pigeonpea intercropping system

Centre: PDKV Akola (Location: KVK, Wardha)

Sr. No.	Treatment
1.	Pendimethalin 38.7% (w/w) CS 678 g/ha as PE through drone
2.	Imazethapyr 35% (w/w) + imazamox 35% (w/w) WG (RM) 70 g/ha as EPoE (15 DAS) through drone
3.	Pendimethalin 38.7% (w/w) CS 678 g/ha as PE through knapsack sprayer
4.	Imazethapyr 35% (w/w) + imazamox 35% (w/w) WG (RM) 70 g/ha as EPoE (15 DAS) through knapsack sprayer
5.	Weedy check

Experimental details:

Design: RBD, Replication: Four

WP 1.1.4.9. Weed management in pearl millet

Centre: RVSKVV, Gwalior

S. No.	Treatments
1.	Atrazine 500 g/ha (PE) *fb* 2,4-D ethyl ester 500 g/ha as PoE (20 DAS) application with drone
2.	Atrazine 500 g/ha (PE) *fb* 2,4-D dimethylamine salt 500 g/ha as PoE (20 DAS) application with drone
3.	Atrazine 500 g/ha (PE) application with drone *fb* mechanical weeding at 30 DAS
4.	Atrazine 500 g/ha (PE) *fb* 2,4-D ethyl ester 500 g/ha as PoE (20 DAS) application with knapsack sprayer
5.	Atrazine 500 g/ha (PE) *fb* 2,4-D dimethylamine salt 500 g/ha as PoE (20 DAS) application with knapsack sprayer
6.	Atrazine 500 g/ha PE application with knapsack sprayer *fb* mechanical weeding at 30 DAS
7.	2 hand weeding at 20 & 40 DAS
8.	Weedy check

WP 1.1.4.10. Weed management in cotton

Centre: ANGRAU Guntur and PJNCOA&RI Puducherry

T1: 100% recommended dose of pendimethalin 30% EC @ 1000 g a.i/ha (PE) *fb* quizalafop-ethyl 50 g/ha + pyrithiobac-sodium 62.5 g/ha with drone (spray fluid of 50 L/ha)
T2: 100% recommended dose of pendimethalin 30% EC @ 1000 g a.i/ha (PE) *fb* quizalafop-ethyl 50 g/ha + pyrithiobac-sodium 62.5 g/ha with drone (spray fluid of 25 L/ha)
T3: 75% recommended dose of pendimethalin 30% EC @ 1000 g a.i/ha (PE) *fb* quizalafop-ethyl 50 g/ha + pyrithiobac-sodium 62.5 g/ha with drone (spray fluid of 50 L/ha)
T4: 75% recommended dose of pendimethalin 30% EC @ 1000 g a.i/ha (PE) *fb* quizalafop-ethyl 50 g/ha + pyrithiobac-sodium 62.5 g/ha with drone (spray fluid of 25 L/ha)
T5: 100% recommended dose of pendimethalin 30% EC @ 1000 g a.i/ha (PE) *fb* quizalafop-ethyl 50 g/ha + pyrithiobac-sodium 62.5 g/ha with knapsack sprayer (spray fluid of 500 L/ha for PE and 375 L/ha for PoE)
T6: 75% recommended dose of pendimethalin 30% EC @ 1000 g a.i/ha (PE) *fb* quizalafop-ethyl 50 g/ha + pyrithiobac-sodium 62.5 g/ha with kna sack sprayer (spray fluid of 500 L/ha for PE and 375 L/ha for PoE)
T7: Weed free check (Hand weeding at 20 & 40 DAS)
T8: Unweeded check

WP-1.1.5 Sustainable management of major weeds in *Bt.* Cotton

Network Centres: AAU Anand and CCSHAU Hisar

Objectives:

1. To evaluate the efficacy of herbicides against weeds in *Bt.* cotton
2. To study the effect of herbicides on growth and yield of *Bt.* Cotton

Treatments:

1. Pendimethalin 38.7% CS 677.25 g a.i./ha PE *fb* mechanical weeding at 40-45 DAS
2. Pyrithiobac sodium 3.1 % w /w + pendimethalin 34.0 % w/w ZC 742 g a.i./ha PE *fb* mechanical weeding at 40-45 DAS
3. Pendimethalin 38.7% CS 677.25 g a.i./ha PE *fb* pyrithiobac sodium 6% w/w + quizalofop-ethyl 4% w/w EC 75 +50 g a.i./ha (RM) PoE at 40-45 DAS
4. Pendimethalin 38.7% CS 677.25 g a.i./ha PE *fb* pyrithiobac sodium 10% EC 62.5 g a.i./ha+ clethodim 120 g a.i./ha PoE at 40-45 DAS
5. Pyrithiobac sodium 3.1 % w /w + pendimethalin 34.0 % w/w ZC- 742 g a.i./ha PE *fb* glufosinate 450 g a.i./ha PoE at 40-45 DAS

6. Mechanical weeding at 20-25 DAS *fb* pyrithiobac sodium 6% w/w + quizalofop-ethyl 4% w/w EC 75 +50 g a.i./ha (RM) PoE at 40-45 DAS
7. Two mechanical weeding at 20-25 DAS and 40-45 DAS
8. Weedy check

Experimental details:
Design: RBD Replication: Three

Observations:
1. Phytosociological study of weed flora at 40 and 80 DAS
2. Weed dry weight at 40 and 60 DAS
3. Weed control efficiency at 40 and 80 DAS
4. Yield and yield attributes
5. Economics

Gujarat is one of the largest producers of *Bt*. Cotton in India and managing weeds effectively can significantly improve yield and reduce cost of cultivation. Here anticipated outputs and outcomes of the experiment are given as under:

Outputs:
- Quantitative data on density and dry biomass of weed reduce due to integrated approach of weed management.
- Comparison of herbicide efficacy against major weed species prevalent in *Bt.* cotton fields, thus, provide effective and economical viable options for farmers.
- Measurement of growth parameters and seed cotton yield for *Bt.* cotton under each treatment.
- Evaluation of the cost of herbicide treatments and mechanical weeding for *Bt*. cotton.

Outcomes:
- Identification of the most effective combination of treatments that can be recommended for farmers in Gujarat for effective weed management and enhance crop yield.
- Integration of mechanical weeding with herbicide may lessen the reliance on herbicides, thus promoting sustainable farming practices and reducing the possibility of herbicide resistance.
- Increase the farmers income by adoption of integrated options and improve soil health.

Station trials

ST 1.1.1 Bio-efficacy of herbicide against complex weed flora in soybean

Centres: AAU, Anand

Objectives:
1. To evaluate the efficacy of herbicides against weeds in soybean
2. To study the effect of herbicides on growth and yield of soybean
3. To evaluate herbicide residues in seed, stover and soil
4. To study the effect of herbicides on soil bacterial population

Treatments:

Sr. No.	Treatments	Dose (g/ha)	Application Time
T_1	Diclosulam 0.9% + pendimethalin 35% SE (RM)	22.5 + 875	PE
T_2	Sulfentrazone 28% + clomazone 30% WP (RM)	350+375	PE
T_3	Fenoxaprop-p-ethyl 6% + chlorimuron ethyl 0.9% + Imazethapyr 10% SC (RM)	60+9+100	PoE
T_4	Fomesafen 12.5% + fenoxaprop-p-Ethyl 10% + Chlorimuron Ethyl 0.9% ME (RM)	125 + 100 + 9	PoE
T_5	Fluthiacet-methyl 2.5% + quizalofop-ethyl 10% EC	12.5 + 50	PoE
T_6	Fomesafen 12 % + quizalofop ethyl 3% w/w SC (RM)	180+45	PoE
T_7	Fomesafen 12.5 % + quizalofop ethyl 4.68% w/w EC (RM)	125 + 46.8	PoE

T_8	Propaquizafop 2.5% + imazethapyr 3.75% w/w ME (RM)	50+75	PoE
T_9	Fomesafen 16.8 % + propaquizafop 5.2% w/w ME (RM)	210+65	PoE
T_{10}	Quizalofop ethyl 7.5% + imazethapyr 15% w/w EC (RM)	32.81+65.625	PoE
T_{11}	HW at 20 and 40 DAS	-	-
T_{12}	Weedy check	-	-

Note: PE = Pre-Emergence (1-2 DAS) HW = Hand Weeding
PoE = Post Emergence (15-20 DAS) RM = Ready mix

Experimental Details
Design: RBD, Replication: Three

Observations:
1. Plant stand (no./m row length) at 20 DAS
2. Plant height (cm) at 30 and 60 DAS and at harvest
3. Weed density (monocot and dicot group wise) at 30 and 60 DAS (no./m^2)
4. Weed dry biomass (monocot and dicot group wise) at 30 and 60 DAS and at harvest (g/m^2)
5. Phytotoxicity on crop, if any at 7 and 14 DAHA (0 to 10 scales)
6. Weed control efficiency (%)
7. Weed index (%)
8. Seed yield (kg/ha)
9. Stover yield (kg/ha)
10. Residue analysis of seed, stover and in soil at harvest
11. Soil bacterial count at 0, 10, 30 days after application of herbicides and at harvest

ST 1.1.2 Bio-efficacy of herbicide against complex weed flora in Ajwain
Centres: AAU, Anand

Objectives:
1. To evaluate the efficacy of weed management practices on weeds in ajwain
2. To study the effect of weed management practices on growth and yield of ajwain
3. To evaluate the herbicide residues in seed and soil, if any
4. To evaluate the effect of weed management practices on soil bacterial population

Treatments:

Sr. No.	Treatments	Dose (g/ha)	Application Time
T_1	Pendimethalin 38.7% SC *fb* HW at 45 DAS	580.5	PPI
T_2	Pendimethalin 38.7% SC + oxyfluorfen 23.5% EC (TM)	580.5 + 120	PPI
T_3	Pendimethalin 30% EC + oxyfluorfen 23.5% EC (TM)	580.5 + 120	HG
T_4	Pendimethalin 30% EC + oxyfluorfen 23.5% EC (TM)	580.5 + 120	PE
T_5	Oxyfluorfen 23.5% EC *fb* HW at 45 DAS	117.5	PE
T_6	Oxadiargyl 6% EC *fb* HW at 45 DAS	75	PE
T_7	Quizalofop 4% + oxyfluorfen 6% (RM) *fb* HW at 45 DAS (RM)	30 + 45	PoE
T_8	Quizalofop 4% + oxyfluorfen 6% (RM) *fb* HW at 45 DAS (RM)	40 + 60	PoE
T_9	HW at 20 DAS *fb* IC+ HW at 50 DAS	-	-
T_{10}	IC *fb* HW at 20 DAS *fb* IC at 50 DAS	-	-
T_{11}	IC *fb* HW at 20 and 50 DAS	-	-

T_{12}	Weedy check	-	-

Note: PPI = Pre-Plant Incorporation (1-2 DBS) PE = Pre-Emergence (1-2 DAS)
HG = Herbigation with irrigation at sowing PoE= Post emergence (20-25 DAS)
TM = tank mix RM = Ready mix
HW = Hand Weeding IC = Interculturing

Observations:

1. Plant stand (no./m row length) at 20 DAS
2. Plant height (cm) at 30 and 60 DAS and at harvest
3. Weed density (monocot and dicot group wise) at 30 and 60 DAS (no./m^2)
4. Weed dry biomass (monocot and dicot group wise) at 30 and 60 DAS and at harvest (g/m^2)
5. Phytotoxicity on crop, if any at 7, 14 and 21 DAHA
6. Weed control efficiency (%)
7. Weed index (%)
8. Seed yield (kg/ha)
9. Residue analysis of seed and in soil at harvest
10. Soil bacterial population at 0, 10, 30 days after application of herbicides and at harvest (Composite sample)

ST-1.1.3 Bio-efficacy of ready-mix herbicides against complex weed flora in wheat

Centres: AAU Anand and BAU Sabour

Objectives:

1. To evaluate the efficacy of herbicides against weeds in wheat
2. To study the effect of herbicides on growth and yield of wheat
3. To evaluate herbicide residues in seed, straw and soil
4. To study the effect of herbicides on soil bacterial population

Treatments:

Sr. No.	Treatments	Dose (g/ha)	Application Time
T_1	Aclonifen 36.89 % w/w + diflufenican 6.15% w/w + pyroxasulfone 4.10 % w/w SC	787.5 + 131.25 + 87.5	PE
T_2	Bixlozone 50% + metribuzin 10% WG	750+150	PE
T_3	Pendimethalin 40% + metribuzin 8% EC	1000+200	PE
T_4	Clodinafop propargyl 9% + metribuzin 20% WP (w/w)	54+120	PoE
T_5	2,4-D Sodium Salt 50% (w/w) + metribuzin 15% (w/w) WP	400 + 120	PoE
T_6	Fluroxypyr 13.8% (Meptyl 20%) + metribuzin 5.6% W/W EC	138 + 56	PoE
T_7	Metribuzin 42% + clodinafop propargyl 12% WG	210+60	PoE
T_8	Clodinafop Propargyl 15% + metsulfuron methyl 1% WP	60+4	PoE
T_9	HW at 20 and 40 DAS	-	-
T_{10}	Weedy check	-	-

Note: PE: 1-2 DAS, PoE: 25-30 DAS

Experimental Details

Design: RBD, Replication: Three

Observations:

1. Plant stand (no./m row length) at 15 DAS
2. Plant height (cm) at 30 and 60 DAS and at harvest
3. Weed density (monocot and dicot group wise) at 30 and 60 DAS (no./m2)
4. Weed dry biomass (monocot and dicot group wise) at 30 and 60 DAS and at harvest (g/m2)
5. Phytotoxicity on crop, if any at 7 and 14 DAHA (0 to 10 scales)
6. Weed control efficiency (%)
7. Weed index (%)
8. Grain yield (kg/ha)
9. Straw yield (kg/ha)

10. Residue analysis of grain, straw and in soil at harvest
11. Soil bacterial count at 0, 10, 30 days after application of herbicides and at harvest

ST 1.1.4 Management of floating aquatic weeds in rice with herbicides

Centre: KAU, Thrissur

Background: Floating aquatic weeds are a serious problem in rice bowls of Kerala; Kuttanad and Kole. Manual removal is labour-intensive, costly, and often ineffective due to rapid vegetative regrowth. Hence, systematic evaluation of suitable herbicides is essential to develop effective and crop-safe management recommendations for floating aquatic weeds in rice.

Objective: To develop herbicidal recommendation for management of floating aquatic weeds in rice

Treatments:

T1-2,4-D @1 kg ha^{-1}

T2- Pyrazosulfuron ethyl @0.03 kg/ha

T3- Bispyribac sodium @0.03 kg/ha

T4- Florpyrauxifen benzyl @0.0315 kg/ha

T5- Carfentrazone ethyl @0.02 kg/ha

T6- Metsulfuron methyl +chlorimuron ethyl @ 0.004 kg/ha

T7- Penoxsulam +butachlor @ 0.82 kg/ha

T8- Penoxsulam+cyhalofop butyl @ 0.15 kg/ha

T9- Pretilachlor + pyrazosulfuron ethyl @ 0.615 kg/ha^{1}

T10- Penoxsulam + Florpyrauxifen benzyl @0.032 kg/ha

T10- Unsprayed check (with weeds)

T11- Hand weeded check (weed free)

Note: Effective herbicides will be screened in a pilot study done in tanks and will be evaluated under field situation. Design:RBD, Replications:3 under field evaluation

Output:

- Identification of effective herbicides, optimum dose and timing for management of floating aquatic weeds with minimal crop phytotoxicity.
- Generation of data on weed control efficiency, yield improvement and economic returns for developing a region-specific recommendation.

Outcome:

- Adoption of an efficient and economically viable herbicide-based strategy for managing floating aquatic weeds thereby realising enhanced rice productivity, reduced labour requirement, and improved farmer profitability under lowland rice ecosystems.

Observations:

1. Phytotoxicity scoring on a scale of 0-5
2. Percentage control
3. Regrowth if any
4. Yield of rice

ST 1.1.5 Estimation of florpyrauxifen benzyl residue in lowland rice (clay loam soils)

Centre: KAU, Thrissur

Background: Farmers in kole lands are increasingly using newer post-emergence molecules such as Florpyrauxifen-benzyl for effective management. The persistence under submerged soil conditions requires systematic evaluation. The high clay content and organic matter in these soils may affect adsorption, degradation, and mobility of the herbicide. Therefore, studying the residue dynamics at different intervals after application is essential to ensure environmental safety and compliance with food safety standards.

Objective: Estimation of Florpyrauxifen benzyl 0.0315 kg ha^{-1} herbicide residue in lowland rice (clay loam soils)

Herbicide residue in clay loam soil at 0, 1, 3, 5, 7, 10, 15, 20, 30, 60, 90DAA and at harvest

Output:

- Assessment of residue in soil and its dissipation in kole lands

Outcome:

- Scientific validation of safe and judicious use of Florpyrauxifen-benzyl in lowland rice systems.

ST 1.1.6 Management of microalgae in wetland rice

Centre: KAU, Thrissur

Background: Microalgae has emerged as a serious constraint, in wetland rice particularly after the basal application of ammonium phosphate sulphate fertilizer. Dense algal mats form physical barrier that restricts seedling emergence and hampers early crop establishment. This results in poor plant stand, uneven growth, and ultimately yield reduction. Application of calcium oxide (CaO) is considered a potential management strategy to suppress algal growth by modifying water pH and nutrient availability, thereby improving seedling emergence and crop vigour.

Objectives: To standardize the dose of CaO for the management of algae

T1- CaO 600 kg/ha
T2- CaO 1200 kg/ha
T3- CaO 2400 kg/ha
T4- CaO 3000 kg/ha
T5-CaO 3600 kg/ha
T6-CaO 4000 kg/ha
T_7- Control (No CaO application)

Design: CRD, Treatments**:**7, Replications :4

Output:

- Standardization of effective CaO dose and timing for suppressing microalgal growth and improving seedling emergence. Also assessing the yield loss due to algal infestation.

Outcome:

- Development of a practical and economical recommendation for managing microalgae in wetland rice fields. Improved crop establishment, uniform plant stand, and enhanced productivity.

Observations:

1. Percent control of algae
2. Water quality parameters
3. Effect on seedling growth of rice

ST 1.1.7 Integrated weed management approach for sustainable banana production

Centre: PDKV, Akola **(**Location: ARS, Achalpur Distt-Amravati**)**

Objectives:

1. To study the effect of treatments on weed dynamics in banana
2. To study the integrated weed management practices on productivity of banana
3. To study the economics of different treatments in banana

Treatments:

T_1: Mulching with polythene sheet
T_2: Intercropping with sunhemp (1:2) 20 DAP *in-situ* mulching 75-85 DAP
T_3: Diuron 80% WP 1.5 kg/ha PE *fb* hand weeding 75 DAP
T_4: Indaziflam 1.65% + Glyphosate Isopropyl ammonium 44.63% 40 SC (RM) 787.5 g/ha *fb* hand weeding 75-85 DAP

T_5: Pendimethalin 677 g/ha PE *fb* Glufosinate ammonium 13.5% SL 0.450 kg/ha 35-45 DAP *fb* hand weeding 75-85 DAP
T_6: Hoeing (30-35 & 60-65 DAP) *fb* hand weeding (40-45 & 70-75 DAP)
T_7: Weedy check

Technical details:

- Design : RBD
- Replications : Thee
- Spacing : 1.5 x 1.5 m
- Plot size (Main) : 6.0 x 6.0 m

Observations:

1. Weed density and dry biomass at 30, 60, 90, 120,150, 180 & 210 DAS
2. Crop growth parameters
3. Yield attributes and yield
4. Soil chemical and microbiological studies
5. Economics

Output:

- IWM managing weed density effectively for achieving higher banana yield also helps in preserving soil health and biodiversity. IWM reduces economic and environmental impact.

