AICRP - WEED MANAGEMENT

Objectives

- Weed survey and surveillance
- Weed Physiology / Biology
- Weed management in crops.
- Herbicides recommendation for different crops.
- Persistence, dissipation and leaching behavior of recommended herbicides.
- Yield loss assessment, technology demonstration and adoption by Farmers.

1. Significant Achievements:

➢ Weed Survey and Surveillance

Major weed flora in different agro-climatic/agro-ecological zones of Uttarakhand

In order to document the major weed flora in crops as well as non-cropped lands, extensive survey was conducted in Kumaon and Garhwal divisions covering the plains as well as hilly areas upto 2000 MSL. The species composition, density as well as importance value index (IVI) has been worked out for several weed species different regions of the state. *Parthenium hysterophorus*, *Chenopodium album, Coronopus didymus, Ageratum conyzoides, Anagallis arvensis*, *Medicago denticulata*, *Ipomea spp*, *P. minor*, *Polygonum*, *Poa annua, Solanum nigrum, Lathyrus aphaca Melilotus indica*, *M. alba, Avena ludoviciana, Medicago sativa, Rumex acetosella, Stellaria media, Vicia hirsuta, Elusine indica, Oxallis latifolia, Euphorbia hirta, Cleome viscose, Caesulia axillaris, E. crus-galli*, *E. colona, A. baccifera*, *O.latifolia*, *A.conyzoides*, *L. cristaceae, Leptochloa chinensis, Commelina bengalensis, Galninsoga parviflora, Cyperus difformis*, *Cyperus rotundus* and *Fimbristylis miliacea* have been recorded as major weed species of the state.

Major problematic weeds of cropped and non-cropped lands

In the plains, during rainy season, annual grasses like *Echinochloa colona*, *E.crus-galli*, *Eleusine indica*, *Bracharia ramosa*, *Dactyloctenium aegyptium*, *Paspalum distichum, Digitaria* spp. and perennial grasses like *Sorghum halepense*, *Phragmites karka, P. comunis* and *Cynodon dactylon* are the major weeds in crops like maize, soybean, rice, sugarcane, pulses and vegetables. Sedges such as *Cyperus rotundus*, *Cyperus iria*, *Cyperus difformis*, *Scirpus* spp. and *Fimbristylis milliacea* are very common in the rice fields. Broad leaved weeds during rainy season include *Trianthema monogyna*, *Celosia argentea*, *Commelina benghalensis, Commelina diffussa*, *Cleome viscosa*, *Caesulia axillaris, Cynotis axillaris, Eclipta alba, Euphorbia hirta, Lindernia spp., Ludwigia spp., Sphenoclea zeylanica,* and *Alternanthera sessilis*. *Ischaemum rugosum, Eragrostis japonica* and *Leptochloa chinensis* are becoming serious problem in the rice crop. Several species of *Ipomoea* have become serious problem in the sugarcane fields. Density of *Trianthema monogyna* is on continuous increase in almost all upland crops during rainy season and in the crops grown during spring and summer seasons.

During winter season, the major weeds in wheat fields are *Phalaris minor, Avena ludoviciana, Chenopodium album*, *Melilotus alba*, *M. indica*, *Medicago denticulata*, *Fumaria parviflora*, *Vicia sativa*, *Anagalis arvensis* and *Lathyrus aphaca*. *Polypogon monspeliensis*, *Poa annua*, *Lolium temulentum, Cirsium arvense* and *Convolvulus*

arvensis are also found infesting wheat fields at some places. Due to continuous use of isoproturon and 2,4-D in wheat, the density of *Lathyrus aphaca*, *Melilotus indica* and *Medicago denticulata* is increasing.

In hilly areas, *Parthenium hysterophorus* and *Lantana camera* are major problematic weeds in wastelands and roadsides. In orchards, gardens and lawns, *Imperata cylindrica* and *Ageratum conyzoides* are problematic weeds.

In the hilly regions, *Oxalis latifolia* is the most common and problematic weed in almost all the crops. In addition, *Galinsoga parviflora, Fumaria parviflora*, *Vicia sativa, Medicago denticulata, Melilotus indica* are also found infesting the crop lands.