Outcomes:

- Long term sustainability.

ST 1.1.8 Weed management in dry sown wheat crop with pre-emergence application of herbicides

Centre: CCSHAU, Hisar

Objective:

- To study the efficacy of herbicides against weed flora in dry sown wheat
- To study effect of timing of pre-emergence herbicides on yield and phytotoxicity in wheat crop

Treatments:

Main Plot: (Timing of herbicide application)

1. Dry sown wheat *fb* herbicide spray *fb* irrigation
2. Dry sown wheat *fb* irrigation *fb* herbicide application 2 days after irrigation
3. Dry sown wheat *fb* irrigation *fb* herbicide application 3 days after irrigation
4. Dry sown wheat *fb* irrigation *fb* herbicide application at 18-20 days after sowing

Sub plots (herbicides)

1. Pyroxasulfone 127.5 g/ha
2. Pyroxasulfone + pendimethalin 127.5 + 1500 g/ha (TM)
3. Aclonifen + diflufenican + pyroxasulfone 900 +150 +100 g/ha (RM)
4. Weedy check

Observations:

1. Weed density at 20 DAS, 60 DAS and 90 DAS
2. Yield attributes and yield
3. Phyto-toxicity, if any, in terms of germination, at 7, 14 and 21 DAS.

Rationale of the experiment: Dry sowing of wheat is gaining importance under situations of delayed irrigation availability and conservation agriculture practices. However, weed infestation is a major challenge in dry sown wheat because weeds emerge simultaneously with the crop and compete aggressively during the early growth stages.

Expected Outcomes: The study will helps to identify the optimum timing of herbicide application in dry sown wheat and phyto-toxicity of herbicide in relation to moisture at time of herbicide application.

ST1.1.9 Weed management in pearlmillet and residual effect on succeeding mustard crop
Centre: CCSHAU, Hisar

Objectives:
1. To study the bio-efficacy of herbicides and herbicide combinations on weed growth in pearl millet.
2. To find out the phytotoxicity of herbicides if any.

Treatments:
1. Atrazine 500 g/ha EPoE
2. Tembotrione 100 g/ha PoE
3. Tembotrione + atrazine (TM) 80 + 500 g/ha PoE
4. Tembotrione 9% + atrazine 45% WG (RM) 135 +675 g/ha PoE
5. Tembotrione 9% + atrazine 45% WG (RM) 112 + 563 g/ha PoE
6. Tembotrione 9% + atrazine 45% WG (RM) 90.0 + 450 g/ha PoE
7. Mesotrione + atrazine (RM) 625 g/ha PoE
8. Metsulfuron + chlorimuron 4 g/ha PoE
9. Weed free
10. Weedy check

Mustard crop will be grown in the treated plots of pearl millet and germination count, phytotoxicity,

Observations:
1. Phytosociological study of weed flora at 20, 40 and 60 DAS
2. Weed dry weight at 40 and 60 DAS
3. Weed control efficiency at 40 and 60 DAS
4. Phyto-toxicity of herbicides on green gram (If any)
5. Yield and yield attributes of green gram
6. Economics

Rationale of the experiment: Pearl millet is an important cereal crop grown under rainfed and semi-arid conditions. Severe weed infestation during the early growth stages of pearl millet causes substantial yield losses due to competition for nutrients, moisture, sunlight, and space. Timely and effective weed management is therefore essential for achieving higher productivity. Herbicide combinations such as tembotrione, mesotrione, and atrazine have shown promising weed control in many crops. However, their effectiveness and possible phytotoxic effects in pearl millet under local conditions need evaluation.

Expected Outcomes: As the problem of grassy weeds is increasing in pearlmillet and application of atrazine not provide effective controls of grassy and sedges resulting in lower pearlmillet yield. So, this study will help to identify effective herbicide combinations for weed control in pearl millet and residual effect of herbicides on succeeding mustard crop.

ST 1.1.10 Efficacy of different herbicides in transplanted rice and studies on their residual effect

Centre: CSKHPKV,Palampur

Rationale: In Himachal Pradesh, rice is cultivated over about 67.30 thousand hectares annually. Among different rice cultures, transplanted lowland rice occupies the major share (about 60–65% area) in mid and higher hill regions and weed management is one of the major constraints for its low productivity in state.

Objectives:
1. To evaluate the efficacy of different herbicide treatments against mixed weed flora in transplanted rice,

2. to study the effect of the treatments on productivity and profitability of rice, and
3. to determine herbicide residues through lab bioassays studies.

Treatments:

Sr. No.	Treatment	Dose (g /ha)	Time of application
1.	Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC (RM)	785	PE
2.	Ipfencabazone 25% EC	125	PE
3.	Beflubutamid 2.5% GR	300	PE
4.	Pretilachlor 5% EC with safner	800	PE
5.	Florpyrauxifen benzyl 2.5% EC	31.25	PoE
6.	Florpyrauxifen benzyl 2.13% + cyhalofop-butyl 10.64% EC (RM)	150	PoE
7.	Florpyrauxifen benzyl 1.31% + penoxsulam 2.1% OD (RM)	15.63+25	PoE
8.	Bispyribac sodium 38%+ chlorimuron ethyl 2.5 % + metsulfuron methyl 2.5 % WG (RM)	43	PoE
9.	Hand weeding at 20 an 40 DAT		
10.	Weedy check		

Treatments : 10
Replication : 3
Design : Randomized Block Design

Observations:
1. Phytosociological study of major weeds at 20, 40, 60 DAT and at harvest
2. Weed dry weight at 20, 40, 60 DAT and at harvest
3. Weed control efficiency against major weeds at 20, 40 and 60 DAT
4. Phyto-toxicity of herbicides on crop (if any)
5. Yield and yield attributes
6. Residual studies through Lab Bioassay tests
7. Economics

Output:
- Enhanced WCE, enhanced input (nutrient & water etc.) use efficiency, reduced yield losses, increased production

Outcome:
- Increased productivity & profitability

ST 1.1.11 Evaluation of weed management treatments on transplanted Barnyard millet

Around 48,522 ha area in Uttarakhand is under this crop may be addressed through inclusion of developed technology in State POP

Centre: GBPUAT, Pantnagar

Objectives:
1-To study the effect of weed management options for
2- To study the effect of treatments on weeds and productivity of barnyard millet.

Output:
- Time and labour saving

Outcome:
- Yield and Economic growth

Symbol	Treatments
T1	Pendimethalin 38.7 % CS 678 g/ha PE
T2	Pendimethalin 38.7 % CS 678 PE g/ha *fb* 1 Hand weeding at 30 DAT

T3	Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 785 g/ha (PE)
T4	Pyrazosulfuron ethyl 10% WP 22.5 g/ha (PE)
T5	Pyrazosulfuron ethyl 10% WP 22.5 g/ha (PE) *fb* Metsulfuron Methyl 10% + Chlorimuron Ethyl 10% WP 4 g/ha (PoE 30 DAT)
T6	Pyrazosulfuron ethyl 10% WP 22.5 g/ha (PE) *fb* Bispyribac sodium 10% SC 25 g/ha (3 DAT)
T7	Bensulfuron Methyl 4.8% + Pretilachlor 48% OD 660 g/ha (PE)
T8	Bensulfuron Methyl 4.8% + Pretilachlor 48% OD 660 g/ha (PE) *fb* Bispyribac sodium 10% SC 25 g/ha (PoE 30 DAT)
T9	Pretilachlor 30.0% + pyrazosulfuron- ethyl 0.75% WG 615 g/ha (PE)
T10	Pretilachlor 30.0% + pyrazosulfuron- ethyl 0.75% WG 615 g/ha (PE) *fb* Bispyribac sodium 10% SC 25 g/ha (PoE 30 DAT)
T11	Weed free
T12	Weedy Check

Experimental details:
Design: RBD **Replication:** Three

Observations:
1. Phytosociological study of weed flora at 20, 40 and 60 DAT
2. Weed dry weight at 20, 40 and 60 DAT
3. Weed control efficiency at 20, 40 and 60 DAT
4. Phyto-toxicity of herbicides on barnyard millet (if any)
5. Yield and yield attributes of barnyard millet
6. Economics

S1.1.12 Evaluation of herbicide weed management in wheat crop

Centre: GBPUAT, Pantnagar

S.No.	Treatments
1.	Bixlozone 50% +Metribuzin 10% WG (625+125) g/ha PoE
2.	Bixlozone 50% +Metribuzin 10% WG (750+150) g/ha PoE
3.	Pendimethalin 40% + Metribuzin 8% EC 1200 g/ha PE
4.	Aclonifen 36.89% + Diflufenican 6.15% + Pyroxasulfone 4.10% SC (787.5 + 131.25 + 87.5) g/ha PE
5.	Aclonifen 36.89% + Diflufenican 6.15% + Pyroxasulfone 4.10% SC (900 + 150+ 100) g/ha PE
6.	Aclonifen 36.89% + Diflufenican 6.15% + Pyroxasulfone 4.10% SC (787.5 + 131.25 + 87.5) g/ha PE *fb* Carfentrazone ethyl 40%DF 20g/ha PoE
7.	Pyroxasulfone 85% w/w WG 127.5 g/ha PE *fb* Clodinafop propargyl 9% + Metribuzin 20% WP (54+120) g/ha PoE
8.	Pyroxasulfone 85% w/w WG 127.5 g/ha *fb* Pinoxaden 5.1% EC 40 g/ha + Metsulfuron Methyl 20% WP 4g/ha PoE **(Tank Mix)**
9.	Pyroxasulfone 85% w/w WG 127.5 g/ha PE *fb* Bixlozone 50% +Metribuzin 10% WG (625+125) g/ha PoE
10.	Pendimethalin 40% + Metribuzin 8% EC 1200 g/ha PE *fb* Bixlozone 50% +Metribuzin 10% WG (625+125) g/ha PoE
11.	Pendimethalin 40% + Metribuzin 8% EC 1200 g/ha PE *fb* Pinoxaden 5.1% EC 40 g/ha + Metsulfuron Methyl 20% WP 4g/ha PoE **(Tank Mix)**
12.	Weedy Check

Design: RBD

Observations:

1. Weed density (30 DAS, 60 DAS, at harvest)
2. Weed biomass (30 DAS, 60 DAS, at harvest)
3. Crop growth parameters (plant height and crop biomass at harvest)
4. Grain yield and attributes

Outputs:

- Comparative evaluation of herbicide treatments for weed management in wheat.
- Identification of effective pre- and post-emergence herbicide combinations.
- Assessment of weed control efficiency, crop yield, and economics.

Outcomes:

- Effective control of grassy and broadleaf weeds in wheat and herbicide resistance management.
- Increased wheat productivity and profitability.
- Recommendation of efficient herbicide options for sustainable wheat weed management.

ST 1.1.13 Weed management in high-density guava orchard.

Centre: MPUAT, Udaipur

Treatments:

S.No.	Treatment
1	Pendimethalin 30%EC + atrazine 50%WP (250 + 500 g/ha) PE (Rainy period)
2	Oxyfluorfen (100 g/ha) PE
3	Pendimethalin 30% EC + atrazine 50%WP (250 + 500 g/ha) PE (Rainy period) *fb* glyphosate 41% SL (1.0 kg/ha) PoE
4	Pendimethalin 30% EC + atrazine 50%WP (250 + 500 g/ha) PE (Spring period) *fb* carfentrazone 40% DF (20.0 g/ha) PoE
5	Oxyfluorfen 23.5%EC (100 g/ha) PE (Spring period) *fb* glyphosate 41% SL (1.0 kg/ha) PoE
6	Oxyfluorfen 23.5%EC (100 g/ha) PE (Spring period) *fb* carfentrazone 40% DF (20.0 g/ha) PoE
7	Pendimethalin 30% EC + atrazine 50% WP (250 + 500 g/ha) PE (Rainy) *fb* Weed mulching
8	Oxyfluorfen 23.5%EC (100 g/ha) (Rainy period) *fb* ***w***eed mulching
9	Weed-free
10	Weedy check

Experimental details: Design: RBD, Replication: Three

Observations:

1. Shoot extension growth (cm)
2. Leaf area (cm^2)
3. Fruit setting (%)
4. No. of fruits per plant
5. Fruit weight (g)
6. Fruit size (Fruit length and Fruit breadth) (cm)
7. Fruit yield per plant (kg)
8. Firmness (kg cm^{-2})
9. TSS (Brix value)
10. Acidity (%)
11. Weed density and weed dry matter (45 and 90 Days after treatment application) and weed control efficiency

Output:

- Effective weed management of grassy and broadleaf weeds during flowering and fruiting and reducing weed density and biomass

Outcomes:

- Increase in income of farmer and increase in average productivity of guava
- To study the effect of weed management practices on weeds and weed flora shift in high-density guava orchard.
- To study the effect of weed management practices on growth parameters and productivity of orchard plants.

ST 1.1.14 Bio-efficacy of new generation ready mix herbicides under varied nutrient management in direct seeded rice (DSR) for the year 2026.

Centre: OUAT, Bhubaneswar

Objectives:

1. To study the weed dynamics and productivity of rice as influenced by nutrient and weed management in DSR.
2. To determine the bio-efficacy of herbicide and under nutrient management in DSR.

Treatments:

A. Main plot

1. STBFR (soil test-based fertilizer recommendation, NPK)
2. STBFR (25% more)
3. STBFR (25% less)

B. Sub plot

1. Pendimethalin + Pyrazosulfuron (RM) 785 g/ha as PE fb triafamone + ethoxysulfuron (RM) 90 g/ha as PoE (25-30 DAS)
2. Pendimethalin + Penoxsulam (RM) 625 g/ha fb penoxulam + cyhalofop butyl (RM) 135 g/ha as PoE (25-30 DAS)
3. Pendimethalin 38.7 % CS PE fb one HW at 30 DAS
4. 2 HW at 20 & 40 DAS
5. Partially weedy check (1 HW at 60 DAS)

Design: Split plot Replication: 3
Plot size: 5m×5m

Observations:

1. Phytosociological study of weed flora at 20, 40 and 60 DAS
2. Weed dry weight at 20, 40 and 60 DAS
3. Weed control efficiency at 20, 40 and 60 DAS
4. Nutrient uptake by weeds & crops (20, 40 & 60 DAS)
5. Yield and yield attributes
6. Economics

ST 1.1.15 Weed management strategies in transplanted sugarcane

Centre: PAU, Ludhiana

Treatments:

Main Plots

1. Planting three budded set of sugarcane (Recommended check)
2. Transplanting sugarcane nursery

Sub-plots

1. Un-treated control
2. Aclonifen + Diflufenican (RM) @ 1200 g/ha as PE
3. Sulfentrazone (28%) + Clomazone (30%) (RM) @ 1450 g/ha as PE
4. Aclonifen + Diflufenican (RM) @ 1200 g/ha as PE *fb* trash/straw mulch *fb* post-emergence herbicide (depending upon weed flora)
5. Sulfentrazone (28%) + Clomazone (30%) (RM) @ 1450 g/ha as PE *fb* trash/straw mulch *fb* post-emergence herbicide (depending upon weed flora)
6. Aclonifen + Diflufenican (RM) @ 1200 g/ha as PE *fb* trash/straw mulch

7. Sulfentrazone (28%) + Clomazone (30%) (RM) @ 1450 g/ha as PE *fb* trash/straw mulch

Observations:
1. Weed dynamics at different intervals
2. Yield and yield attributes of Sugarcane

ST 1.1.16: Evaluation of resistance in *Phalaris minor* against different herbicides in HT Rice-Wheat System in pots.
Centre: PAU, Ludhiana

Treatments:
1. **B**ixlozone 50% + metribuzin 10% (RM) 750 g/ha
2. Mesosulfuron + iodosulfuron 14.4 g/ha
3. Clodinafop+ metsulfuron 64 g/ha
4. Pyroxasulfone + pendimethalin 127.5 + 1500 g/ha (TM)
5. Aclonifen + diflufenican + pyroxasulfone 900 +150 +100 g/ha
6. Metribuzin 42%+clodinafop 12% (RM) g/ha

ST 1.1.17 Evaluation of Sustainable Weeding Tools in Maize
Centre: UAS, Bengaluru

Maize (*Zea mays* L.) is one of the most important cereal crops in the world and is popularly known as the "Queen of Cereals" due to its high productivity potential and diverse uses. It serves as a staple food for humans, an important feed source for livestock and poultry, and a valuable raw material for several agro-based industries. Maize is also rich in carbohydrates, fiber, antioxidants, vitamins, and minerals, making it an important component of human and animal nutrition. In India, however, a major share of maize production is utilized for poultry and animal feed. With increasing population, urbanization, changing food habits, rising standards of living, and rapid economic growth, the demand for maize and maize-based processed products has increased considerably in both rural and urban areas. Products such as corn flakes and other processed maize foods are gaining popularity due to their convenience, taste, and nutritional value, creating significant opportunities for the expansion of maize-based food processing industries in major maize-growing regions.

In India, maize is cultivated over an area of about 11.24 million hectares with a production of 37.66 million tonnes and an average productivity of 3.35 t/ha. Karnataka is one of the major maize-growing states, cultivating maize on 1.97 million hectares with a production of 5.63 million tonnes and productivity of 2.89 t/ha, which is lower than the national average. Over the past decade, maize cultivation in Karnataka has expanded rapidly, replacing several traditional rainfed crops such as potato, tobacco, cotton, groundnut, finger millet, and sorghum. Despite its importance, maize productivity is often constrained by several factors, among which weed infestation is one of the most serious problems, causing severe competition for nutrients, moisture, sunlight, and space during the critical stages of crop growth. Uncontrolled weed growth in maize can result in yield losses ranging from 30 to 80 per cent, depending on the intensity and duration of weed competition, thereby significantly reducing farm income and overall productivity.

Maize fields are infested with a wide range of weed species, including sedges, broad-leaved weeds, and grasses. Important weeds associated with maize cultivation include *Cyperus rotundus* among sedges; broad-leaved weeds such as *Euphorbia* spp., *Parthenium hysterophorus*, *Amaranthus viridis*, *Commelina benghalensis*, *Borreria hispida*, *Acalypha indica*, *Abutilon hirtum*, *Phyllanthus niruri*, *Boerhavia coccinea*, *Argemone mexicana*, *Achyranthus aspera*, *Celosia argentea*, *Cardiospermum helicacabum* and *Xanthium strumarium*; and grassy weeds such as *Rottboellia cochinchinensis*, *Cynodon dactylon*, *Digitaria marginata*, *Dactyloctenium aegyptium*, *Panicum repens* and *Echinochloa colona*. Effective weed management during the critical crop growth period is therefore essential to achieve higher productivity and profitability in maize cultivation.