➢ Weed Physiology / Biology

Biology of major weed species: Biology of major problematic weed species of crop lands such as *Echinochloa colona, Echinochloa crus-galli, Phalaris minor, Medicago denticulate, Anagallis arvensis, L. chinensis, C. rotundus, I. rugosum, Fimbristylis miliacea, Ipomoea spp.,*and of non-cropped lands such as *Lantana camara* and *Parthenium hysterophorus* has been studied. Biomass production and seed production potential were estimated for all the species.

Herbicide Resistance: Resistance of *Phalaris minor* to isoproturon has been confirmed in the rice-wheat cropping system of the state. Inheritance of resistance to isoproturon was also confirmed. Biochemical studies revealed that the mechanism of resistance was due to enhanced metabolism of the herbicide. This weed species is successfully controlled by the herbicides clodinafop ,sulfosulfuron, pinoxaden as well as by herbicide mixtures.

Weed Seed Bank in Long term trials: Weed seed banks were continuously monitored in long term herbicide and tillage trials of the centre. Differences in composition of grasses, BLWs and sedges were observed among tillage trials and herbicidal treatments. Conservation tillage methods combined with chemical weed management recoded lesser weeds in the seed bank as compared to those with integrated management or without any management practices.

Weed seed longevity in rice-wheat and soybean-wheat cropping system

Higher populations of *Gnaphalium* spp. and *Anagallis arvensis* in *Rabi* season and maximum population of *C. rotundus* in rainy season were observed in rice – wheat cropping system. In both the cropping systems, during winter season the population of *P. minor* was very high and maximum weeds emerged during 30-60 day growth stage. *C. rotundus* was noticed only in soybean-wheat cropping system while it was absent in the rice-wheat cropping system. In the soybean-wheat system, this sedge was the major weed during both the seasons. During the rainy season, the population of *C. rotundus* and *Lindenia* spp. was very high in both rice and soybean crops.

Economic threshold of weeds in different crops: Economic threshold of *E. crus-galli* in Rice and *Celosia argentia* in Soybean has been worked out.

Selection of competitive crop cultivars: Rice cultivars Pant Dhan 16 & 18, Govind, Pusa 44, Pant Sugandha 17 and UPR 2962-6-2-1 and Wheat cultivars UP 2365, UP2382,Raj3765 were found to be more competitive against weeds .

Allelopathy: Rice cultivars such as Pant Dhan 16 as well as some pre-released rice lines developed by Pantnagar were competitive against weeds due to their morpho-physiological and allelopathic ability. Estimation of allelochemicals in rice plants revealed several phenolics such as ferullic acid, PHBA, garlic acid which are responsible for the allelopathic properties. Incorporation of rice straw in soil could control some of the weed flora in winter season.

➢ WEED MANAGEMENT IN CROPS

Based on the studies conducted in different crops and cropping system for effective weed management, the centre has developed following management practices:

Cereals

Rice:

- **Direct seeded rice:** Pre-emergence application

of pendimethalin followed by post-emergence application of bispyribac-sodium or chloromuron-ethyl+metsulfuron-methyl or penoxsulam or cyhalofop-butyl or fenoxaprop-p-ethyl alone or ready mix combination of penoxsulam +cyhalofop butyl provides satisfactory control of weeds.

- **Transplanted rice:** Pre-emergence application of butachlor or pretilachlor or oxadiargyl alone or ready mix of bensulfuron-methyl +pretilachlor followed by either one hand weeding or post-emergence application of herbicides- bispyribac-sodium or penoxsulam or cyhalofop-butyl or fenoxaprop-p-ethyl, chloromuron-ethyl+metsulfuron-methyl, and anilofos. Under well puddled condition, if standing water is maintained for about 25 days, there is no need to apply pre-emergence herbicides.
- Even ready mix combination of penoxsulam +cyhalofop butyl or bispyribac–sodium+ ethoxysulfuron is also effective.

These herbicide treatments may be supplemented with one hand weeding at 40-45 DAS/DAT if required.