The experiment is necessitated by the increasing shortage and rising cost of labor during the peak weeding period in maize cultivation. Traditional hand weeding methods are labor-intensive, time-consuming, and often delay timely intercultural operations, thereby adversely affecting crop growth

and yield. Although several improved manual and power-operated weeding tools are available, limited information exists regarding their field performance, operational efficiency, cost-effectiveness, crop safety, and environmental impact under local conditions. Moreover, there is an increasing need to reduce dependence on chemical herbicides and promote sustainable and eco-friendly weed management practices. Therefore, the present experiment is undertaken to identify suitable and efficient weeding tools that can reduce labor drudgery, lower operational costs, improve weed control efficiency, minimize carbon footprint, and ultimately enhance maize productivity.

Objective: To evaluate the performance, efficiency, cost, crop impact and carbon footprint of different weeding tools

Treatments:

	Treatment details
T_1	Hand weeding using varavri (control) at 20 and 40 DAS
T_2	Wheel Hoe weeder at 20 and 40 DAS
T_3	Cycle weeder at 20 and 40 DAS
T_4	Soil crumbler at 20 and 40 DAS
T_5	Power weeder at 20 and 40 DAS
T_6	Double wheel Harrow at 20 and 40 DAS
T_7	Hand culti-weeder at 20 and 40 DAS

Experimental details:
Design: RCBD **Replication:** 3 **Gross Plot Size:** 16.2 m × 9.6 m

Observations:

Physiological Parameters (Ergonomic observations)	**Performance Parameters**
1) Heart beat (Beats/min) 2) Oxygen consumption (L/min) 3) Energy expenditure rate (kJ/min)	1) Theoretical field capacity (ha/h) 2) Effective field capacity (ha/h) 3) Field efficiency (η) 4) Work capacity (h/ha) 5) Weeding efficiency (%) 6) Plant damage percentage 7) Yield and economics 8) Carbon emission calculation

Output:

- Comparative data generated on the performance and efficiency of different sustainable weeding tools in maize.
- Assessment on labor requirement, operational cost, field capacity, and energy use of each weeding tool.
- Crop growth, weed control efficiency, and yield response under different weeding tools.
- Estimation of carbon footprint and environmental impact associated with each weeding tool.
- Identification of suitable eco-friendly and cost-effective weeding implements for maize cultivation.

Outcomes:

- Reduction in labor drudgery and time required for intercultural operations in maize.
- Lower operational cost and reduced dependence on manual labor for weeding.
- Promotion of sustainable and climate-smart weed management practices in maize cultivation.
- Reduction in carbon emissions through adoption of energy-efficient weeding tools.

ST 1.1.18 Bio-efficacy of new generation ready mix herbicides in managing broad spectrum weed flora in groundnut

Centre: SKNAU, Jobner

Objectives:

1. To evaluate the bio-efficacy of new generation ready mix herbicides on weeds in groundnut
2. To study the effect of different herbicides on growth and yield of groundnut
3. Bioassay study to assess the residual effect of new generation ready mix herbicide on the succeeding crops.
4. To work out economics of different treatments.

Treatments:

T_1 - Weedy Check

T_2 - Sodium Acifluorfen 16.5% + Clodinofop-propargyl 8% EC (RM) @ 245 ga.i./ha at 15-20 DAS

T_3 - Propaquizafop 2.5% + Imazethapyr 3.75% w/w (RM) @ 125 g a.i./ha at 15-20 DAS

T_4 - Imazethapyr 35% + Imazamox 35% WG (RM) @ 70 g a.i./ha at 15-20 DAS

T_5–Metamifop 8% + Imazethapyr 4% + Imazamox 3% ME (RM) @ 100 g a.i./ha at 15-20 DAS

T_6 - Metamifop 8% + Imazethapyr 4% + Imazamox 3% ME (RM) @ 125 g a.i./ha at 15-20 DAS

T_7 - Metamifop 8% + Imazethapyr 4% + Imazamox 3% ME (RM) @ 150 g a.i./ha at 15-20 DAS

T_8 - Weed Free

Design: RBD

Replications: 3

Observations:

1. Plant population
2. Weed density
3. Weed Control Efficiency
4. Weed Index
5. Phytotoxicity rating
6. Yield and Yield attributes
7. Economics: Net returns and BC ratio
8. Bioassay studies: Germination of succeeding crop & phytotoxicity rating

Outcome of the research trial:-

- Economically effective ready mix herbicide will be evaluated for groundnut which can manage broad spectrum weed flora, as there is combination of 3 herbicides as a ready mix which is first time introduced for the groundnut crop.
- Residual effect, if any, of ready mix herbicides on succeeding crop can also be evaluated through bioassay.

ST 1.1.19 Weed management in *Gobhi sarson* for *Rabi* season

Centre: CSKHPKV, Palampur

Rationale: *Gobhi sarson* is an important rabi oilseed crop of Himachal Pradesh, particularly in the mid and low hill regions, owing to its high yield potential, superior oil quality, and wide adaptability under diverse agro-climatic conditions. However, its productivity remains low due to severe weed infestation during the early growth stages. Under chemical weed control, the improved formulation of pendimethalin 38.7% CS which offers improved weed control efficiency, prolonged residual activity, and better crop safety compared to the conventional pendimethalin 30% EC formulation can be an effective pre-emergence herbicide option. Its integration with post-emergence herbicides such as propaquizafop and quizalofop-ethyl can provide broad spectrum, efficient and sustainable weed management strategy for this crop under the hill conditions of Himachal Pradesh.

Objectives:

1. To find out the effective herbicide(s) for controlling weeds in *gobhi sarson.*

2. to study the effect of treatments on growth, productivity and profitability of *gobhi sarson*

Treatments:

Sr. No.	Treatments	Dose (g/ha)	Time of application
1.	Pendimethalin 38.7% CS	338.625	PE
2.	Pendimethalin 38.7% CS	367.65	PE
3.	Pendimethalin 38.7% CS	396.675	PE
4.	Quizalofop ethyl 5% EC	50	PoE
5.	Propaquizafop 10% EC	60	PoE
6.	Pendimethalin 38.7% CS *fb* quizalofop ethyl 5% EC	338.625 *fb*.50	PE *fb*. PoE
7.	Pendimethalin 38.7% CS *fb* propaquizafop 10% EC	338.625 *fb*. 60	PE *fb*. PoE
8.	Propaquizafop 5% + oxyfluorfen 12% EC (RM)	148.75	PoE
9.	Pendimethalin 38.7% CS *fb* 1 HW at 30-35 days	338.625 *fb*. 1 HW	PE
10.	Pendimethalin 30% EC	1400	PE
11.	2 hand weedings		
12.	Weedy check		

*PE=Pre emergence, PoE=Post emergence

Treatments : 12
Replication : 3
Design : Randomized Block Design

Observations:

1. Species-wise weed count (No./m^2) at 30, 60, 90 DAS
2. Species-wise weed dry weight (g/m^2) at 30, 60, 90 DAS
3. Weed control efficiency (%) at 30, 60 and 90 DAS
4. Phyto-toxicity of herbicides on crop (if any)
5. Yield and yield attributes
6. Economics

Outputs:

- Evaluation of new herbicides, Enhanced WCE, enhanced input use efficiency, reduced yield losses and increased production

Outcomes:

- Increased availability, productivity & profitability of Gobhi sarson, Oilseed enhancement/sufficiency, Recommendation for weed control in Gobhi sarson

ST 1.1.20 Integrated use of competitive cultivars and weed management strategies on weed dynamics, crop growth and yield of summer sesame

Centre: PJNCOA&RI Puducherry

Objectives:

1. To evaluate the effect of weed management practices for different sesame cultivars on weed dynamics, crop growth, and yield of summer sesame.
2. To study the impact of weed management practices for different sesame cultivars on economics of summer sesame.

Treatments:

Main plot (Cultivars) – Three levels

V_1 – VRI 4
V_2 – VRI 5
V_3 – TMV 7

Subplot (Weed management) – Four levels

W_1 – Pendimethalin 750g/ha *fb* Quizalofop 50g/ha
W_2 – Pendimethalin 750g/ha + 1 HW @30 DAS
W_3 – Hand weeding twice (15 DAS and 30 DAS)

W_4 – Unweeded control

Total number of Treatments: 12

Replication **:** 3

Design : Split plot design

Observations:

1. Weed density and dry biomass at 30DAS & at harvest
2. Weed control efficiency (%) at 30 DAS
3. Crop growth parameters
4. Yield attributes and yield.
5. Phytotoxicity on crop
6. Economics analysis

ST 1.1.21 Integrated Weed Management in Saffron

Centre: SKUAST, Kashmir

Saffron (*Crocus sativus*) is the most expensive spice, colouring agent and medicinal plant worldwide. In India saffron is exclusively grown in the Kashmir valley. Several weed species December to May in saffron fields need to be proper control. There is an excessive labour requirement for its cultivation. Weeding and hoeing accounts for major labour cost component (35% of the total labour cost). Appropriate weed management may reduce drudgery for cost effect cultivation. An experiment is proposed to control weeds in saffron field with following Objectives:.

Objectives:

1. To study the effect of weed management practices on weed flora and weed control performance in saffron
2. To study the effect of weed management practices on growth and productivity of saffron

Treatments:

Factor 1: Number of Sprinkler Irrigation

1. **35 m^3/ha** (5 during late August – mid October and 1 irrigation in mid-November)
2. **52.5 m^3/ha** (7 during late August – mid October and 2 irrigation in mid-November)
3. **70 m^3/ha** (9 during late August – mid October and 3 irrigation in mid-November)
4. **Rainfed** (control)

Factor 2: Weed Management

1. Metribuzin 560 g/ha (autumn) *fb* manual weeding (spring)
2. Meribuzin 560 (autumn) g/ha *fb*. Metribuzin 560 g/ha (spring)
3. Intercropping with vegetable peas
4. Weed free
5. Weedy check

Design: Factorial RBD

Replication: 3

Plot size: 2.0 m x 2.00 m

Spacing: 20 cm x 20 cm

Observations:

1. **Weed flora study:** Population density and dry matter accumulation (category wise: Sedge, Grasses, BLW, Total)
2. **Vegetative Growth Parameters:** (at 30 days interval): Foliage dry matter (g/plant), Leaf length (cm) and mean number of leaves per corm
3. **Flower yield attributes and yield:** Number of flowers per corm, Fresh stigma yield per kg of flower (g), Dry stigma yield per kg of flower (g), Stigma length (cm), Style length (cm)
4. **Corms characteristics:** Weight of replacement Corms / daughter corms (g), Diameter of replacement Corms / daughter corms (cm); using Vernier calliper

ST 1.1.22 Weed management in clonal rootstock and grafted nurseries of apple

Centre: SKUAST, Kashmir

Objectives:

1. To study the effect of weed management practices on weed dynamics and weed flora shift in the clonal rootstocks and grafted nurseries
2. To study the effect of weed management practices on growth parameters of nursery plants

Treatments:

S. N.	Early season (Spring)	Mid season (Summer)
Clonal Rootstock Nursery of Apple		
1.	Hand hoeing	Pendimethalin 30 %EC (1.0 kg/ha) *fb* Carfentrazone 40% DF (20.0 g/ha)
2.	Hand hoeing	Pendimethalin 30 %EC (1.0 kg/ha) *fb* Glufosinate ammonium 13.5% SL 600 g/ha
3.	Hand hoeing	Oxyfluorfen 23.5%EC (100 g/ha) *fb* Carfentrazone 40% DF (20.0 g/ha)
4.	Hand hoeing	Oxyfluorfen 23.5%EC (100 g/ha) *fb* Glufosinate ammonium 13.5% SL 600 g/ha
5.	Hand hoeing	Hand hoeing
6.	Weedy check	Weed check
7.	Weed free	Weed free
Grafted Nursery of Apple		
1.	Pendimethalin 30 %EC (1.0 kg/ha)	Carfentrazone 40% DF (20.0 g/ha)
2.	Oxyfluorfen 23.5%EC (100 g/ha)	Carfentrazone 40% DF (20.0 g/ha)
3.	Hand hoeing	Carfentrazone 40% DF (20.0 g/ha)
4.	Plastic mulching	Plastic mulching
5.	Hand hoeing	Hand hoeing
6.	Weedy check	Weed check
7.	Weed free	Weed free

Observations

Clonal rootstocks nursery:

i. No. of layers per mother rootstock
ii. Plant height (cm)
iii. Percent graftable layers
iv. Root biomass per layer
v. Weed density and dry matter

Grafted nursery:

i. Plant height (cm)
ii. Scion girth (mm)
iii. No. of branches per plant
iv. No. of leaves per plant
v. Leaf area (cm^2)
vi. Survival percentage

ST 1.1.23 Weed management in HDP orchard of apple

Centre: SKUAST, Kashmir

Objectives:

1. To study the effect of weed management practices on weed dynamics and weed flora shift in the high-density orchard of apple
2. To study the effect of weed management practices on growth parameters and productivity of orchard plants

Treatments:

1	Pendimethalin 30%EC + Atrazine 50%WP (250 + 500 g/ha) PE (Spring period)
2	Oxyfluorfen (100 g/ha) PE (Spring period)
3	Pendimethalin 30%EC + Atrazine 50%WP (250 + 500 g/ha) PE (Spring period) *fb* glyphosate 41% SL (1.0 kg/ha) POE (Summer period)
4	Pendimethalin 30% EC + Atrazine 50%WP (250 + 500 g/ha) PE (Spring period) *fb*carfentrazone 40% DF (20.0 g/ha) POE (Summer period)
4	Oxyfluorfen 23.5%EC (100 g ha) PE (Spring period) *fb* glyphosate 41% SL (1.0 kg/ha) POE (Summer period)
5	Oxyfluorfen 23.5%EC (100 g/ha) PE (Spring period) *fb* carfentrazone 40% DF (20.0 g/ha) POE (Summer period)
6	Pendimethalin 30%EC + Atrazine 50%WP (250 + 500 g/ha) PE (Spring period) *fb* Weed mulching (Summer period)
7	Oxyfluorfen 23.5%EC (100 g/ha) (Spring period) *fb* Weed mulching (Summer period)
8	Weed free
9	Weedy check

Observations:

1. Shoot extension growth (cm)
2. Leaf area (cm^2)
3. Fruit setting (%)
4. No. of fruits per plant
5. Fruit weight (g)
6. Fruit size (Fruit length and Fruit breadth) (cm)
7. Fruit yield per plant (kg)
8. Firmness (kg cm^{-2})
9. TSS (Brix value)
10. Acidity (%)
11. Weed density and weed dry matter (45 and 90 Days after treatment application)

ST 1.1.24 Evaluation of new herbicide molecules for weed management in sugarcane

Centre: UAS, Dharwad

Objectives:

1. To evaluate new herbicide molecules for broad spectrum weed control in sugarcane plant crop.
2. To develop a cost effective weed management technology for managing weeds in sugarcane plant crop.

Treatments:

1. Pre-emergence application of Clomazone 22.5 % + Metribuzine 21 % WP (ready mix) 2.5 kg/ha followed by one inter-cultivation at 60 days after planting (partial earthing up)
2. Pre-emergence application of Clomazone 30 % + Sulfentrazone 28 % WP (ready mix) 2.5 kg/ha followed by one inter-cultivation at 60 days after planting (partial earthing up)
3. Post emergence application of 2-4 D sodium salt + Metribuzine+ Pyrazosulfuron ethyl (ready mix) 3 kg/ha at 2-4 leaf stage of weeds followed by earthing up at 120 DAP
4. Post emergence application of Halosulfuron methyl + Metribuzine (ready mix) @ 1 L/ha at 24 leaf stage of weeds followed by earthing up at 120 DAP

5. Post emergence application of Topramezone + Atrazine (ready mix) 3 L/ha at 2-4 leaf stage of weeds followed by earthing up at 120 DAP
6. Pre-emergence application of Atrazine 80% WP @ 2.5 kg/ha followed by one inter-cultivation at 60 days after planting (partial earthing up)
7. Post emergence application of 2,4 D Na salt @ 2.5 kg/ha at 2-4 leaf stage of weeds followed by earthing up at 120 DAP
8. Weed free check
9. Weedy check

Treatments: 09
Design: RBD
Replication: 3

Observations:
1. Germination % at 30, 45 days; Tiller count at monthly interval
2. Harvesting parameters: Total height, Millable height, Girth, No. of internodes, Length of internodes, No. of millable canes at 10th month age and Yield (kg/plot & t/ha)
3. Juice Quality parameters: Pol, Brix, CCS %, Purity %, CCS yield (t/ha) and Reducing/ Non-reducing sugar
4. Economics: Cost of cultivation, Gross returns, Monitory returns and B:C ratio
5. Weed observations: Weed count at 30 days interval up to 120 days after planting, weed density and weed dry weight of grasses, broad-leaved weeds and sedges and Weed control efficiency and Weed index of different treatments

ST 1.1.25 Validation of herbicide tolerant inoculum consortia on growth and yield parameters of soybean under the influence of herbicides.