Wheat:

- Pre-emergence application of pendimethalin followed by Post-emergence application metsulfuron-methyl or 2,4-D or dicamba or carfentrazone were found effective in controlling both grassy and BLWs effectively.
- Post-emergence application of clodinafop – propargyl, pinoxaden, fenoxaprop-p-ethyl, diclofop-methyl alone effectively control the grassy weeds. These must be followed by some broad leaved weed killer for complete weed eleminations.
- Ready mix combination of clodinafop-propargyl+ msm, sulfosulfuron+msm, mesosulfuron+idosulfuron, sulfosulfuron+ carfentrazone, clodinafop-propargyl +metribuzin are effective in controlling broad spectrum of weeds
- In zero till wheat, pre- sowing application of paraquat dichloride followed by post emergence application of any of the ready mix combination of herbicides is effective to control the weeds.

Maize :

Pre-emergence application of atrazine or alachlor effectively controls grassy as well as some broadleaf weeds. It should be followed by post-emergence application of 2,4-D or tembotrione is most effective in managing grassy as well as broadleaf weeds.

Sorghum and Pearl millet:

- Pre-emergence application of atrazine and pendimethalin controls grassy and some broadleaf weeds effectively.
- Post-emergence application of 2,4-D is effective in controlling broadleaf weeds.

Sugarcane:

- Pre-emergence application of metribuzin / atrazine / diuron *followed by* hoeing at 45 DAP *followed by* 2, 4-D (PoE) is most effective in controlling broad spectrum of weeds
- Early-post emergence ready mix combination of diuron + hexazinon is most effective in controlling grassy and non-grassy weeds
- In ratoon crop, to control the weeds hoeing followed by any pre-emergence herbicide viz. atrazine/ metribuzin/diuron followed by 2, 4-D. (PoE) is very effective.
- Mulching with the trash also controls weeds besides conserving moisture for the crop.

Oilseeds & pulses

Soybean:

- Pre plant incorporation of trifluralin or fluchloralin or pre-emergence application of metribuzin, clomazone, alachlor, pendimethalin, sulfentrazone or diclosulam alone or ready mix of pendimethalin+imazethapyr followed by one hand weeding, if required.
- Post-emergence application of imazethapyr,

fenoxaprop-p-ethyl, fluazifop-p-butyl, propaquizafop, chlorimuron ethyl, haloxyfop, flumioxazin, quizalofop-ethyl or ready mix imazethapyr+imazamox, quizalofop-ethyl+ chlorimuron ethyl, fluazifop-p-butyl+fomesafen and propaquizafop+ imazethapyr

Groundnut:

Pre-emergence application of alachlor or oxyfluorfen or post-emergence application of imazethapyr or quizalofop-ethyl or ready mix of imazethapyr+imazamox, quizalofop-ethyl+ fomesafen.

Black gram/Green gram:

- Pre-plant incorporation of fluchloralin or pre-emergence application of alachlor, pendimethalin, oxadiazon or oxyfluorfen or ready mix imazethapyr + pendimethalin
- Post-emergence application imazethapyr, fenoxaprop-p-ethyl, quizalofop-ethyl or propaquizafop or imazethapyr+ imazamox effectively control grassy and non-grassy weeds.

Chickpea/Lentil/ Pea:

Pre-plant incorporation of fluchloralin or pre-emergence application of pendimethalin or oxyfluorfen or post-emergence application of quizalofop-ethyl controlling mostly the grassy weeds.

Vegetable and spices

Potato:

- Inter row application of paraquat at 5 to 10% potato germination most effective in reducing the annual weed species.
- Pre emergence application of pendimethalin, metribuzin or oxyfluorfen sufficient to manage the grassy and upto some extent to broadleaf weeds.

Turmeric:

Integrated approaches of weed control viz. application of pendimethalin or metribuzin *fb* straw mulch 10 t/ha supplemented with one HW at 75 DAP are very effective in weed management.

Garlic:

Pre-plant incorporation of fluchloralin or pre emergence application pendimethalin, oxyfluorfen or oxadiagryl followed by mulching at 5 t/ha or post-emergence application of quizalofop-ethyl.

French bean:

Pre emergence application pendimethalin, alachlor, metalochlor or Linuron followed by one hand weeding supplimentation is sufficient to control the weeds.

Fenugreek/ Coriander:

Pre-plant incorporation of fluchloralin or pre-emergence application of pendimethalin or post-emergence application of quizalofop-ethyl effectively control the grassy and upto satisfactorily level of broadleaf weeds.