Centre: UAS, Dharwad

Treatments:

	Factor – I (Herbicides)		Factor-II (Herbicide tolerant microbial consortium)
H1	Diclosulum 84 % WDG 26 g/ha (PE)	M1	Herbicide tolerant mycorrhizal consortium
H2	Imazathepyre 10 % SL 100 g/ha (PoE)	M2	Herbicide tolerant PPFM consortium spray (15^{th}, 30^{th} and 45^{th} DAS)
H3	Diclosulum 84 % WDG 26 g/ha (PE) + Imazathepyre 10 % SL @ 100 g/ha (PoE)	M3	Herbicide tolerant mycorrhizal and PPFM consortium spray (15^{th}, 30^{th} and 45^{th} DAS)
H4	Weed-free check	M4	UIC (Uninoculated control)

Methods of Application:
- Herbicide tolerant mycorrhizal consortium (Soil application at the time of sowing)
- Herbicide tolerant PPFM consortium (Sprayed at 30th and 45th DAS)

Details of herbicidal tolerant microbial consortium:

AMF consortia	
Herbicide tolerant mycorrhizal consortium	AMFHT17 (*Glomus intraradices)* AMFHT23 (*Glomus leptotichum)* AMFHT54 (*Glomus mosseae)*
PPFM consortia	
Herbicide tolerant PPFM consortium	PPFMH - 1 PPFMH - 27 PPFMH - 31 PPFMH - 59

Observations:
1. Growth parameter: Plant height (30 and 60 DAS)
2. Weed parameters: Weed density/m^2 (30 and 60 DAS) and Weed dry weight (g/ m^2) (30 and 60

DAS)
3. Physiological Parameters: Relative chlorophyll content (SPAD) (45 DAS)
4. Microbiological parameters (45 DAS): Dehydrogenase and Phosphatase
5. Yield attributes and seed yield

Note: The consortium developed by UAS-Dharwad centre will be distributed to all centers

WP 1.2 Weed Management under conservation tillage-based cropping systems

Objectives:

1. To monitor weed and pest dynamics, crop-cum-energy productivity, resource use efficiency, profitability under long-term conservation tillage and weed management practices
2. Study on weed seed dynamics
3. 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

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 (40 DAS)]

Observations:

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. Phytosociological parameters: relative frequency, abundance, importance value index and other diversity indices
4. Weed seed bank study at 0-10 and 10-20 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 (incollaboration with soil science department)
10. It has been suggested to conduct a bioassay after 3 years to know the herbicide resistance andweed flora shift

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

Network centres: PAU Ludhiana, CCSHAU Hisar, and SKUAST Jammu

Treatment	**Rice (DSR)**	**Wheat**	**Greengram/green manure**
Main plot	**Tillage**		
	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 1000 g/ha (2 DAS) *fb* bispyribac sodium+chlorimuron+metsulfuron 43 g/ha (20-25 DAS) **2nd year:** Pretilachlor + pyrazosulfuron 615 g/ha (2 DAS) *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha (20-25 DAS) **(2026)** **3rdyear:** Pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20 DAS)	**1st year:** bixlozone + metribuzin 750 g/ha (30 DAS) **2nd year:** Pyroxasulfone 127.5 g/ha *fb* mesosulfuron + iodosulfuron 14.4 g/ha (30 DAS) **(2026-27)** **3rd year:** Aclonifen + diflufenican + pyroxasulfone 900 + 150+ 100 g/ha (PE) *fb* bixlozone + metribuzin 750 g/ha (30 DAS)	**In greengram** **1st year:** Pendimethalin + imazethapyr 1.0 kg/ha (2 DAS) **2nd year:** Imazethapyr 100 g/ha (20 DAS) **(2027)** **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	Aclonifen + diflufenican + pyroxasulfone 900 + 150+ 100 g/ha (PE) *fb* HW (40-45 DAS) *fb* weed seed harvest **(2026-27)**	Pendimethalin 678 g/ha (2 DAS) *fb* hand weeding (30 DAS)
Weedy check	Partially weedy (weeds removed after critical period)	Weedy check	Weedy check

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

Centre: OUAT, Bhubaneswar

Treatments:

	Kharif	***Rabi***	**Summer**
Treatment	**Rice (DSR)**	**Maize**	**Blackgram**
Main Plot	**Tillage**		
	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 1000 g/ha (2 DAS) *fb* bispyribac sodium+chlorimuron+metsulfuron 43 g/ha (20-25 DAS) **2nd year:** Pretilachlor + pyrazosulfuron 615 g/ha (2 DAS) *fb* florpyrauxifen-benzyl + cyhalofop-butyl 150 g/ha (20-25 DAS) **(2026)** **3rdyear:** Pendimethalin+pyrazosulfuron 920 g/ha (2 DAS) *fb* triafamone+ethoxysulfuron 66.5 g/ha (20 DAS)	**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 + 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)
Un weeded	Partially weedy (weedy up to 60 DAS)	Weedy check	Weedy check

WP 1.3 Weed management strategies in natural farming agriculture

WP 1.3.1 Weed management in turmeric under natural farming

Centre: AAU, Anand and BCKV, Kalyani

Objective: To monitor the effect of treatments on weed dynamics and crop productivity in turmeric under natural farming

Tr. No.	Treatments
T_1	Stale seedbed *fb* live mulch of dhaincha (cutting and spread at 40-45 DAP) *fb* HW at 75 DAP
T_2	Stale seedbed *fb* live mulch of sunnhemp (cutting and spread at 40-45 DAP) HW at 75 DAP
T_3	Live mulch of dhaincha (cutting and spread at 40-45 DAP) *fb* HW at 75 DAP
T_4	Live mulch of sunnhemp (cutting and spread at 40-45 DAP) *fb* HW at 75 DAP
T_5	Live mulch of cowpea (cutting and spread at 40-45 DAP) *fb* HW at 75 DAP
T_6	Live mulch of greengram (cutting and spread at 40-45 DAP) *fb* HW at 75 DAP
T_7	Partial weedy (weeds will be removed at 90 DAP after taking observation)

Natural farming practices (Protocol)

- Crop: **Turmeric**
- Seed treatment: *Bijamrut* (300 mL/kg rhizome)
- *Ghan Jivamrut* (6 t/ha) soil application at sowing
- *Jivamrut* (1250 L/ha) at sowing, 30, 60, 90, 120 and 150 DAP as soil application
- Foliar spray of *Jivamrut* at 45, 75, 105 and 135 DAP
- Mulching: As per treatment
- Plant protection: *Agniastra*, *Brahmastra* and *Neemastra*, if required

Experimental details

1.	Crop & Variety	:	Turmeric (GNT 2)
2.	Season	:	*Kharif* & *Rabi* 2026-27 & 2027-28
3.	Seed rate	:	2500 kg/ha rhizome
4.	Spacing	:	45 x 15 cm

5.	Method of sowing	:	Planting
6.	Design	:	RBD
7.	Replication	:	3
8.	Plot size	:	3.6 x 4.5 m

Observations:

1. Phytosociological study of weed flora at 30, 60 and 90 DAP
2. Crop growth parameters
3. Yield attributes and yield
4. Weed shifts
5. Soil microbial population initial and at harvest (cfu g/soil)
6. Economics

The outcomes of this research on weed management in turmeric under natural farming conditions provide crucial insights to enhance agricultural productivity in Gujarat. By effectively managing weeds and maintaining healthy soils through mulching practices, farmers can achieve improved yields while also enhancing the ecological balance in their farming systems. The following anticipated outputs and outcomes are derived from the monitoring of treatments aimed at managing weeds and evaluating crop productivity in turmeric under natural farming practices in Gujarat.

Outputs:

- Evaluation of weed density, biomass and species composition at different growth stages of turmeric across all the treatments. Data will indicate the effectiveness of different mulching strategies in suppressing weed populations.
- Measurement of turmeric growth and rhizome yield allowing for a direct comparison of productivity across the various treatments.
- Evaluation of soil health parameters such as organic carbon and microbial population, as they could be affected by different mulching practices and crop management.
- Estimation of the economic viability of each treatment, considering the inputs cost in comparison to produced yield.

Outcomes:

- Identification of the most effective treatment(s) for weed management in turmeric under natural farming.
- Anticipated higher rhizome yields for treatments with effective weed management strategies compared to the partial weedy treatment, leading to improved economic returns for turmeric farmers.
- Promotion of natural farming methods that utilize the crops like dhaincha, sunnhemp, cowpea and greengram as a live mulch enhance soil health, moisture conservation leading to increased microbial activity crucial for sustainable agriculture.

WP 1.3.2 Weed management in pigeonpea-summer sorghum cropping sequence using cover crops for sustainable productivity under natural farming

Centre: PDKV, Akola

Objectives:

1. To study the effect of cover crops on weeds dynamic, growth and yield of pigeonpea-summer sorghum cropping sequence.
2. To determine the weed smothering efficiency, weed control efficiency and weed competition index of treatments.
3. To determine the effect of cover crops on physico-chemical properties and biological indicators of soil after harvest of pigeonpea and summer sorghum.
4. To study the profitability of the treatments.

Symbol	Treatment
T_1	Amaranth (1:1) *in situ* mulching at 45-50 DAS
T_2	Dhaincha (1:1) *in situ* mulching at 45-50 DAS
T_3	Sunhemp (1:1) *in situ* mulching at 45-50 DAS
T_4	Greengram (1:1) *in situ* mulching at 45-50 DAS

T_5	Soybean (1:1) *in situ* mulching at 45-50 DAS
T_6	Weed free (3 Hoeing + 2 Hand weeding)
T_7	Weedy check

Observations:

1. Weed density and weed biomass at 30, 60 DAS & at harvest
2. Crop growth parameters
3. Yield attributes and yield
4. Soil chemical and microbiological studies
5. Profitability

Technical details:

- Design : RBD
- Replications : Thee
- Spacing : 60 x 30 cm
- Plot size : 4.80 m x 6 m

Nutrient schedule:

- Beejamrut : 300 ml/kg seed
- Ghanjeevamrut : 2.5 t/ha (furrow application)
- Jivamrut : Soil application (1250 L/ha) at sowing and 20-25 days interval up to 120 DAS
- Jivamrut : Foliar spray (300 L/ha) at 30, 60, 90 and 120 DAS
- Mulching : Crop waste or weeds 5 t/ha
- Inter-copping : In additive series

Output:

- Effective weed management in a pigeonpea-summer sorghum system under natural farming depend on utilizing competitive cover crops to suppress weeds through competition, shading, and residue management, reducing the need for manual or chemical weeding. Important strategies include using fast-growing, low-stature cover crops that complement the slow initial growth of pigeonpea.

Outcomes:

- Sustainable weed control through cover crops promotes ecological balance and soil microbial activity by eliminating herbicides. Cover crops enhanced soil fertility by adding nitrogen to the soil. The soil moisture conservation due to cover crop mulching helps to withstand dry spells. It also reduces labour cost by suppressing weeds naturally and minimizing multiple manual weeding operations.

WP 1.3.3 Evaluation of weed management option for various cropping systems under natural farming.

Centre: GBPUAT, Pantnager

Objective:

1. To find best weed management practice for various cropping systems under Natural farming
2. To find out the productivity of the crops and cropping system
3. Soil health initial and after five years

Symbol	Treatment
	Main plot (Cropping system)
M1	DSR-Mustard+Veg Pea (1:1)-Sweet corn
M2	Maize-Wheat+Mustard (1:1)-Greengram
M3	Soybean-Vegetable pea+Coriander (1:1)-Blackgram
	Sub plot (Weed management)
S1	One hand weeding at 15 DAS with retention of weeds as mulch
S2	Two hand weeding at 15 and 30 DAS with retention of weeds as mulch
S3	Three hand weeding at 15 and 30 and 45 DAS with retention of weeds as mulch
S4	Weedy check

Note;
Seed treatment: With *Beejamrit* in all the crops. **Nutrient management:** With herbal *kunap jal*/*Jeevamrit* in all the crops. **Plant protection:** With *Neemastra* /*Dashparni ark* in all the crops.

Design: SPD, Replication: 03

Observations:

1. Weed density at 15 DAS, 30 DAS and 45 DAS
2. Weed dry weight at 15 DAS, 30 DAS and 45 DAS
3. Weed control efficiency at 15 DAS, 30 DAS and 45 DAS
4. Yield and yield attributes of crops
5. Economics
6. Soil health analyses at initial and after 5 years

Expected output:

- Assessment of weed density, crop productivity, system profitability, and soil health under natural farming

Outcome:

- Development of weed management for cropping systems under natural farming
- Improved crop productivity, profitability, and resource-use efficiency.
- Development of eco-friendly and climate-resilient cropping systems suitable for natural farming.

WP 1.3.4 Evaluation of weed management practices in baby corn-fennel under natural farming system

Centre: MPUAT, Udaipur

Objective:

- To develop weed management practices in baby corn-fennel under Natural Farming system

Treatments:

	Baby corn	Fennel
1.	Intercropping with blackgram (1:2)	Intercropping with chickpea (1:2)
2.	Stale seedbed + 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
3.	Baby corn : blackgram (2:2) intercropping	Fennel : chickpea (2:2) intercropping
4.	Stale seedbed preparation + Baby corn : blackgram (1:2)	Stale seedbed preparation + Fennel : Chickpea (1:2)
5.	Stale seedbed preparation + Baby corn : blackgram (1:2) + 1 hand weeding at 50 DAS	Stale seedbed preparation + Fennel : chickpea (1:2)+ 1 hand weeding at 50 DAS
6.	Stale seedbed preparation + Maize : blackgram (1:2) + straw mulch previous crop (5 t/ha) at 30 DAS	Stale seedbed preparation + Fennel : chickpea (1:2) + straw mulch previous crop (5 t/ha) at 30 DAS
7.	Stale seedbed preparation + Baby corn : blackgram (1:2) + straw mulch previous crop (5 t/ha) at 30 DAS+1 hand weeding at 50 DAS	Stale seed bed preparation + Fennel : chickpea (1:2) + straw mulch previous crop (5 t/ha) at 30 DAS+1 hand weeding at 50 DAS
8.	Control (Direct sowing & no other treatment)	Control (Direct sowing & no other treatment)

Other details of experiment

(i)	Test crop	**:**	Maize and Fennel
(ii)	Variety	**:**	-

(iii)	Season	:	*Kharif & Rabi Season*
(v)	Experimental design	:	RBD
(vi)	No. of treatments	:	8
(vii)	No. of replication	:	3
(viii)	Total no. of plots	:	30
(ix)	Plot size	:	Gross size: 9 m x 6 m = 54 m^2 Net size: 8.4 m x 6 m= 50.4 m^2

Natural farming practices (Protocol for treatment T1 to T7)

- Intercropping: Maize + blackgram (2:2) and (1:2)
- Seed treatment: *Bijamrut* (300 mL/kg seed for both crops)
- *Ghan Jivamrut* (3 t/ha) + FYM (3 t/ha) soil application at sowing
- *Jivamrut* (1250 L/ha) at sowing, 30, 45, 60, 75, 90,105,120,135 and 150 DAP as soil application
- Foliar spray of *Jivamrut* 1.0 L/10 L of water at 45 DAP and *Jivamrut* 2.5 L/10 L at 75 105 and 135 DAP
- *Achhadan*: Crop residue: 5 t/ha (as per treatment)
- Plant protection: *Agniastra*, *Brahmastra* and *Neemastra*, if required

Note: Quantity of FYM will be reduced 25% from second year onwards (it should be produced in NF field)

Observations:

1. Weed density species-wise (no./m^2) and dry matter (g/m^2) at 45 and 75 DAS.
2. Crop growth parameters
3. Yield attributes and yield
4. Economic analysis
5. Soil physico-chemical properties
6. Soil microbial biomass

Output:

- Better soil health, improved crop growth and development and reducing weed density and biomass

Outcomes:

- Enhanced biodiversity, yield stability, improved health of animals, human beings and long-term sustainability of agro-ecosystem

WP 1.3.5 Weed management in DSR-wheat cropping system under natural farming (Collaboration with Organic and Natural Farming Center SKUAST-J)

Center: SKUAST, Jammu

Objectives:

1. To monitor the effect of treatments on weed dynamics and crop productivity.
2. To find out the economics of rice-wheat cropping system under different treatments.

Treatment details

S.N	DSR (*Kharif*)	Wheat (*Rabi*)
1.	Reduced spacing in rice crop (15 x 10 cm)	1. Wheat + gram (2:1)
2.	Reduced spacing in rice crop (15 x 10 cm) + wheat straw mulch (5 t/ha)	2. Wheat + pea (2:1)
3.	Live mulch with sesbania (in-situ 40 DAS)	3. Wheat + mustard (2:1)
4.	Stale seedbed with reduced spacing in rice crop (15 x 10 cm)	4. Wheat + gram (2:1) + rice straw mulch (5 t/ha)
5.	Stale seedbed with live mulch with sesbania (in-situ 40 DAS)	5. Wheat + pea (2:1) + rice straw mulch (5 t/ha)
6.	Stale seedbed with reduced spacing in rice crop (15 x 10 cm) + wheat straw mulch (5 t/ha)	6. Wheat + mustard (2:1) + rice straw mulch (5 t/ha)
7.	Weedy check	7. Weedy check (sole wheat)

Natural farming practices (Protocol for treatment 1 to 7)
1. Seed treatment of *Beejamrit* (300 mL/kg seed)
2. Foliar spray of *Jeevamrit* at 20 days interval up to panicle initiation
3. Plant protection: *Agniastra*, *Brahmastra* and *Neemastra*, if required

Observations:
1. Weed density and dry biomass at 20, 40 DAS & 60 DAS
2. Crop growth parameters
3. Yield attributes and yield
4. Economics

Outcomes:
- In the Union Territory of Jammu & Kashmir, where the rice–wheat cropping system predominates in hilly areas there is significant scope for promoting natural farming practices. The proposed study is expected to develop effective, eco-friendly weed management strategies, which will help in reducing weed pressure and ensuring stable and improved crop productivity for farmers
- In natural farming systems, weed management approaches such as live mulching, straw mulching, and intercropping are expected to enhance soil health by improving soil organic matter, microbial activity, moisture retention, and nutrient cycling, thereby contributing to sustainable crop productivity in the long term.

WP 1.3.6 Evaluation of non-chemical weed management practices in basmati rice and cauliflower under organic farming system

Center: SKUAST, Jammu

Objective:
1. To monitor the effect of weed management practices on weeds and crop productivity in rice and cauliflower.
2. To study the economics of different weed management treatments.

Treatments:

S. No.	Basmati rice	Cauliflower	Green manure (Summer)
1.	Cono-weeder at 40 DAT	Cycle wheel hoeing at 20 DAS & 40 DAS	Dhaincha
2.	Cono-weeder at 20 & 40 DAT	Twin wheel hoeing at 20 DAS & 40 DAS	Dhaincha
3.	Vinegar 5% at 5 DBT	Rice straw mulch (5 t/ha)	Dhaincha
4.	Vinegar 10% at 5 DBT	Intercropping with radish (1:1)	Dhaincha
5.	Vinegar 5% at 5 DBT *fb* cono-weeder at 40 DAT	Intercropping with spinach (1:1)	Dhaincha
6.	Hand weeding at 20 & 40 DAT (Farmer's practice)	Hand weeding at 20 and 40 DAT (Farmer's practice)	Dhaincha
7.	Weedy check	Weedy check	Dhaincha

Source of Nutrients: FYM/Vermicompost (as per recommended dose of N)
Design: RBD **Replications:** 03

Observations:
1. Weed density at 30 and 60 DAT
2. Weed dry weight at 30 and 60 DAT
3. Weed control efficiency 30 and 60 DAT
4. Yield and yield attributes
5. Economics of different treatments
6. Organic carbon, N, P, K status before and after harvest of crops.

Outcomes:
- Basmati rice covers about 62,000 ha in the Jammu region, with Basmati-370 valued for its export quality and aroma. As farmers shift toward organic farming, weed management has

become a major challenge. This study evaluates effective non-chemical weed control practices aimed at improving weed control efficiency, enhancing soil health, and increasing farmers' income through premium organic markets, thereby ensuring sustainable livelihoods for Basmati growers.

- Furthermore, in organic cauliflower, where weed infestation remains a major constraint, the integration of mechanical weeding, mulching, and intercropping is anticipated to improve weed suppression, increase productivity, and enhance economic returns under organic farming.

WP 1.3.7 Weed management in brinjal- barnyard millet- green manure cropping system under natural farming

Centre: TNAU, Coimbatore

Objectives:

1. To monitor the effect of treatments on weed dynamics and crop productivity
2. To study the dynamics of micro-flora and nutrient status of the soil.
3. To study the economics of weed management practices

Rationale:

Weed management in natural farming is important to reduce competition between weeds and crops for nutrients, water, sunlight and space, which helps improve crop growth and yield. Since natural farming avoids herbicides, it relies on eco-friendly practices such as mulching, crop rotation, intercropping, cover crops and manual weeding to control weeds. These methods not only suppress weed growth but also help maintain soil fertility, conserve moisture, and protect beneficial soil organisms. Overall, natural weed management supports sustainable agriculture by maintaining ecological balance and ensuring long-term productivity without harming the environment.

Treatments:

	Brinjal (*Kharif*)	**Barnyard millet (*Rabi*)**
T_1	Stale seedbed *fb* HW at 50 DAP	Stale seedbed
T_2	Stale seedbed *fb* crop residue mulch @ 5 t/ha *fb* HW at 50 DAP	Stale seedbed *fb* crop residue mulch @ 5 t/ha
T_3	Live mulch of green manure (*daincha*) at 30 DAP *fb* HW at 50 DAP	Live mulch of green manure (*daincha*) at 30 DAS
T_4	Intercropping with green leaf vegetable (Amaranthus) *fb* HW at 50 DAP	Intercropping with green leaf vegetable (Amaranthus)
T_5	Mulching with previous crop residue (Total available quantity) *fb* HW at 50 DAP	Mulching with previous crop residue (Total available quantity)
T_6	HW 20 & 40 DAP	HW 20 DAS
T_7	Unweeded control	Unweeded control

Design: RBD, **Replication:** Three

Observations:

1. Weed density and dry biomass at 30, 45 and 60 DAS
2. Crop growth parameters
3. Yield attributes and yield
4. Soil chemical and microbiological studies
5. Economics

Output:

- Higher weed control efficiency and yield of brinjal and barnyard millet under natural farming.

Outcome:

- Increased productivity and profitability of the brinjal-barnyard millet cropping system through sustainable, chemical-free weed management.

WP 1.3.8 Weed management in finger millet–field bean cropping system under natural farming

Centre: UAS, Bengaluru

Objective:

1. To find out the best weed management practice in natural farming systems

Treatments:

Treatments	*Kharif* - Finger millet	*Rabi* – Field bean
T_1	Stale seedbed followed by crop residue mulch at the same day	Stale seedbed followed by crop residue mulch at the same day
T_2	Stale seedbed followed by hand weeding at 30 DAS	Stale seedbed followed by hand weeding at 30 DAS
T_3	Pongamia flower and leaf residues as a mulch @ 6 t/ha	Pongamia flower and leaf residues as a mulch @ 6 t/ha
T_4	Finger millet + cowpea at 2:1 ratio (Replacement series)	Field bean + cowpea at 2:1 ratio (Replacement series)
T_5	Reduced spacing (20 cm) followed by one HW at 25 DAS	Reduced spacing (20 cm) followed by one hand weeding at 25 DAS
T_6	2 HW at 20 and 40 DAS	2 HW at 20 and 40 DAS
T_7	Weedy check	Weedy check

* Prior to the sowing of main crop, cowpea will be grown as a cover crop

* Seed treatment with *beejamrutha*

* *Ghana jeevamrutha/ jeevamrutha* as a source of nutrient

* Pest management using *agniastra/ brahmastra/ neemastra*

Design: RBD **Replication:** Three **Plot size:** 5.4 m × 4.8 m

Observations:

1. Weed density, fresh weight, dry weight and weed control efficiency at 40 and 60 DAS
2. Yield and Yield attributes
3. Economics
4. OC, N, P, K status before and after harvest of crops
5. Dehydrogenase enzyme activity initial and at harvest

Outputs:

- Standardized natural farming practices developed for finger millet and field bean cropping system.
- Field data generated on crop growth, yield performance, soil health, and input use efficiency.
- Increased knowledge and practical skills of farmers and field functionaries on natural farming practices.
- Documentation of indigenous inputs and bio-formulations used in the system.
- Technical recommendations prepared for sustainable cultivation of finger millet and field bean under natural farming.

Outcomes

- Improvement in soil fertility, soil microbial activity, and overall ecosystem health.
- Eco-friendly crop production, enhanced sustainability and resilience of the finger millet–field bean cropping system.
- Reduction in cost of cultivation through the use of locally available natural inputs.
- Improvement in crop productivity, profitability, and farm income over time.

WP 1.3.9 Weed management in pearl millet-chickpea cropping system under natural farming
Centre: RVSKVV, Gwalior
Objective: To find out the best weed management practice in pearl millet-chickpea cropping system under natural farming

Treatments:

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

Note: Previous crop residue in chickpea @ 5 t/ha
1. **Design:** RBD 2. **Replication: Three** 3. **Plot size:** 4.0 x 3.2 m^2
4. Sesbania broadcasting in between two rows of pearlmillet @ 25 kg/ha

Natural production systems:

- Seed treatment: With *Beejamrit* in both seasons.
- Nutrient management: With herbal *kunapjal / Jeevamrit / Ghanjivamrit* in both seasons.
- Weed management: As per treatment
- Plant protection: With *Neemastra / Dashparni ark* in both seasons.

Observations:
1. Weed density and biomass of 30 & 60 DAS
2. Growth and yield parameters of pearl millet & chickpea
3. economics of the treatment
4. Sesbania biomass at incorporation
5. Soil nutrient status before sowing of experiment and after harvesting

Justification: Weeds are in major constraint in pearmillet –chickpea cropping system. Natural farming discourages the use of synthetic herbicides "Therefore effective weed management strategies are required".

Output:
- Reduce weed density and weed biomass through hand weeding, mulching, intercropping.

Outcome:
- Increase Pearlmillet and chickpea productivity and profitability under Natural farming.

WP 1.3.10 Weed Management in Redgram-sesame cropping system under natural farming
Centre: PJTSAU, Hyderabad
Objective: To find out the best weed management practice in Redgram sesamum cropping system under natural farming

Treatments:

Tr. No.	Redgram (*kharif*)	Sesame (summer)
T_1	Stale seedbed *fb* one hand weeding at 30 DAS	Leaf litter mulching of redgram
T_2	Live mulch with *Sesbania* (*dhaincha*) upto 60 DAS and cutting and spreading at 60 DAS.	Live mulch with cowpea upto 20 DAS and cutting and spreading at 20 DAS.
T_3	Crop residue 3-5 t/ha as mulch	Crop residue 3-5 t/ha as mulch
T_4	Redgram + fox tail millet intercropping at 2: 4	Sesame + greengram intercropping at 1: 1

T_5	Datura /neem/karanj leaf extract concentrate 30% at 2-3 weed leaf stage	Datura / neem/karanj leaf extract concentrate 30% at 2-3 weed leaf stage
T_6	Three hand weedings at 20, 40 and 60 DAS	Two hand weedings at 20 and 40 DAS
T_7	Control (No weed management)	Control (No weed management)

Design: RBD **Replications:** 3

Observations:

Redgram (*kharif*)	**SESAME (summer)**
Weed density at 30 and 60 DAS	Weed density at 15 and 30 DAS
Weed dry weight at 30 and 60 DAS	Weed dry weight at 15and 30 DAS
Weed control efficiency at 30 and 60 DAS	Weed control efficiency at 15 and 30 DAS
Yield and yield attributes	Yield and yield attributes
Economics	Economics
Soil OC, nutrient status before and after harvest of each cycle.	

- **All the package of practices will be followed as per natural farming guidelines**

WP 1.3.10 Weed Management in maize–wheat cropping system under natural farming
Centre: CSKHPKV, Palampur

Objectives:
1. To evolve remunerative / economically viable weed management practices in maize -wheat cropping system under natural farming
2. To study the effect of weed management practices on productivity of maize – wheat cropping system under natural farming

Treatment Details

	Kharif	***Rabi***
T_1	Maize alone (check, no weed control)	Wheat alone (check, no weed control)
T_2	Maize alone (with mulch 5 t/ha)	Wheat alone (with mulch 5 t/ha)
T_3	Maize + soybean (check, no weed control)	Wheat + gram (check, no weed control)
T_4	Maize + soybean + 1 HW at 20 DAS	Wheat + gram + 1 HW at 20 DAS
T_5	Maize + soybean (with mulch 5 t/ha)	Wheat + gram (with mulch 5 t/ha)
T_6	Maize + soybean (with mulch 5 t/ha) + 1 HW at 20 DAS	Wheat + gram (with mulch 5 t/ha) + 1 HW at 20 DAS
T_7	Maize + soybean + 2 HW at 20 & 50 DAS	Wheat + gram + 2 HW at 20 & 50 DAS
T_8	Maize + soybean (with mulch 5 t/ha) + 2 HW at 20 & 50 DAS	Wheat + gram (with mulch 5 t/ha) + 2 HW at 20 & 50 DAS
T_9	Maize alone (weed free) 3 HW	Wheat alone (weed free) 3 HW
T_{10}	Maize + soybean (weed free) 3 HW	Wheat + gram (weed free) 3 HW

Year of start: *Kharif* 2024

Treatments : 10
Replications : 3
Design : RBD

Observations:
1. Species wise weed count and weed dry matter at periodic intervals
2. Yield attributes and yields of all the crops in the system
3. Economics

Remarks:
Will be continued as second year *Rabi* crop has been harvest and need another two more years to see the impact of weed management practices after transition period under natural farming conditions.

WP 1.3.11 Weed management in organically grown maize-garlic cropping system

Centre: CSKHPKV, Palampur

Rationale: The maize-garlic sequence is a highly profitable, intensive cropping system used in the mid-hill regions of Himachal Pradesh. It diversifies from traditional system like maize-wheat and maximizes land productivity and profitability. It is typically managed with non-chemical (organic) practices to meet market demands for high-value organic produce. But the constraint of weed infestation limits the production of both crops adversely.

Objectives:

1. To study the weed dynamics in organically grown maize-garlic cropping system
2. To evolve remunerative / economically viable weed management practice in maize-garlic organic production system
3. To find out the effect of treatments on soil micro-flora and nutrient status (plant, weeds & soil) after the completion of cropping cycle

Centre: CSHPKV, Palampur

Treatments:

Sr. No.	Maize (*Kharif*)	Garlic (*Rabi*)
1.	Hoeing at 20 DAS *fb* earthing up at knee high stage	Hand weeding at 30 & 60 DAP
2	Stale seedbed + 1HW	Stale seedbed + 1HW
3.	Stale seedbed + mulch 5 t/ha	Stale seedbed + mulch 5 t/ha
4	Stale seedbed + mulch 5 t/ha + 1HW	Stale seedbed + mulch 5 t/ha + 1HW
5.	Maize + cowpea (1:1 additive series) + 1HW	Garlic + pea (2:1 replacement series) + 1HW
6.	Maize + cowpea (1:1 additive series) + mulch 5 t/ha	Garlic + pea (2:1 replacement series) + Mulch 5 t/ha
7.	Maize + cowpea (1:1 additive series) + mulch 5 t/ha + 1HW	Garlic + pea (2:1 replacement series) + Mulch 5 t/ha + 1HW
8.	Stale seedbed + maize + cowpea (1:1 additive series) + 1HW	Stale seedbed + garlic + pea (2:1 replacement series) +1 HW
9.	Stale seedbed + maize + cowpea (1:1 additive series) + Mulch 5 t/ha	Stale seedbed + garlic + pea (2:1 replacement series) + Mulch 5 t/ha
10.	Stale seedbed + maize + cowpea (1:1 additive series) + mulch 5 t/ha +1HW	Stale seedbed + garlic + pea (2:1 replacement series) + mulch 5 t/ha + 1HW

Treatments : 10
Replication : 3
Design : Randomized Block Design

Observations:

1. Weed density & weed dry biomass (species-wise and total) at periodic intervals
2. Monitoring of weed shifts over base year
3. Phytosociological parameters
4. Growth, yield attributes and yield of different crops in the system
5. Soil microbiological & nutrients (N, P & K) studies {initial & final}
6. Economics

Outputs:

- Reduced weed infestation, better input (nutrient and water) use efficiency, higher yields (system productivity), improved produce quality and premium price,

Outcomes:

- Improved soil health, sustainable weed management, enhanced livelihood security and increased adoption of organic farming

WP 1.1.12 Weed management in Sesame – Lentil cropping system under natural farming
Centre: BUAT, Banda
Objective:
1. To find out the best weed management practice in Sesame – Lentil cropping system under natural farming.

Treatments:

Sl. No.	Sesame (*Kharif*)	Lentil (*Rabi*)
1.	Stale seed bed fb Mulching (2nd week) @2t/ha *fb* Hand weeding 40 DAS	Stale seed bed fb Mulching (2nd week) @2t/ha *fb* Hand weeding 40 DAS
2.	Mulching (1st week) @2t/ha fb Hand weeding 30 DAS	Mulching (1st week) @2t/ha *fb* Hand weeding 30 DAS
3.	Live Mulch of Dhaincha (Cutting at 30 DAS) *fb* Hand weeding 40 DAS	Live Mulch (Cutting at 30 DAS) *fb* Hand weeding 40 DAS
4.	Reduced spacing (20cm) fb Hand weeding 30 DAS	Reduced spacing (20cm) *fb* Hand weeding 30 DAS
5.	Mechanical weeding at 20 and 40 DAS	Mechanical weeding at 20 and 40 DAS
6.	Hand weeding at 20 and 40 DAS	Two hand weeding at 20 & 40 DAS
7.	Weedy check	Weedy check
8.	Weed free	Weed free

• Design : RBD
• Replication : Three
• Plot size: 4.0 x 3.2 m2
• Sesbania broadcasting in between two rows of sesame @ 25 kg/ha

Natural production systems:
• Seed treatment: With Beejamrit in both season.
• Nutrient management: Jeevamrit / Ghanjivamrit in both season.
• Weed management: As per treatment
• Plant protection: With Neemastra / Dashparni in both season.

Observation:
1. Weed density and biomass of 30 & 60 DAS
2. Growth and yield parameters of sesame& lentil
3. economics of the treatment
4. Soil nutrient status and DHA before sowing of experiment and after harvesting

WP 1.4. Management of parasitic weeds

WP 1.4.1. Management of *Orobanche* in *calcutti* tobacco

Centre: AAU, Anand

Objectives:
1. To evaluate the efficacy of herbicides against weeds in *Calcutti* tobacco
2. To study the effect of herbicides on growth and yield of *Calcutti* tobacco

Sr. No.	Treatments
T_1	Sulfentrazone 39.6% SC 360 g a.i./ha PPI
T_2	Pendimethalin 38.7% CS 580.5 g a.i./ha PPI *fb* HW at 60 DATP
T_3	Sulfentrazone 39.6% SC 360 g a.i./ha PPI *fb* HW at 60 DATP
T_4	Pendimethalin 30% EC 500 g a.i./ha PE *fb* HW at 60 DATP
T_5	Pendimethalin 38.7% EC 580.5 g a.i./ha PPI *fb* pendimethalin 30% EC 500 g a.i./ha at 40 DATP with irrigation
T_6	Sulfentrazone 39.6% SC 360 g a.i./ha PPI *fb* pendimethalin 30% EC 500 g a.i./ha at 40 DATP with irrigation
T_7	IC *fb* HW at 20 and 40 DATP
T_8	Weedy check

Note: PPI = Pre plant incorporation (2 DBTP) HW = Hand weeding
PE = Pre-emergence (1-2 DATP)

Experimental details

Season	:	*Rabi,* 2026
Crop and Variety	:	Tobacco, GAT 3
Design	:	RBD
Replications	:	3
Plot Size	:	**Gross plot:** 3.60 m x 6.00 m
		Net plot: 2.40 m x 4.20 m
Spacing	:	60 x 30 cm
Method of Sowing	:	Transplanting
Fertilizer dose	:	$N_{200} + P_0 + K_0$ kg/ha

Observations:

1. Phytosociological study of *Orobanche* at 60 ,90 DAP and at harvest
2. Dry biomass (g/m^2) of *Orobanche* at 60 ,90 DAP and at harvest
3. Crop growth parameters
4. Yield (kg/ha)
5. Soil microbial population at initial and harvest (cfu g/soil)
6. Economics

The following anticipated outputs and outcomes are based on the specified treatments for managing *Orobanche* and evaluating the efficacy of herbicides in *Calcutti* tobacco grown in Gujarat.

Outputs:

- Statistical data on weed density and dry weed biomass for each treatment will assess the effectiveness of different herbicide applications in controlling weeds and *Orobanche*.
- Analysis on the timing of herbicide applications help to identify optimal application strategies for effective weed control.
- Quantitative analysis of tobacco leaf yield from different treatments indicates how weed management strategies impact final productivity.

Outcomes

- Identification of the most effective treatment(s) for controlling *Orobanche* and other weeds in *Calcutti* tobacco, provide practical solution to the farmers for improve weed management practices.
- Anticipated higher yields in herbicide-treated plots compared to the weedy check indicate a positive relationship between effective weed management and crop productivity.
- Promotion of integrated weed management strategies that combine pre-emergence herbicides with cultural practices to reduce herbicide dependency and enhance soil health.

WP 1.4.2 Management of *Loranthus* in Citrus
(*in collaboration with AAU-Citrus and Plantation Crops Research Station, Tinsukia*)
Centre: AAU, Jorhat
Objectives:
1. To arrive at herbicidal management measures against the parasitic weed *Loranthus* on citrus
2. To study the visual phyto-toxicity on Citrus plant, if any

Design: RBD **Replication:** 3
Treatments:

1. 2,4- D Na salt 80 WSP 5 g/l + $CuSO_4$ (2%) and urea 5% foliar spray
2. Cutting down the affected branch of the host plant
3. 2,4-D amine salt 1% on the host plant trunk
4. 2,4-D amine salt 1% on the pest trunk
5. Spraying of Diesel on the host plant trunk
6. Unsprayed Check

Observation:

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

WP 1.4.3 Management of *Orobanche* in mustard

Centre: CCSHAU Hisar, MPUAT Udaipur, RVSKVV Gwalior, and SKNAU Jobner

Objective:

1. To find out a suitable management option for *Orobanche* in mustard

Treatments:

1. Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 490.62 g/ha PRE
2. Pretilachlor 30% + pyrazosulfuron 0.75% WG 461.25 g/ha PRE
3. Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 490.62 g/ha PPI
4. Pretilachlor 30% + pyrazosulfuron 0.75% WG 461.25 g/ha PPI
5. Pyroxasulfone 100 g/ha PRE
6. Pyroxasulfone 100 g/ha PPI
7. Metsulfuron 5% SE 4 g/ha PRE
8. Metsulfuron 5% SE 4 g/ha PPI
9. Clearfield mustard (45S42) with imazapic 35 g a.i./ha + imazapyr 105 g a.i./ha+MSO adjuvant @ 2 ml/L of water
10. Weedy check

Design: RBD Replication: 3

Observations:

1. Visual Phytotoxicity on mustard plants at 0, 7, 14 and 21 days after germination
2. No. of *Orobanche* shoots emerged 45, 90 and 120 DAS and at harvest
3. Growth characters

4. Yield and Economics

Justification: Orobanche is a serious parasitic weed in mustard that attaches to crop roots and absorbs water, nutrients, causing severe yield losses. Orobanche infestation reduce mustard yield and quality, leading to economic losses for farmers.

Output:

- Reduction in *Orobanche* emergence and infestation levels in mustard field.

Outcome:

- Increased mustard productivity and profitability.