Brinjal:

Pre transplanting pre-plant incorporation of fluchloralin or pre-emergence application of alachlor, pendimethalin, oxadiazon or metribuzin or post-emergence application quizalofop-ethyl are most effective to grassy weeds.

Okra:

Pre-emergence application of pretilachlor or pendimethalin or anilofos

Fodder and forage crops

Barseem:

Pre-emergence spray of butachlor or alachlor.

Management of *Cyperus rotundus*: The sedge *Cyperus rotundus* is controlled effectively by glyphosate at 0.75 to 1.5 kg/ha, but there is no effect on the viability of tubers.

Residue, Toxicity and Leaching Behaviors of herbicides

Residues of recommended herbicides for various crops, mentioned below against each crop, were estimated in their grain and straw at harvest as well as in soil and water bodies.

Rice: Butachlor, Anilophos, Pretilachlor, Oxyflurofen, pendimethalin, Oryzalin, metsulfuron-methyl ,

➢ Herbicides recommendation for different crops

S.N	Crops	Herbicide	Dose a.i.(kg/ha)	Stages of application
1	Maize	Atrazine 50%WP	1	Pre-emergence
		Alachlor 50%EC	2.5	Pre-emergence
		Alachlor 10% GR	1.5-2.5	Post-emergence
		2,4-D Dimethyl Amine Salt 58%SL	0.5	Post-emergence
		2,4-D Ethyl Ester 38%EC	0.9	Post-emergence
		Tembotrione 42% SC	0.1	
2	Soybean	Alachlor 50%EC	2.5	Pre-emergence
		Alachlor 10% GR	2.5	Pre-plant incorporation
		Trifluralin 48%EC	1	Pre-emergence
		Metribuzin 70%WP	0.35 – 0.525	Pre-emergence
		Imazethapyr 10%SL	0.1	Post-emergence
		Quizalofop- ethyl 5%EC	0.0375- 0.05	Post-emergence
		Fenoxaprop-p-ethyl 9.3% EC	0.1	Post-emergence
		Imazamox35%+Imazethapyr 35%	0.07	Post-emergence
		Pendimethalin30%EC+Imazethapyr2%EC	0.750+0.050	
3	Groundnut	Alachlor 50%EC	2.5	Pre-emergence
		Alachlor 10% GR	2.5	Post-emergence
		Imazethapyr 10%SL	0.10- 0.15	Pre-emergence
		Oxyflourfen 23.5 EC	0.100-0.200	Post-emergence
		Quizalofop- ethyl 5%EC	0.0375- 0.05	
4	Black gram, Green gram, cowpea, arhar	Alachlor 50%EC	2.5	Pre-emergence
		Pendimethalin 30%EC	1	Pre-emergence
		Trifluralin 48%EC	1	Pre-plant in corp.
		Metribuzin 70%WP	0.35	Pre-emergence
		Quizalofop- ethyl 5%EC	0.0375- 0.05	Post-emergence
5	Rice nursery	Pretilachlor 50 EC	1.0-2.0	Pre -emergence
		Bispyribac sodium10%SC	0.02	Post-emergence
6	Transplanted rice	Butachlor50%EC	1.5	Pre-emergence
		Anilofos 30%EC	0.3-0.45	Pre-emergence
		Anilofos 18%EC	0.3-0.45	Pre-emergence
		Pretilachlor 50%EC	0.5-0.75	Pre-emergence
		Oxadiargyl 80%WP	0.1	Post-emergence
		2,4-D Ethyl Ester 38%EC	0.85	Post-emergence
		Metsulfuron methyl 20%WG	0.004	Post-emergence
		Bispyribac sodium 10%SC	0.02	Pre- emergence
		Bensulfuron Methyl 60%DF	0.06	Pre- emergence
		Penoxsulam24%SC	0.022-0.025	Early post-emergence
		Penoxsulam 24%SC	0.020-0.022	post-emergence
		Azimsulfuron 50%DF	0.035	post-emergence
		Ethoxysulfuron 15%WDG	0.0125-0.015	post-emergence
		Fenoxaprop-p-ethyl 9.3% EC	56.25	Pre-eme. to Early post
		Pyrazosulfuron Ethyl 10%WP	0.010-0.015	
7	Direct Seeded rice	Pendimathalin 30%EC	1.0-1.5	Pre-emergence
		Metsulfuron methyl 20%WP	0.004	Post-emergence
		Bispyribac sodium10%SC	0.02	Post-emergence
		Azimsulfuron 50%DF	0.035	Post-emergence
		Cyhalofop butyl 10%EC	0.075-0.080	Post-emergence
		Oxyflourfen 23.5 EC	0.150-0.240	Pre-emergence
8	Wheat	Metribuzin 70%WP	0.170-0.210	30Days stage
		Clodinafop-propargyl 15%WP	0.06	30 days stage
		Clodinafop 15%+MSM 1%WP	0.060+0.004	30 days stage
		Sulfosulfuron 75%WG	0.025	30-35 days stage
		Fenoxaprop-p-ethyl10%EC	0.100 - 0.120	30 days stage
		2,4-D Dimethyl Amine Salt 58%SL	0.5-0.75	35-40 days stage
		2,4-D Ethyl Ester 38%EC	0.45-0.75	35-40 days stage
		metsulfuron-methyl 20%WG	0.004	35-40 days stage

		Carfentrazone ethyl 40%DF Pinoxaden 5.1%EC Sulfosulfuran 755 + MSM 1%	0.02 0.05 0.003+0.002	35-40 days stage 35-40 days stage 35-40 days stage
9	Gram, pea, lentil	Pendimethalin 30%EC Trifluralin 48%EC	0.75-1.0 1	Pre –emergence Pre-plant incorporation
10	Potato	Paraquat dichloride 24%SL Pendimethalin 30EC Metribuzin 70%WP Oxyflourfen 23.5EC	0.5 1 0.35 0.100-0.200	Post to weeds and before potato emergence Pre –emergence Pre –emergence Pre –emergence
11	Sugarcane	Atrazine 50%WP Metribuzin 70%WP 2,4-D Dimethyl Amine Salt 58%SL 2,4-D Ethyl Ester 38%EC metsulfuron-methyl 20%WP Hexazinone13.2%+Diuron 46.8%	2 1 3.5 1.2-1.8 0.006 0.264+0.936	Pre –emergence Pre –emergence Post-emergence Post –emergence Post –emergence Post-emergence

Metsulfuron methyl + chlorimuron ethyl

Wheat: Isoproturon, Fenoxaprop-p-ethyl, Clodinafop propargyl, Sulfosulfuron, 2, 4-D

Maize and soybean: Atrazine , Pendimethalin

In all the crops, residues were non-detectable either in straw or in grains at harvest.

In water bodies at famers' fields, residues of herbicides such as Pendimethalin, butachlor, anilophos, pretilachlor, isoproturon, 2,4-D, clodinafop, atrazine, metsulfuron-methyl, clodinafop-propargyl and bispyribac-sodium were non – detectable.

➢ **Persistence, dissipation and leaching behavior of recommended herbicides**

- Sulfosulfuron leached upto 35-40 cm soil depth showing high mobility in soil. In soil, Anilophos persisted for more than 60 days at double dose while pretilachlor was detected upto 60 days after treatment at recommended dose. Anilophos dissipated by about 94.6 % after 60 days of treatment. Oxyflurofen (in rice) dissipated by 60th day after application.
- Oryzalin residues were maximum at upper soils layer. Its adsorption was more in silty clay loam than sandy loam soil. It did not move beyond 10 cm in both silty clay loam and sandy loam soil indicating low mobility of this herbicide in soil column. Desorption of oryzalin was slow and was highly correlated with organic carbon content of soil thus its desorption being less in amended soil.
- Mobility of metsulfuron methyl in soil column was high.
- Most of the recommended herbicides dissipated during the first 30- 45 days after their application.
- The residues of paraquat were detectable up to 20 days at higher dose but no residues were detected after 20 days at both the levels of application. The pH, EC and free CO2, carbonate and bicarbonate contents increased after treatment whereas dissolved oxygen decreased.

➢ **Yield loss assessment, Technology demonstration and adoption by Farmers**

Estimated yield loss due to infestation of weeds is about 74% in soybean followed by sugarcane (68.9%), pulses (60.6%), rice (53%) and wheat (47%). Adoption of recommended weed management practices resulted in about 30 % increase in soybean yield and 8 to 12 % increase in rice and wheat yields as compared to farmer's practice.On farm trials (OFTs) and front line demonstrations (FLDs) are being conducted continuously in the tarai, bhabar and hilly areas in rice, soybean and wheat crops. During 2011-17, a total of 225 trials and demonstrations have been conducted in these three crops.