WP 1.4.4 Management of Striga in sugarcane

Centre: PJTSAU, Hyderabad and UAS Dharwad

Objective:

- Evaluation of UAS-D AMF consortium against Striga emergence in sugarcane
- To study the visual phytotoxicity on sugarcane crop

Treatments:

T_1: 2,4-D sodium salt 44% + metribuzin 35% + pyrazosulfuron ethyl 1.0% WDG 2400 g/ha as post-emergence

T_2: 2,4-D sodium Salt 48% + metribuzin 32% + chlorimuron ethyl 0.85% WDG 2020 g/ha as PoE

T_3: Atrazine 1.0 kg/ha on 3 DAP + HW on 45 DAP + earthing up on 60 DAP + PoE 2,4-D Na salt 5.0 g/L+ urea 20 g/L on 90 DAP fb trash mulching @ 5t/ha on 120 DAP

T_4: UAS-D AMF consortium

T_5: Untreated check

WP 1.5 Management of herbicide resistance in weeds

WP 1.5.1 Baseline survey and confirmation of herbicide resistance in weeds in different crops

Centre: CSKHPKV, Palampur, UAS, Bengaluru

Objectives:

1. To quantify resistance levels and distribution of weeds
2. To identify resistant biotypes in different cropping systems
3. To quantify the economic and agricultural impact of resistant weeds on crop production

Methodology

Base line Survey

Field scouting will be conducted in various cropping systems. Baseline information on type of herbicides using in particular crop is documented. Later, weeds not controlled by particular herbicides are documented.

Sample herbicides collections

Farmers will be contacted randomly for weed seed collection from different cropping systems. Standard protocols will be adopted for seed collection, and execution of the experiments.

Plant propagation

Seed samples will be stored at 4°C. To break dormancy, seeds of all species will be treated with a solution of 0.2% KNO_3 for 24 hours. Depending on seed availability, up to 20 seeds per sample (per herbicide) will be planted in rows into plastic propagation trays filled with potting mix at open place.

Herbicide treatment

Pre emergence herbicides will be applied at same day of sowing and post-emergence herbicides at the 3-leaf stage for grass species and 4-leaf for the broadleaf species as per herbicide recommendations at X and 2X dose. Weed survival will be assessed 3–5 weeks after treatment imposition. Weeds survived will be considered as resistant.

Outputs:

- Identification and documentation of herbicide-resistant weed biotypes in major cropping systems.
- Baseline database on herbicide usage, resistant weed distribution, and resistance levels.
- Development of suitable herbicide resistance management recommendations for farmers.

Outcomes:

- Early detection and effective monitoring of herbicide-resistant weeds.
- Improved adoption of integrated weed management practices and judicious herbicide use.
- Reduction in yield losses and economic impact caused by herbicide-resistant weeds.

WP-1.5.2 Assessment of weed resistance for tembotrione in maize in Telangana State

Centre: PJTSAU, Hyderabad

Objective:

- To find out the weed resistance for tembotrione in maize

Methodology:

- Seeds of the surviving weeds will be collected from the farmers' fields and ARS, Karimnagar and AICRP on Maize, PJTSAU where the maize is grown for more than 10 years and tembotrione herbicide used continuously.

Factor I: Weed Species: Four

W_1: *Digitaria sanguinalis*
W_2: *Rottoboellia cochinchinensis*
W_3: *Digera arvensis*
W_4: *Commelina benghalensis*

Note: The seeds of the seeds surviving at harvest of maize crop will be collected. Hence, the species may vary.

Factor II: Tembotrione doses: Five + 1 control

H_1: Tembotrione 30 g a.i./ha
H_2: Tembotrione 60 g a.i./ha
H_3: Tembotrione 120 g a.i./ha
H_4: Tembotrione 180 g a.i./ha
H_5: Tembotrione 240 g a.i./ha
H_6: unsprayed control

Design: CRD with factorial concept; Replications: Three

Observations:

1. Germination percent
2. Plant height at 30 DAS
3. Plant dry weight at 30 DAS
4. Visible mortality
5. % reduction in weed biomass

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

WP 2.1. Management of weeds in non-cropped area

Centre: CSKHPKV, Palampur

Rationale*: Lantana camara* is one of the most destructive invasive weeds in Himachal Pradesh, extensively infesting forests, grazing lands, orchard boundaries and degraded areas of the lower and mid-hill regions. Its aggressive growth habit forms dense brushes that suppress native plant species, hinder natural forest regeneration, reduce biodiversity and replace valuable fodder grasses, thereby affecting livestock-based livelihoods. The weed also increases forest fire hazards due to accumulation of dry biomass and exhibits strong regenerative ability, making its management difficult once established. In addition, its allelopathic effects adversely influence soil health and seed germination of native species. Therefore, effective and timely control of *Lantana camara* through IWM approach is essential for ecological restoration, biodiversity conservation, sustainable forest management and protection of grazing resources in the Himalayan ecosystem of Himachal Pradesh.

Treatments:

A. Main plot treatments

a) Time of cutting

T_1- 1st week of July
T_2- 1st week of August
T_3- 1st week of September

b) Time of spray

S_1- One month after cutting
S_2- Two months after cutting

B. Sub plot treatments (Herbicide application)

H_1- Carfentrazone ethyl 0.43% + glyphosate 30.82% EW (RM) 937.5 g/ha
H_2- Paraquat dichloride 7.50% + glyphosate 30% SC (RM) 1125 g/ha
H_3- Saflufenacil 70.0% WG 70 g/ha
H_4- Glyphosate 41% SL 1500 g/ha + metsulfuron methyl 1% WP 4 g/ha (TM)
H_5- Control (Unsprayed)

Treatments : 30
Replications : 3
Design : Factorial Randomized Block Design

Observations:

1. Shoot height of regenerated *Lantana camara* bushes
2. No. of shoots/plant of regenerated *Lantana camara* bushes
3. Fresh and dry biomass/plant of regenerated *Lantana camara* bushes
4. Developmental studies

5. Per cent regeneration
6. Control rating

Outputs:

- Infestation reduction, restoration of range & forest lands and recommended technology for management

Outcomes:

- Rangeland/grassland/Forest restoration, reduction in fire in forests, fodder enhancement and ecological stability

WP 2.2. Weed management of aquatic weed (water hyacinth)
(*in collaboration with Fishery Research Centre, Jorhat*)
Centre: AAU, Jorhat
Objective: To evaluate eco-friendly methods for aquatic weed control and identify suitable weed management practices
Design: CRD **Replications**: 3

Treatments:
T_1: Manual removal (hand pulling of aquatic weeds at 30 days interval)
T_2: Biological control using common carp @ 2500 fingerlings/ha water area
T_3: Biological control using *Neochetina* weevils @ 1500-2000 adults/ha
T_4: Biological control using *Neochetina* weevils @ 1500-2000 adults/ha + common carp @ 2500 fingerlings/ha
T_5: 2,4-D dimethyl amine salt 58% SL @ 1.0 kg a.i./ha
T_6: 2,4-D dimethyl amine salt 58% SL @ 1.0 kg a.i./ha + common carp @ 2000 fingerlings/ha + using *Neochetina* weevils @ 1500-2000 adults/ha
T_7: Florpyrauxifen-benzyl 31.5 g a.i/ha
T_9: Florpyrauxifen-benzyl 31.5 g a.i/ha + common carp @ 2000 fingerlings/ha + using *Neochetina* weevils @ 1500-2000 adults/ha
T_{10}: Bioherbicide (Ag bio-science product) + common carp @ 2000 fingerlings/ha + using *Neochetina* weevils @ 1500-2000 adults/ha
$T_{11:}$ Weedy Check

Observations:
1. Weed density
2. Weed biomass
3. Water quality
4. Root length, shoot length, Root length/Shoot length,
5. Effect of chemical on Grass carp and *Neochetina*
6. Economics

WP 2.3 Organic acids for the management of invasive aquatic weed
Centre: KAU, Thrissur (Pistia and water hyacinth), and MPUAT Udaipur (Salvinia)
Background: Invasive aquatic weeds such as *Pistia stratiotes*, *Eichhornia crassipes* and *Salinia molesta* have become serious threats to wetlands, irrigation canals, and rice-based aquatic ecosystems. These species form dense floating mats that obstruct water flow, reduce dissolved oxygen, impair biodiversity, and interfere with agricultural and fisheries activities. Chemical herbicides are not used in aquatic systems due to concerns about water contamination, non-target toxicity, and ecological imbalance. Mechanical removal is labour-intensive and often ineffective due to rapid vegetative multiplication and reinfestation. Hence, evaluation of organic acids as eco-friendly, biodegradable alternatives offers a promising approach for sustainable management of these invasive aquatic weeds.

Objective:
1. To study the efficacy of organic acids as ecofriendly alternative to chemical herbicides for aquatic weed pistia, water hyacinth and salvinia
T1, T2 & T3 - Acetic acid 2.5%, 5%, 10% solution along with sticker @ 2 ml/L

T4, T5 &T6 - Lactic acid 2.5%, 5%, 10% solution along with sticker @ 2 ml/L
T7, T8 &T9- Formic acid 2.5%, 5%, 10% solution along with sticker @ 2 ml/L
T10- Unsprayed check
Design: CRD factorial, Replications -3

Observations:
1. Phytotoxicity scoring at regular intervals
2. Regrowth, if any
3. Weed injury symptoms, regrowth suppression, and impact on water quality parameters (pH, dissolved oxygen).

Outcome: Development of an eco-friendly management strategy for invasive aquatic weeds in water bodies where chemical herbicides cannot be used.
Improved water flow, enhanced aquatic ecosystem health, and sustainable long-term weed suppression.

WP 2.4 Identification of weeds of national importance (WoNI)
Network centres: All

Objective:
1. To identify the weeds of national importance for their management

Testing of weed species for WoNI is data dependent. Where the data cannot be supplied for a species the score will be reduced accordingly. Consistency of data is critical as the ranking of WoNI is based on weed species relativities. Data will be screened to assess the validity of estimates provided so as notto disadvantage other weed candidates.

Submission Date
In order to progress the WoNI, it is essential that deadlines be met. For this reason. Data not provided by the due date will be interpreted as non-provision of data.
This list of National Significance may be developed based on the following key criteria:

Criteria for Weeds of National Significance
- Invasiveness' and 'impacts' criteria
- Potential for spread' criterion
- Current distribution
- Potential distribution
- Socioeconomic and environmental values' criterion
- Economic data for agricultural and forestry weeds (primary industries)
- Environmental values
- Biodiversity indicators
- Threatened species data
- Number of threatened conservation areas
- Conservation indicators
- Monoculture potentialSocial values

Data collection
1. Questionnaire has to be filled up based on own survey, from primary and secondary information following the guidelines (will be given)
2. Data should be collected from each district of the state based on the guidelines
3. Each center has to get information from the regional station/KVKs and all other possible sources. They should send the questioner to maximum possible sources from where data canbe collected. Should be compiled at their own level in first hand and all collected information should be sent to DWR.
4. Statistical analysis of collected data will be done at the Directorate based on the weight of each criteria

Questionnaire: Weeds of National Importance

AICRP-WM center name:

Climate: Tropical/ Sub-tropical/Temperate

Weed botanical name:

Weed English name/common name:

Weed Local name

A. Invasiveness

What is the weed's ability to establish amongst existing vegetation?

1 Poor	**2**	**3**	**4**	**5**	**6 very strong**	**Don't Know**

What is the tolerance of seedlings/juveniles of the weed to routine weed control practices?

1 Highly susceptible	**2**	**3**	**4**	**5**	**Extremely resistant**	**Don't Know**

How competitive is the weed when it is established?

1 Non competitive	**2**	**3**	**4**	**5**	**6 Highly suppressive**	**Don't Know**

What is the likelihood of long-distance dispersal (>1km) by water, flying birds, wild terrestrialvertebrates, and/or wind?

1 Extremely unlikely	**2**	**3**	**4**	**5**	**6 Extremely frequent**	**Don't Know**

What is the likelihood of long-distance dispersal (>1km) by accidental and/or intentional humanmovement, human transport, produce contaminant, and/or domestic terrestrial vertebrates?

1 Extremely unlikely	**2**	**3**	**4**	**5**	**6 Extremely frequent**	**Don't Know**

A. Impacts

How long does an infestation of the weed last?

1 Rapidly replaced	**2**	**3**	**4**	**5**	**6 Extremely long**	**Don't Know**

What reduction in the amount of desired vegetation is caused by the weed?

1 Very little impact on adjacent species	**2**	**3**	**4**	**5**	**6 Total reduction of other species**	**Don't Know**

Does the weed limit the recruitment of desired vegetation?

1 No limitation	**2**	**3**	**4**	**5**	**6 Totally**	**Don't Know**

Does the weed form thick infestations which physically limit the movement of humans, animals,vehicles or water?

1 No impediment Poor	**2**	**3**	**4**	**5**	**6 Major impact**	**Don't Know**

Does the weed cause negative ecosystem changes?

1 None	2	3	4	5	6 Major impact	Don't Know

Potential for Spread

Current Distribution (Optional Answer – short description of known distribution) Potential Distribution (Optional Answer – short description of potential distribution)

B. Social Impacts

List of major social impacts like loss of biodiversity, health issue, chocking of navigation/ reduction infish production etc with brief description where necessary like Impact Description

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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: PAU Ludhiana, PJTSAU Hyderabad, TNAU, Coimbatore, CSKHPKV Palampur, AAU Anand*, CCSHAU Hisar*, and KAU Thrissur*

Objective:

- To estimate herbicide residues and persistence in major crops and cropping systems

Methodology

- Collect soil samples at 0 (2 h), 10, 20 30, 60, 90 day & harvest from each treatment of major crops and cropping systems for residue analysis.
- Collect plant samples at harvest only (grain, straw or other edible part of plant).
- Herbicide residues will be estimated as per standard procedure of residue analysis mentioned as note.
- Submit chromatograms of each replicated samples along with report.
- Define output and outcome of the experiment

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, and CSSHAU Hisar*,

Objective:

- To estimate herbicide persistence and residues in long-term conservation tillage-based cropping

Methodology

- Collect soil samples at 0 (2 h), 10, 20, 30, 60, 90 day & harvest from each treatment of long-term conservation tillage-based cropping experiment for residue analysis.
- Collect plant samples at harvest only (grain, straw or other edible part of plant).
- Herbicide residues will be estimated as per standard procedure of residue analysis mentioned as note.
- Submit chromatograms of each replicated samples along with report.
- Define output and outcome of the experiment

S. No.	Centre	TP		Herbicide
1.	PAU, Ludhiana, and CSSHAU Hisar	WP 1.2.3	Rice-wheat-greengram	As used in the system

WP 3.3 Assessment of herbicide residues in high value crops

Network centres: PAU Ludhiana, PJTSAU Hyderabad, TNAU Coimbatore, CSKHPKV Palampur, AAU Anand* and CCSHAU Hisar*

Objective:

- To estimate herbicide residues in high-value crops

Centre	Crop	Herbicide
PAU, Ludhiana	Carrot	Atrazine
TNAU, Coimbatore	Turmeric Okra	Oxyfluorfen Pendimethalin
PJTSAU, Hyderabad	Turmeric chili	Atrazine Pendimethalin
CSKHPKV, Palampur	Tomato	Pendimethalin

Methodology

- Samples will be collected from ongoing experiments under AICRP-WM high value crops or other AICRPs or departments
- Collect soil samples at 0 (2 h) day & harvest from each treatment for residue analysis in the long-term conservation agriculture experiment.
- Collect high-value crops such as spices, tea, coffee, etc. samples at harvest (grain, straw, seeds or other edible part of plant).
- Herbicide residues will be estimated as per standard procedure of residue analysis mentioned as note.
- Submit chromatograms of each replicated samples along with report.
- Define output and outcome of the experiment

WP 3.4 Assessment of leaching potential of new herbicide molecules

Network centres: PAU Ludhiana, CSKHPKV Palampur, PJTSAU Hyderabad, TNAU Coimbatore

Objective:

- To estimate leaching potential of new herbicide molecules in the two different textured soils

S. No.	Centre	Herbicide	Year
1.	PAU Ludhiana, TNAU Coimbatore, CSK HPKV, Palampur	Bispyribac-sodium	First year
2.	PAU Ludhiana, TNAU Coimbatore, CSKHPKV, Palampur	Ethoxysulfuron	Second year
3.	PJTSAU, Hyderabad	Topramezone and pyrithiobac	First/second

Methodology

Studies will be carried out according to OECD Test Guideline 312 (Leaching in Soil Columns)

WP 3.5 Assessment of herbicide residues at farmer field

Network centres: PAU Ludhiana, TNAU Coimbatore, PJTSAU, Hyderabad, CSK HPKV, Palampur

Objective:

1. To estimate herbicide residues in soil, mature plants (grain and straw, vegetables) and ground water at farmers' fields

Crops: Wheat and rice - Ludhiana, Faridkot; **Cotton-** Bathinda; **Potato-** Ludhiana

Methodology

- Collect soil samples and plant samples (grain, straw or other edible part of plant) at harvest from farmer's field for residue analysis by standard procedures mentioned as note*.
- Soil and ground water samples from farmer's fields which were under continuous use of herbicides (at least with a history of 10 years) to be collected at least 10 samples from each centre and analysed and information.
- Define output and outcome of the experiment
- Submit chromatograms of each replicated samples along with report.

Note: Provide this information in all experiments common format for reporting residue data under

WP 3.6 Assessment of herbicide residues on microbes with key soil enzymatic activities

Network centres: PAU Ludhiana, TNAU Coimbatore, PJTSAU, Hyderabad, CSHKPV, Palampur

Objective:

- To determine impact of herbicide residues on non-targeted organisms (Earthworms/soil enzymatic activities, etc.)

S. No.	Centre	Herbicide
1.	PAU Ludhiana,	Pendimethalin
2.	TNAU Coimbatore,	
3.	PJTSAU, Hyderabad,	

Methodology

- Herbicide dose: Field dose (0, X and 2X dose)
- Evaluate impact of herbicide on mortality on earthworms
- Evaluate impact of herbicide on key soil enzymatic activities
- Report ED_{50} for earthworm
- Collect soil and earthworm samples at 1, 5, 10 days and completion of experiment for residue analysis by standard procedures mentioned as note*.
- Define output and outcome of the experiment
- Submit chromatograms of each replicated samples along with report.

Note: Provide this information in all experiments common format for reporting residue data under WP 3:

- Season and year
- Soil type
- Instrumentation : GC/HPLC/GC-MS/LC-MS etc
- Replications: Three
- Report LOD and LOQ and Recovery experiment at LOQ and 10 times of LOQ (Example if LOQ is 0.01 µg/g then recovery should be conducted at 0.01 and 0.1 µg/g).
- Give chromatograms of all samples in all studied commodities (0 days to harvest) and standards.
- Report any matrix effect, interferences, if any.
- Follow the standard methodologies for herbicide residue analysis.

Note: Follow standard protocols while taking observations and reporting data.