➢ **Adoption level**

The recommended weed management

practices are being adopted by 57-60% farmers in rice and wheat crops and about 39% in sugarcane. On the other hand, about 1-3% farmers growing rice and sugarcane and about 16% of wheat growers did not adopt any weed management practices.

Herbicide consumption is higher in *Tarai* area as compared to *bhabar* area particularly in wheat & rice crops. Farmers have started using herbicides in pulses. However, herbicidal use is very limited in hilly areas because of the use of weeds as fodder.

2. Research publications:

1. Bartwal, A., Mall, R., Lohani, P., Guru, S.K. and Arora, S. 2012. Role of secondary metabolites and brassinosteroids in plant defence against environmental stress. *J. Plant Growth Regulation*. (DOI 10.1007/s 00344-012-9272-x).

2. Chauhan, B. S., Singh, V.P., Kumar, A. and David, J. E. 2011. Relations of rice seeding rates to crop and weed growth in aerobic rice. *Field Crops Res.* 121:105-115.

3. Patni, B. and Guru, S.K. 2012. Morpho-physiological and biochemical parameters associated with competitive ability of rice genotypes against weeds. *Indian J. Plant Physiology*, Vol.17, No. 3&4, (N.S.) pp.215-223.

4. Srivastava, N., Singh, D., Shukla, A., Guru, S.K., Singh, M. and Rana, D.S. 2012. Effect of high temperature stress at post-anthesis stage on photo system II. senescence, yield and yield attributes of wheat genotypes. *Indian J. Plant Physiology.*17(2):158-165.

5. Singh, G. and Guru, S.K. 2013. Stimulation of reserpine production in the whole plant culture of *Rauwolfia serpentina* L. by elicitors and precursor feeding. *Journal of Plant Biochemistry and Biotechnology.* (DOI 10.1007/s13562-013-0235-5).

6. Lakshmanakumar P., Bana, O.P.S. and Guru, S.K. 2013. Physiological basis of yield variability in wheat (*Triticum aestivum* L.) under varying degrees of shades. *Indian Journal of Plant Physiology*, 18(2):164–168 (DOI 10.1007/s40502-013-0028-9).

7. Kumar, S., Tandon, S. and Sand, N.K. 2013. Determination and method validation of metamitron in soil by RP-HPLC. Bulletin of Environmental Contamination and Toxicology 11 (2013)

8. Bhandari, K., Chandola, P. and Guru, S.K. (2014). Inhibitory effects of rice straw on the germination and seedling growth of major weeds of wheat (*Triticum aestivum* L.). *Annals of Plant Physiology*.

9. Jha,B.K., Chandra,R. and Singh,R. 2014. Influence of post –emergence herbicides on weeds, nodulation and yield of soybean and soil properties. *Legume Research* 37(1):47-54.

10. Tandon,S. 2014. Degradation kinetics and harvest time residue analysis of anilofos in soil, straw and rice grain and husk. *Pest Management Science* 70:1706-1710 (2014)

11. Vasmatkar, P., Dubey, A., Tyagi, B., Baral, P., Tandon, S. and Kadam, A. 2014. Antibacterial activity and GC-MS analysis of methanolic extract from stem bark and leaves of *Mitragyana parvifolia* (Roxb.) Korth. *Indo American Journal of Pharmaceutical Research* 4(1): 304-311 (2014).

12. Singh, V.P., Dhyani, V.C., Singh, S.P., Kumar, A., Manalil, S., Chauhan, B.S. 2015. Effect of herbicides on weed management in dry-seeded rice sown under different tillage systems. *Crop Protection*. 80:118-126.

13. Tandon,S. and Singh, A. 2015. Field dissipation kinetics of atrazine in soil and post harvest residues in winter maize crop under subtropical conditions. *Chemistry and Ecology* 31(3): 273-284 (2015)

14. Tandon,S. and Singh, N. 2015. Dissipation kinetics of cyazofamid in water. *Journal of Liquid Chromatography & Related Technologies* 38(9): 993-996 (2015).

15. Tandon,S., Kumar,S., and Sand, N.K. 2015.

Development and validation of GC-ECD method for the determination of metamitron herbicide in soil. *International Journal of Analytical Chemistry* 2015: 1-5 (2015).

16. Tandon,S. 2016. Dissipation of pendimethalin in soybean crop under field conditions. *Bulletin of Environmental Contamination and Toxicology*. 96(5): 694-698.

17. Mittal, A.K. and Tandon,S. 2017. Study of fatty acids profile in kernel oil of Heynea trijuga Roxb. Ex Sims. (syn. Trichilia connaroides (Wight & Arn.) Bentv.). *Journal of Chemistry.* 2017: 1-3

18. Chaturavedi, S., Pandey, J., Dhyani, V.C., Guru, S.K. and Kaushal, R. 2012. Phytotoxic potential of Eucalyptus leaf essential oil to control Parthenium hysterophorus. *Allelopthay J.* 29(2): 315-342 (ISSN, Print: 0971-4693. Online: 0974-1240.).

19. Guru, S.K. and Panwar, G.S. 2012. Influence of gibberellic acid and seed coat removal on the seed germination behavior of Rauvolfia serpentine L. under controlled environment. *J Non-Timber Forest Products*.19 (1): 1-4.

20. Semwal, A., Singh, V.P., Singh,S.P, Kumar, A., Tripathi, N. 2012.Bio-efficacy evaluation of new herbicide molecule (AEF-10% EC and DICI 468-70% WP) against prominent weeds in wheat crop (*Triticum aestivum* L.). *Pantnagar J. Res.* .10:108-110.

21. Singh, P. and Guru, S.K. 2011.Effect of rice straw incorporation on weed management and crop growth in rice. *Indian J. Weed Sci*. 43 (3&4):236-238.

22. Singh, R., Shyam, R., Bhatnagar, A., Singh, V.K. and Kumar, J. 2011.Bio-efficacy of herbicides applied at 2 to 4 leaf stage of weeds in sugarcane after second interculture. *Indian J. Weed Sci*. 43 (3&4):145-148.

23. Singh, V.K., Dixit, V., Singh, R. and Barthwal, A.2011.Efficacy of mechanical, cultural and chemical methods on weed suppression and yield of lentil. *Indian J. Weed Sci.* 43(3&4): 192-194.

24. Singh V.P., Tripathi, N. and Kumar, A. 2011. Resource Conservation Technology in Rice-Wheat Cropping System: An Ecological and Sustainable Approach. *Res. J. of Chemistry and Environ.* 15(2):365 - 371.

25. Tandon S. 2012. Residue analysis of isoproturon and butachlor in long term trial of rice-wheat system. *Pestology* XXXVI(1): 27-29 .

26. Singh V.P., Singh, S.P., Kumar, A., Banga, Akshita and Tripathi, Neeta. 2012. Effect of monsoon and weed management on growth and yield of direct seeded rice. *Indian J. Weed Sci.* 44(3):147-150.

27. Singh V.P., Guru, S.K., Kumar, A., Banga, Akshita and Tripathi, Neeta. 2012. Bio-efficacy of Tembotrione against mixed weed complex in maize. *Indian J. Weed Sci.* 44(1):1-5.

28. Chandola P., Dhyani, K., Bhandari, K., Guru, S.K. 2012.Effect of pre-emergence herbicides and hand weeding on the weed dry weight and grain yield of transplanted rice. *Journal of Sustainable Environmental Research.* 1 (2): 121-123.

29. Guru, S.K., Pratap, T. and Singh, V.P. 2013. Parthenium weed awareness campaigns and people's initiative. *International Parthenium News*, No.7: 4-7.

30. Panwar, G.S. and Guru, S.K. 2013. Influence of the Culture Medium Nitrogen Concentration on Alkaloid Profile and Reserpine Content of the *Rauwolfia serpentina* Plant Roots. T*he Indian Forester,* 139(1):69-74.

31. Anjani, Shukla, A.and Guru, S.K. 2013. Histological Characterization of Embryogenic and Non-embryogenic Calli o*f Jatropha curcas* L. *The Indian Forester.* 139 (3): 244-247.