WP 4 : Demonstration and impact assessment of weed management technologies & SCSP

WP 4.1: On-farm research trials

Centre: AAU, Anand

Weed management in *Kharif* blackgram 2026-28 (2 OFR)

Sr. No	Treatment	Dose (g a.i./ha)	Application time
T_1	Sodium acifluorfen 16.5% + clodinafop propargyl 8% (RM)	165+80	PoE (15-20 DAS)
T_2	Propaquizafop 2.5% + imazethapyr 3.75% w/w ME	125	PoE (15-20 DAS)
T_2	Farmers' practice (IC *fb* HW at 15 and 30 DAS)	-	-

Centre: KAU, Thrissur

Broad-spectrum weed management in wet sown rice

T1-Florpyrauxifen-benzyl ester + cyhalofop butyl at 150 g/ha
T2- Penoxsulam + cyhalofop butyl 135g/ha
T3- Bispyribac-sodium 30 g/ha (Farmers' practice)

Centre: PDKV, Akola

Weed management in soybean (2 OFR)

Sr. No.	Treatment	Dose (g/ha)	Application time
T_1	Diclosulam 0.9% + pendimethalin 35% SE *fb* 1 Hand weeding	897.5	PE (0-2 DAS) & 30 DAS
T_2	Pendimethalin *fb* 1 Hand weeding	677.5	PE (0-2 DAS) & 30 DAS
T_3	Farmers practice (2 HW at 20 & 40 DAS)	--	--

Weed management in cotton (2 OFR)

Sr. No.	Treatment	Dose (kg/ha)	Application time
T_1	Diuron 80% *fb* pyrithiobac sodium 6% + quizalofop-ethyl 4% EC (RM)	1.50 & 0.125	PE & 25-30 DAS
T_2	Pendimethalin 38.7% *fb* glufosinate ammonium 13.5% (Protective hood)	0.677 & 0.375	PE & 40-45 DAS
T_3	Farmer practice (2 Hoeing 20 days interval *fb* 2 Hand weeding)	--	--

Weed management in cotton (2 OFR)

Sr. No.	Treatment	Dose (kg/ha)	Application time
T_1	Pyrithiobac sodium 3.1% + pendimethalin 34% (Ready-mix) ZC *fb* pyrithiobac sodium 6% + quizalofop-ethyl 4% EC (RM)	0.649 & 0.125	PE & 25-30 DAS
T_2	Pendimethalin 38.7% *fb* glufosinate ammonium 13.5% (Protective hood)	0.677 & 0.375	PE & 40-45 DAS
T_3	Farmer practice (2 Hoeing 20 days interval *fb* 2 Hand weeding)	--	--

Centre: AAU, Jorhat

Weed Management in direct-seeded finger millet (Location: 6 nos, Season- 2026-27)

Treatments:

T_1: Pretilachlor 30.7 % 500 g/ha + HW at 30 DAS
T_2: Atrazine 500 g/ha as PE *fb* 2, 4-D Sodium salt 800 g/ha as PoE
T_3: Farmer's Practice (Hand Weeding 25 DAS and 40 DAS)

Weed management in transplanted finger millet (Location: 6 nos, Season- 2026-27)

Treatments:

T_1: Pretilachlor 500 g/ha as PE
T_2: Pretilachlor + pyrazosulfuron WG 615 g/ha (PE)
T_3: Farmer's Practice (Hand Weeding at 25 DAT)

Centre: BCKV, Kalyani
Weed Management in direct-seeded rice (Location: Nadia and South 24 Parganas**)**
Total no. 05

Treatments:

1. Pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 785 g/ha as PE *fb* bispyribac-Sodium 15% + metsulfuron-methyl 2.4% + chlorimuron ethyl 3.6% OD 43 g/ha (25-30 DAS)
2. Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha as PoE (25 DAS)
3. Farmer's practice: One HW at 25-30 DAS

Weed Management in maize (Location: Nadia / Murshidabad)
Total no. 05

Treatments:

1. Atrazine 1.0 kg/ha *fb* topramezone 25 g/ha 25 DAS
2. Topramezone + atrazine (25.2+500 g/ha) EPoE (20 DAS) *fb* IC + HW at 40 DAS
3. Farmer's practice: Earthing up at 30-35 DAS

Centre: CCSHAU, Hisar
Weed management in clusterbean (3 OFR)

1. Pendimethalin 1000 g/ha PRE (Farmer practice)
2. Imazethapyr + imazamox 70 g/ha PoE
3. Propaquizafop + imazethapyr 15 g/ha PoE

Weed management in pearlmillet crop (3 OFR)

1. Atrazine 500 g/ha 15-20 DAS (farmer practice)
2. Tembotrione 100 g/ha 15-20 DAS
3. One hand weeding

Resistant *Phalaris minor* management in wheat (3 OFR)

1. Aclonifen + diflufenican + pyroxasulfone (RM) 900 +150 +100 g/ha PRE
2. Pyroxasulfone + pendimethalin (TM) 127.5 + 1500 g/ha PRE
3. Pyroxasulfone 127.5 g/ha before first irrigation *fb* pinoxaden PoE (farmer practice)

Centre: CSKHPKV, Palampur

OFR (3 each)
1. Rice (Direct Seeded): T_1: Pendimethalin + pyrazosulfuron (RM) 785 g/ha (PE) *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha (PoE) T_2: Pendimethalin 38.4%+ pyrazosulfuron 0.85% ZC (RM) 785 g/ha (PE) *fb* bispyribac-sodium 38% + chlorimuron ethyl 2.5% + metsulfuron methyl 2.5% WG (RM) 43 g/ha (PoE) T_3: Bispyribac sodium 10% SC 25 g/ha (PoE) T_4: Farmers' practice – Butachlor 1.5 kg/ha (PE)
2. Soybean T_1: Sulfentrazone 28 % + clomazone 30 % WP (RM) 725 g/ha (PE) T_2: Pendimethalin 30 % + imazethapyr 2 % EC (RM) 800 g/ha (PE) T_3: Quazalofop-ethyl 5% 60 g / ha + chlorimuron-ethyl 25% WP 4 g/ha (25 - 30 DAS) T_4: Farmers' practice (1 HW 20 DAS)

3. Peas T_1: Pendimethalin 30% + imazethapyr 2% EC (RM) 800 g/ha (PE) *fb* quizalafop 5% EC 50 g/ha (PoE) T_2: Pendimethalin 30% + imazethapyr 2% EC (RM) 800 g/ha (PE) *fb* propaquizafop 10% EC 50 g/ha (PoE) T_3: Pendimethalin 30% EC 1.0 kg/ha (PE) T_4: Farmers' practice (HW 30 and 60 DAS)
1. Potato T_1: Ethalfluralin 36% EC 720 g/ha (PPI) T_2: Metribuzin 70% WP 525 g/ha (PE) T_3: Paraquat dichloride 24% SL 600 g/ha (5% emergence of potato plants) T_4: Farmers' practice (Earthing up)

Centre: GBPUAT, Pantnagar

Weed management in direct seeded rice, transplanted rice, finger millet, and wheat

(a) Direct Seeded Rice (03)	**(b) Transplanted Rice**	**(d) Finger millet (02)**
Treatments		
T1: Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha (PoE)	T1: Florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha (PoE)	T1: Pretilachlor 4.8% + bensulfuron 48% OD 600 g/ha (PE)
T2: Pretilachlor 30.0% + pyrazosulfuron- ethyl 0.75% WG 615 g/ha (PE) *fb* Bispyribac-sodium 10% SC 25 g/ha (PoE)	T2: Bispyribac- sodium 38% + chlorimuron ethyl 2.5% + metsulfuron methyl 2.5% WG (RM) 43 g/ha (PoE)	T2: Pretilachlor 30.0% + pyrazosulfuron- ethyl 0.75% WG 615 g/ha (PE)
T3: Farmer's practice-Bispyribac sodium 10% SC 25 g/ha (PoE)	T3: Farmer's practice- Pretilachlor 50 % EC 500-750 g/ha (PE)	T3: Farmer's practice- Hand weeding/2,4-D amine salt 58% SL 1800 g/ha
Output: Cost Saving, better weed management **Outcome:** Economic growth		
***Rabi* Season: OFR-05**		
(a) Wheat (05)		
T1: Pendimethalin 40% + metribuzin 8% EC 1200 g/ha (PE) *fb* metsulfuron-methyl 20% WP 4 g/ha (PoE)		
T2: Pyroxasulfone 85% WG 127.5 g/ha (PE) *fb* metsulfuron-methyl 20% WP 4 g/ha (PoE)		
T3: Farmer's practice- Sulfosulfuron 75% WG 25 g/ha (PoE)		

Centre: IGKV, Raipur

Weed management in direct-seeded rice 2026 and 2027 (06 OFR) at Janjgir-Champa

Treatment	**Dose**	**Application time**
T1: Penoxsulam + florpyrauxifen benzyl (rec. practice)	40.63 g/ha	25 DAS
T2: Pretilachlor + pyrazosulfuron ethyl (PE) *fb* florpyrauxifen-benzyl + cyhalofop-butyl (PoE) (tech developed)	615 g/ha *fb* 150 g/ha	PE *fb* 20-25 DAS
T3: Bispyribac Na (Farmers' practice)	25 g/ha	20-25 DAS

Weed management in mustard 2026 and 2027 (02 OFR) at Raipur

Treatment	Dose	Application time
T1 Pendimethalin PE	750 g/ha *fb* HW at 30 DAS	2-3 DAS
T2 Oxyfluorfen PE	150 g/ha *fb* HW at 30 DAS	2-3 DAS
T3 Oxadiargyl PE	45 g/ha *fb* HW at 30 DAS	2-3 DAS
T4 Isoproturon PE	750 g/ha *fb* HW at 50 DAS	2-3 DAS

Centre: -MPUAT, Udaipur

Weed management in wheat no. of OFR-1

Sr. No	Treatment	Dose(g/ha)	Application time
T1	Pinoxaden + metsulfuron (TM)	60+4	PoE (30 DAS)
T2	Clodinafop propargyl 9% + metribuzin 20%WP	174 (54+120)	PoE (30 DAS
T3	IC *fb* HW at 20 and 40 DAS (FP)		

Weed management in wheat No. of OFR-1

Sr. No	Treatment	Dose (g/ha)	Application time
T1	Fenoxaprop-p-ethyl 7.77% + metribuzin 13.6% w/w EC	100+175	PoE (30-35 DAS)
T2	Carfentrazon 20%+sulfosulfuron 25 WG (RM)	20+25	PoE at 35 DAS
T3	IC *fb* HW at 20 and 40 DAS (FP)		

Weed Management in blackgram (1 OFR)

Sr. No	Treatment	Dose (g/ha)	Application time
T1	Clodinafop propargyl 8% + sodium acifluorfen 16.5%	245	PoE(15-20 DAS)
T2	Pendimethalin 30% + imazethapyr 2% *fb* HW at 30-35 DAS	1000	PE
T3	Farmers' practice (Pendimethalin *fb* hand weeding at 30-35 DAS)	1000	PE

Weed management in *kharif* soybean (1 OFR)

Sr. No	Treatment	Dose (g/ha)	Application time
T1	Propaquizafop 2.5% + imazethapyr 3.75% w/w	125	EPoE
T2	Sulfentrazone + clomazone	725	PE
T3	Farmer practice - IC *fb* HW at 20 and 40 DAS	-	-

Weed management in *kharif* Maize (1 OFR)

Sr. No	Treatment	Dose (g/ha)	Application time
T1	Topramezone	25.2	PoE at 2-4 leaf stage (20-25 DAS)
T2	Atrazine+ tembotrione (TM)	750 +120	EPoE at (15-20 DAS).
T3	Farmers' practice (Atrazine + HW)	750	PE at 3-5 DAS *fb* 1 HW at 30-35 DAS)

Output:

- Yield gain by weed management technologies in comparison to farmer's practice

Outcomes:

- Demonstration and transfer of proven weed management technologies to the benefit of farmer

Centre: OUAT, Bhubaneswar

Weed management in direct-seeded rice (nos. 04)

Treatment details
T_1= Pretilachlor + pyrazosulfuron ethyl @ 615 g/ha PE *fb* florpyruxifen-benzyl + cyhalofop-butyl 150 g/ha PoE (25-30 DAS)
T_2= Pendimethalin + penoxulam (RM) 625 g/ha at 2 DAS *fb* fenoxaprop 67 g/ha + ethoxysulfuron 18 g/ha (TM) at 21 DAS in DSR
T3= Application of pretilachlor 750 g/ha at 2 DAS *fb* manual weeding at 21 DAS in DSR (FP)

Centre: PAU, Ludhiana

Weed management in *Tarr-wattar* Direct-Seed Rice (02 OFR)

Treatments:

1. 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.
2. Pendimethalin 750 g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE.
3. Pendimethalin 750 g/ha as PE *fb* broadcasting of pretilachlor (37.0% EW) 700 g/ha in standing water with second irrigation *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha PoE (Farmers' Practice)

Weed management wheat (02 OFR)

Treatments:

1. Bixlozone 50% + metribuzin 10% (RM) 750 g/ha
2. Clodinafop + metribuzin 270 g/ha (RM)
3. Broadcasting metribuzin with urea mixture @ 437.5 g/ha during first irrigation (Farmers' Practice)

Centre: RVSKVV, Gwalior

Weed management in Maize (2 OFR)

T_1	:	Atrazine 1000g/ha PE *fb* topramezone 25.2 g/ha PoE
T_2	:	Atrazine + mesotrione (RM) 875 g/ha as PoE (20 DAS)
T_3	:	Farmer's practices (One hand weeding at 30 DAS)

Weed management in Sorghum (2 OFR)

T_1	:	Atrazine 500 g/ha (PE) with drone *fb* mechanical weeding at 30 DAS
T_2	:	Atrazine + topramezone TM (500+18.9) g/ha EPoE (15 DAS) with drone
T_3	:	Farmer's practices (one hand weeding at 30 DAS)

Weed management in wheat crop (2 OFR)

T_1	:	Sulfosulfuron 75% + metsulfuron – methyl 5% WG 30+2 g/ha as PoE
T_2	:	Clodinafop-propargyl + metsulfuron (60+4 g/ha) as PoE (30 DAS)
T_3	:	Farmer's practices (one hand weeding at 30 DAS)

Weed management in Chickpea (2 OFR)

T_1	:	Topramezone 336 g/l SC at 20.0 g/ha as PoE at 20 DAS
T_2	:	Topramezone 336 g/l SC at 25.2 g/ha as PoE at 20 DAS
T_3	:	Farmer's practices (one hand weeding at 30 DAS)

Centre: - SKUAST, Jammu

Weed management in blackgram (03)

Locations: Samba

S.No.	**Treatments**
1.	Pendimethalin + imazethapyr (RM) 1000 g/ha PE
2.	Imazethapyr + imazamox 60 g/ha PoE
3.	HW at 30 DAS (Farmer practice)

Weed management in transplanted basmati rice under organic farming (03)

Locations: R.S.Pura

S.No.	Treatments
1.	Cono-weeder at 20 & 40 DAT
2.	*Sesbania* green manure before transplanting *fb*1 mechanical weeding through Cono-weeder at 30 DAT
3.	HW at 30 DAS (Farmer practice)

Management of *Saccharum spontaneum* in non-cropped area (01)

Locations: International border area of Kamore, Tanwar post, Ramgarh, District Samba

S.N	Treatments	Application method
1.	Glyphosate 2.0 kg/ha + Urea 1 % + surfactant	Drone with 25 L water/ha
2.	Glyphosate 2.0 kg/ha + Ammonium sulphate 2 %	Drone with 25 L water/ha
3.	Glyphosate 2.0 kg/ha + Urea 1 % + surfactant	Knapsack sprayer 500 L water/ha
4.	Glyphosate 2.0 kg/ha + Ammonium sulphate2 %	Knapsack sprayer 500 L water/ha
5.	Weedy check (Control)	-

Centre: TNAU, Coimbatore

Weed Management in transplanted rice (3 Nos.)

T_1 - Bensulfuron-methyl + pretilachlor 660 g/ha as PE *fb* bispyribac-sodium 25 g/ha as PoE

T_2 - Pyrazosulfuron-ethyl 20 g/ha as PE *fb* penoxsulam+ cyhalofop- butyl 135 g/ha as PoE

T_3- Farmers practice (Two hand weeding at 20 and 40 DAT)

Centre: UAS, Bengaluru

1. Weed management in Dry-DSR (15 nos.)

T_1- 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

T_2- 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

T_3- Two hand weeding at 20 and 40 DAS (Farmer's practice)

2. Weed management in Sesame – 15 No's

T_1-Pendimethalin 30 % EC @ 0.75 kg/ha as pre-emergence

T_2-Two hand weeding at 20 and 40 DAS (Farmer's practice)

3. Weed management in drill sown finger millet – 15 No's

T_1- Pyrazosulfuran-ethyl 15 g/ha as PE *fb* 2,4-D sodium salt 800 g/ha as PoE

T_2- Pyrazosulfuran-ethyl 15 g/ha as PE *fb* metsulfuron methyl 10%WP + chlorimuron ethyl 10% WP @ 4 g/ha as PoE

T_3- Two hand weeding at 20 and 40 DAS (Farmer's practice)

Centre: PJTAU, Hyderabad

Weed Management in sunflower: (2 OFR)

IP 1: Pyroxasulfone 85% w/w WG @ 127.5 g a.i./ha as PE application

IP 2: Quizalofop ethyl 4% + oxyfluorfen 6% EC (RM) @100 g a.i./ha as PoE application

FP: IC/HW at 30 DAS.

Weed Management in chickpea: (2 FLD)

IP 1: Pendimethalin 30%+ Imazethapyr 2% EC @ 750+50 g.a.i./ha as PE *fb* MW at 30 DAS.

IP 2: Topramezone 336 g/l w/v SC @ 25.2 g a.i./ha as PoE at 15-20 DAS other than NBeG 47 variety.

FP: IC/HW at 30 DAS.

WP 4.2. Front-line demonstrations

Centre: AAU, Anand

Weed management in *kharif* groundnut 2026-28 (5 FLDs)

Sl. No.	Treatment	Dose g a.i./ha	Application of time
T_1	Propaquizafop 2.5% + imazethapyr 3.75% w/w ME (RM) *fb* IC + HW at 40 DAS	125	PoE (15-20 DAS)
T_2	Farmers' Practice (IC + HW at 20 and 40 DAS)	-	-

Weed management in onion 2026-28 (5 FLDs)

Sl. No.	Treatment	Dose g a.i./ha	Application of time
T_1	Propaquizafop 5% + oxyfluorfen 12% w/w EC (PM)	43.75 +105	PoE (25-30 DATP)
T_2	Farmers' Practice (HW at 20 and 40 DATP)	-	-

Centre: KAU, Thrissur

Broad spectrum weed control in wet sown rice using premix herbicide, (FLD)

- Pretilachlor + pyrazosulfuron ethyl (WG) 615 g/ha at 3-7DAS
- Control (Farmers practice) – Hand weeding

Centre: PDKV, Akola

Weed management in soybean (5 FLD)

Sr. No.	Treatment	Dose (kg/ha)	Application time
T_1	Propaquizafop 2.5% + imazethapyr 3.75%	0.125	POE (15 DAS)
T_2	Farmers practice (2 Hoeing and 1 Hand weeding)	--	--

Centre: AAU, Jorhat

Weed Management in direct-seeded finger millet (Location: 6 nos, Season- 2027-28)

Treatments:

T_1: Best treatment from OFR (2026-27)

T_2: Farmer's Practice (Hand Weeding 25 DAS and 40 DAS)

Weed management in transplanted finger millet (Location: 6 nos, Season- 2027-28)

Treatments:

T_1: Best treatment from OFR (2026-27)

T_2: Farmer's Practice (Hand Weeding at 25 DAT)

Centre: BCKV, Kalyani

Weed management in rice (Location: Ranaghat and Gosaba**)**

Total No. 6

Treatments:

1. Pendimethalin 38.4% + pyrazosulfuron ethyl0.85% ZC 785 g/ha as PE *fb* Bispyribac Na 25 g/ha25 DAS
2. Farmer's practice: One HW at 25-30 DAT

Weed management in Maize (Location: Nadia and 24 Parganas**)**

Total No. 06

Treatments:

1. Atrazine 1.0 kg/ha *fb* topramezone 25 g/ha 25 DAS
2. Farmer's practice: Earthing up at 30-35 DAS

Centre: CCSHAU, Hisar

Resistant *Phalaris minor* management in wheat (3 FLD)

1. Aclonifen + diflufenican + pyroxasulfone (RM) 900 +150 +100 g/ha (PRE)
2. Pyroxasulfone 127.5 *fb* pinoxaden 50 g/ha

Performance of HT and non-HT DSR (3FLD)

1. HT DSR with pendimethalin + pyrazosulfuron (TM) 1000 + 20 g/ha fb imazethapyr 100 g/ha PoE
2. Non HT DSR with pendimethalin + pyrazosulfuron (TM) 100+20g/ha as PE *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC 150 g/ha

Centre: CSKHPKV, Palampur

FLDs (3 each)
Rice (Direct seeded rice) Pendimethalin + pyrazosulfuron (RM) 785 g/ha (PE) *fb* florpyrauxifen-benzyl + cyhalofop-butyl (RM) 150 g/ha (PoE) Farmers' Practice (Hand weeding twice at 20 and 45 DAS)
Maize Topramezone 25.2 g/ha + atrazine 750g/ha (PoE) Farmers' practice (hoeing 20 DAS + earthing up 45 DAS)
Wheat Clodinafop 60 g/ha + MSM 4 g/ha (PoE) Farmers' practice (Hand weeding at 90 DAS)
Soybean Quizalofop-ethyl 60 g/ha + chlorimuron-ethyl 4 g/ha (PoE) Farmers' practice (one hand weeding at 20 DAS)
Maize Tembotrione 120 g/ha + surfactant (PoE) Farmers' practice (hoeing 20 DAS + earthing up 45 DAS)

Centre: GBPUAT, Pantnager

Weed Management in direct seeded rice, transplanted rice, soybean, finger millet, and wheat

***Kharif* Season: FLD-08**	
(a) Transplanted rice (04)	**(c) Soybean (04)**
Treatments	
T1:Penoxsulam 0.97% + butachlor 38.8% SE 820 g/ha (Apply up to 7 DAT)	T1: Fluazifop-p butyl 11.1 % w/w + fomesafen 11.1 % w/w SL 250 g/ha (20 DAS) T2: Sodium acefluorfen 16.5 % + clodinafop-propargyl 8% EC 245 g/ha (20 DAS)
T2: Farmer's practice-Pretilachlor 50 %EC 750 g/ha (PE)	T3: Farmer's practice-Imazethapyr 10% SL 100 g/ha (20 DAS)
***Rabi* Season: FLD-05**	
(a) Wheat (05)	
T1: Clodinafop propargyl 9% + Metribuzin 20% WP 174g/ha (PoE)	
T2: Farmer's practice- Sulfosulfuron 75% WG 25g/ha (PoE)	

Centre: IGKV, Raipur

Weed management in direct seeded rice 2026 and 2027 (10 FLD) at Dhamtari

Treatment	Dose	Application time
T1: Bispyribac Na (Farmers' practice)	25 g/ha	20-25 DAS
T2: Penoxsulam + florpyrauxifen benzyl (rec. practice)	40.63 g/ha	20-25 DAS

Weed management in Rabi maize 2026-27 and 2027-28 (10 FLD) at Narayanpur/Kanker

Treatment	Dose	Application time
T1: Atrazine (Farmers' practice)	1.0 kg/ha	Pre-Emergence
T 2: Atrazine 1.0 kg/ha *fb* topramezone (Rec. practice)	1.0 kg/ha *fb* 25.28 g/ha	Pre-emergence *fb* 20-25 DAS

Centre: MPUAT, Udaipur

Maize (5)

T_1- Atrazine 50%WP + tembotrione -500 +120 g/ha at 20 DAS (Tank mix)

T_2- farmers practice (Atrazine 50%WP 500 g/ha PE)

Maize (5)

T_1-Atrazine 50%WP + topramazone-500 +25.2 g/ha g/ha at 20 DAS (Tank mix)

T_2- farmers practice (Atrazine 50%WP 500 g/ha PE)

Soybean (5)

T_1-Imazethapyr 3.75% SL + propaquizafop 2.5% EC (125 g/ha RM) PoE 21 DAS

T_2- farmers practice (Imazethapyr 75 g/ha PoE (15-20 DAS)

Soybean (5)

T_1- Sulfentrazone + clomazone - 725 g/ha (PE)

T_2- farmers practice (Imazethapyr 75 g/ha PoE (15-20 DAS)

Wheat (5)

T_1-Carfentrazon + sulfosulfuron (RM) 20+25 g/ha PoE at 35 DAS

T_2- farmers practice (Metsulfuron Methyl 20% WP 40 g/ha POE (25-30 DAS)

Wheat (5)

T_1- Carfentrazone 20 g/ha PoE at 35 DAS

T_2- farmers practice (Metsulfuron Methyl 20% WP 40 g/haPOE (25-30 DAS)

Centre: OUAT, Bhubaneswar

Weed management in transplanted Paddy	
T1	Butachlor 1.0 kg/ha (PE) *fb* bispyribac sodium 25 g/ha (PoE)
T2	Hand weeding at 25 DAT (Farmers' practice)
Weed management in Rabi Maize	
T1	Tembotrione 100 g/ha + atrazine 500 g/ha at 15-20 DAS
T2	Atrazine 1.0 kg/ha (Farmer's practice)

Centre: PAU, Ludhiana

Weed Management in Summer moong: 05 locations

Treatments:

1. Imazethapyr 100 g/ha as PoE (20-25 DAS)
2. Pendimethalin 750 h/ha as PE

Integrated Weed Management in Wheat: 05 locations

Treatments:

1. "000" Seeding technique retaining whole paddy straw as mulch + Bixlozone 50% + Metribuzin 10% (RM) 750 g/ha (PoE)
2. Super Seeder sowing-incorporation of whole paddy straw *fb* Pendimethalin 750 g/ha Bixlozone 50% + Metribuzin 10% (RM) 750 g/ha (PoE)

Centre: RVSKVV, Gwalior

Weed management in Pearl millet(2 FLDs)

T1	:	Atrazine 500 g/ha *fb* 2,4-D 500 g/ha EPoE (15 DAS)
T2	:	Farmer's practices (one hand weeding at 30 DAS)

Weed management in wheat (4 FLDs)

T1	:	Clodinafop propargyl 60 g/ha + metsulfuron 4 g/ha as PoE (30 DAS)
T2	:	Farmer's practice (Using 2,4-D 500 g/ha herbicide)

Centre: SKUAST, Jammu

In wheat: 25 FLDs (under SCSP)

S. N	Treatments
1.	Pyroxasulfone 85% WG 127.5 as PE *fb* Clodinafop-propargyl 15% WP 60 g/ha as PoE
2.	Metribuzin 200 g/ha PoE (Farmer practice)

Centre: TNAU, Coimbatore

Weed management in blackgram (5 Nos.)

T_1- EPoE Clodinafop propargyl 8% + sodium-acifluorfen 16.5% (185 g/ha) *fb* hand weeding at 30-35 DAS

T_2- Farmers' practice (PE Pendimethalin 1.0 kg/ha *fb* hand weeding 30 - 35 DAS)

Centre: UAS, Bengaluru

Weed management in soybean (3)

T_1- Sodium acifluorfen 16.5% + Clodinafop propargyl 8% EC @ 245 g/ha as PoE (20 DAS)

T_2- Two hand weeding at 20 and 40 DAS (Farmer's practice)

Weed management in field bean (3)

T_1- Imazethapyer 10% SL + surfactant @ 75 g/ha + 2ml per liter of water as PoE

T_2- Two hand weeding at 20 and 40 DAS (Farmer's practice)

WP 4.3 Impact Assessment of weed management technology

Network centres: All centres

Objective:

1. To assess the impact of weed management technologies developed and disseminated byAICRP-WM centres

Guidelines for data collection:

1. Collect data on the area and yield of only major crops in the state.
2. Data on herbicide consumption should be collected at the district level after consultation with the state departments and (or) other reliable private agencies.
3. S.No. 5 is very important and it is solely pertaining to the impact of weed management technologies released from the centres and hence due care should be taken while obtaining and compiling the data.
4. Conduct a few focus group discussions with the farmers and (or) any other stakeholders from the area wherein the centre already conducted OFR/FLD of the developed weed management technologies
5. Provide the name of the district(s) and number of farmers surveyed/participated in the said focus group discussions
6. Collect and compile data on cost savings in weed management, yield increase, approximate area covered, per cent of farmers adopted, reasons for non-adoption, etc. through the said survey/ focus group discussions
7. The impact assessment exercise is compulsory for all the AICRP-WM centres
    1. Name of the centre:
    2. Number of technologies developed:
    3. Area under crops (major crops in the state):

Sl.No.	Name of crop	Average area (ha)*	Average yield (tonnes/ha) *

*The average area/yield should be on the basis of last three years data available.

1. Herbicide consumption pattern in the district ----------(Name of the district)

Sl.No.	Name of the Herbicide	Consumption (tonnes)				
		2017	2018	2019	2020	2021

2. Weed management technologies released and their impact:

Name of the districts:_____ No. of farmers surveyed/participated in focus group discussion: _____

S.No.	Crop	Name of the technology	Year of inclusion in thestate PoP[#]	Cost of the technology (Rs./ha)	Cost saving inweed management (Rs./ha)*	Yield increase (Kg/ha)*	Percent of farmers adopted (%)[$]	Approximate area covered (ha)	Percent of area covered (%) ** (we have added one new columnin table 5)	Reasons fornon-adoption, if any (List the reasons in theorder of mostserious to least serious)
										1. 2. 3.
										1. 2.

Note: The information on average cost-saving and yield increase should be on the basis of data from larger plots, which reflect the district.

Package of practices; ***** In comparison to the existing farmer's practice; **$** In relation to the total number of farmers in the district

6. Remarks by centre in-charge:

Signature of centre

Centre: AAU, Anand

Sr. No	Crop	Technology	Study area (District/region)
1	Wheat	Sulfosulfuron 75%+ metsulfuron methyl 5%WG 30+2 g a.i./ha PoE at 25-30 DAS	Anand
		Clodinafop Propargyl 15% + metsulfuron methyl 1% WP 60+4 g a.i./ha PoE at 25-30 DAS	Kheda
2	Soybean	Propaquizafop 2.5% + imazethapyr 3.75% w/w ME 125 g a.i./ha at 15-20 DAS	Dahod

Centre: KAU, Thrissur

Impact assessment of weed management technologies

Objective: To assess the impact of weed management technologies developed and disseminated by the Centre AICRP on Weed Management- KAU-Thrissur

Technologies

1. Technology Management of common weeds of rice using Florpyrauxifen-benzyl ester 1.5g/ha Crop: Rice Study area: Kole - Purathur
2. Technology: Broad spectrum weed control in rice using preemergent herbicide (pretilachlor +pyrazosulfuron ethyl) 615g/ha
Crop: Rice Study area: Alathur-Palakkad

Centre: BCKV, Kalyani

Impact assessment of weed management technologies

Sl. No	Crop	Name of the technology	Study area(district/Region)
1.	Maize	PoE application of Topramezone + Atrazine (25.2+500 g/ha) at 20 DAS controls the weed flora in maize resulting in better cob size compared to traditional hand weeding	Alluvial region of Gangetic plains

Centre: GBPUAT, Pantnager

Impact Assessment of weed management technology

S. N.	Crop	Technology Description	Study Area (Name of Districts/Region)
1.	Wheat	• Sulfosulfuron 75% + metsulfuron methyl 5%WG 32 g/ha (30 DAS) • Clodinafop propargyl 9% + metribuzin 20% WP 174 g/ha (30 DAS) • Clodinafop-propargyl 15% + metsulfuron- methyl 1% WP 64 g/ha (30 DAS) • Pinoxaden 5.1% EC 40-45 g/ha PoE • Pendimethalin 40% + metribuzin 8% EC 1200 g/ha 0-3 DAS PE	District: Udham Singh Nagar and Nainital
2.	Sugarcane	• Ametryne 80% WDG 2000 g/ha PE/EPoE • Mesotrione 2.27 % + atrazine 22.7 % SC 875 g/ha PoE	District: Udham Singh Nagar and Nainital

3.	Rice	• Penoxsulam 0.97% + butachlor 38.8% SE 820 g/ha (Apply up to 7 DAT) • Penoxsulam 1.02% + cyhalofop-butyl 5.1% OD 135 g/ha (15-20 DAT/DAS). • Florpyrauxifen-benzyl 2.13% w/w + Cyhalofop-butyl 10.64% w/w EC (20-25 DAT/DAS) • Bispyribac Sodium 10% SC 20-25 g/ha PoE	District: Udham Singh Nagar and Nainital
4.	Soybean	• Sodium acifluorfen 16.5% + clodinafop- propargyl 8% EC 165 + 80 g/ha (20 DAS) • Fluazifop-p butyl 11.1% w/w + fomesafen 11.1% w/w SL 250 g/ha (20 DAS)	District: Udham Singh Nagar and Nainital
5.	Maize	• Atrazine 50% WP 500 g/ha + topramezone 25.2 g/ha (TM) (20 DAS) • Atrazine 500 g/ha + tembotrione 120 g/ha (TM) (20 DAS) • Topramezone 336 g/l w/v SC 25 g/ha 20 DAS • Tembotrione 34.4% SC 120 g/ha	District: Udham Singh Nagar and Nainital

DAS: Days After Sowing, **DAP:** Days After Planting, **DAT:** Days After Transplanting, **PE:** Pre-emergence, **TM:** Tank-mix, **RM:** Ready-mix

Centre: OUAT, Bhubaneswar

Impact assessment of weed management technologies

Sl. No	Crop	Name of the technology	Study area(district/Region)
1.	Maize	PoE application of Tembotrione(100g/ha) +Atrazine(500g/ha) at 20 DAScontrols the weed flora in maize resulting in better cob size compared to traditional hand weeding	East and South Eastern coastal plain zones of Odisha
2.	Blackgram	Preemergence application of Pendimethalin followed by PoE application of Quizalofopethyl gives best yield and economic return in blackgram	North Eastern ghat and East and South Eastern coastal plain zones of Odisha

Centre: PAU, Ludhiana

Technology Assessment

Sr No.	Crop	Technology Description	Study Area (District/Region)
1.	Rice	Adoption of *fb* florpyrauxifen-benzyl 2.13% w/w + cyhalofop-butyl 10.64% w/w EC as PoE.	Tarn Taran, Bathinda, Rupnagar, Shri Muktsar Sahib, Fazilka, Ferozpur

Centre: TNAU, Coimbatore

Impact of weed management technologies

S.No.	Crop	Technology description	Study area (Name of District/Region)
1	Tomato	PE Pendimethalin 1.0 kg/ha + hand weeding on 30-35 DAP	Madukkarai, Coimbatore district

Centre: UAS, Bengaluru

Impact Assessment Studies

SL.No.	Crop	Technology description	Dosage (g/ha)	Application time	Study area (Name of the Districts/ Region)
01	Field Bean	Diclosulam 84 WDG	26 g/ha	PE	

		Imazethapyer 10% SL + surfactant	75 g/ha + 2ml per liter of water	PoE	Bengaluru Rural, Ramanagara, Tumakuru, Mandya, Kolar, and Hassan.
02	Kodo millet	Metsulfuron methyl +chlorimuron ethyl 20%WP	4 g/ha	PoE	Bagalkot, Chitradurga, Dharwad, Raichur, and Tumakuru.
03	Foxtail millet	Metsulfuron methyl +chlorimuron ethyl 20%WP	4 g/ha	PoE	
04	Maize	Tembotrione 34.4 SC	120 g/ha	PoE	Davangere, Haveri, Shivamogga, Belagavi, Ballari, Koppal, Hassan, Chikkaballapura, Bangalore rural and Chitradurga.
05	Transplanted Ragi	2,4D sodium salt 80%WP	0.50 - 0.75kg/ha	PoE	Tumakuru, Mandya, Hassan, Bengaluru Rural and Urban, Ramanagara, and Mysuru.
06	Transplanted Paddy	Pretilachlor 6% + Bensulfuron methyl 0.6% GR	652 g/ha	PE	Mandya, Mysore, Chamrajanagara, Hassan and Tumkuru

Protocol for collecting data on aquatic weed infestation in India:

- Data on aquatic weed infestation should be collected through primary as well as secondary sources.
- Number of aquatic bodies in the state (where centre is located) should be collected.
- Area of each aquatic body along with coordinates (latitude & longitude) should also be collected from related sources.
- Level of infestation of weeds present in water bodies such as water hyacinth, Salvinia etc. should be collected in terms of percentage of area infested or in exact area infested by each weed.

Proforma for collecting data is as follows:

Name of the water body	:	
Type of water body (pond/lake/canal/dam/river)	:	
Place	:	
District & State	:	
Date of data collection	:	
Coordinates (latitude & longitude)	:	
Area of the water body (in acre)	:	
Name of weeds present in the water body and level of infestation	:	S.No. | Name of weed | Water body Area infested with weed (%) 1. | | | 2. | | | 3. | | | 4. | | | 5. | | |
Weed management, if any	:	

Problem arises due to weed infestation in the water body	:	

Area infested with Parthenium hysterophorus in the state

S. No.	District name	Area		(%) area infested with *Parthenium*
1.		Cropped area	:	
		Non-cropped area	:	
2.		Cropped area		
		Non-cropped area		
3.		Cropped area		
		Non-cropped area		

Protocol for on-line data submission and analysis through Information system for AICRP-WM:

- There will be three level of user: Administrator, Sub-administrator and end user.
- Administrator and Sub-administrator will be at Headquarter level while End user will be the scientist of the centre.
- Programme and experimental details will be entered by Sub-administrator of the system at Headquarter level.
- End user will be created and approved by Sub-administrator at Headquarter level.
- After login into the system, end user has to submit the data of the experiment assigned by the Sub-administrator as per Technical programme.
- End user can't make change in the data after final submission.
- Submitted data will go to the Sub-administrator. He/she can return the data to the centre if not found as per requirement.
- Sub-administrator can generate or delete the experiments as per technical programme and see the data submission details with status.
- If Sub-administrator approves the data of any experiments, it will go to the Administrator for approval otherwise system will revert back to end user by adding some remarks.
- Administrator has all rights to see, approve or reject the data submitted by the centres.