32. Priyanka, K., Pratap,Tej, Singh,V.P., Singh, R. and Singh,S.P. 2014. With herbicide mixture. control of complex weed flora in transplanted rice.In Indian Journal of Weed Science.46(4):377-379.

33. Shukla, D.K; Prasad, B. and Pratap,Tej 2014.

Weed management strategies for better yield and economies of grain amaranth (*Amaranthus hypochordriaesis*) in mountain agriculture. Journal of Hill Agriculture. 5(2) 194-197.

34. Singh,V.P., Singh, S.P., Kumar, A., Rekha, Tripathi, N. and Banga, A. 2014. Bio- efficacy of oxyflurofen for weed control in potato. *Progressive Horticulture* 46(1):89-91.

35. Singh, D., Mirza, N.M., Singh,N. and Kumar, J. 2014. Furiflex 25%: A promising post emergence herbicide for effective control of weeds in soybean (*Glycine max* L. Marcell). *Internantional Journal of Basic and Applied Research* (accepted).

36. Singh, R. Tej Pratap, Rampal, Singh Virpal, Rekha and Singh Jodhpal 2014. Bio-efficacy of Ethoxysulfuron (Sunrice 15 WG) for control of Cyperus rotundus (nut sedge) in sugarcane. In Indian Journal of weed Science.

37. Singh, V.Pratap, Singh, S.P., Kumar, A., Banga, A, Tripathi, N. and Rekha.2014. Performance of quizalafop-p-ethyl 5 % EC against Weeds and Yield of soybean. *Soybean Research* 12(2):120-126

38. Singh, V.Pratap., Singh, S.P., Kumar, A., Tripathi, N., Banga A. and Yadav,V.R. 2014. Bio-efficacy of oxyflurofen in transplanted riceunder tarai region of uttarakhand. *Journal of Eco-friendly Agriculture* 9(2):195-198.

39. Singh,R., Pal,R., Singh,T.P., Singh,A.P., Yadav,S. and Singh,J.2014.Evaluation of Bispyribac sodium for managing major weeds in directed seeded rice. *Indian journal of weed science* 46(2):126-128

40. Joshi, Neeshu, Singh, V.P., Dhyani, V.C. and Pratap, Tej. 2015. Effects of planting geometry and weed management practices on weeds, growth and yield of direct seeded (aerobic) rice (*Oryza Sativa* L.). *J. Env. Bio-Sci*. 29(1): 23-28.

41. Singh N and Tandon Shishir. 2015. Dissipation kinetics and leaching of cyazofamid in texturally different agricultural soils. *International Journal of Environmental Science and Technology* 12(8): 2475-2484 (2015).

42. Singh, R., Singh Vir Pal, Pratap Tej, Rampal and Rekha, 2015. Evaluation of Triasulfuron 20 WG from new source against weeds in wheat, phytoxicity and its effect on succeeding urd crop. *Journal of Environment and Bioscience.28(2):357-360*

43. Singh, V.P., Pareek, N., Kumar A., Satyawali K., Banga A., Bisht, N. and Singh, D.B. 2015. Efficacy of ACM-9 (clodinafop propargyl + metribuzin) on weeds, growth and yield of wheat. *Journal of environment and bioscience* 29(2):361-366.

44. Singh, V.P., Singh, S.P., Banga, S., Kumar, A., Tripathi, N. and Bisht, N. 2015. Compatibilty of penoxsulam+cyhalafop with insecticide,fungicide and urea 2% in direct seeded rice. *Journal of Eco-friendly Agriculture* .10(1):74-76.

45. Singh,V.P., Pratap Tej, Dhyani V.C., Kumar A., Banga A., Tripathi N. and Bisht, N. 2015. Performance of post-emergence herbicide on weed flora and yield on soybean (glycine max L.). *Journal of environment and bioscience.* 29(1):51-56.

46. Singh,V.P., Pratap Tej, Singh S.P., Kumar A., Banga A., Bisht, N. and Neeshu. 2015. Comparative efficacy of Post – emergence herbicide on yield of wheat. *Indian Journal of Weed Science*. 47(1):25-27

47. Sirazuddin, Singh, S. P., Singh, V.P. and Mahapatra, B.S. 2015. Dynamics of *Phalaris minor* in wheat (*Triticum aestivum* L.) under different establishment methods and weed control measures. *International Journal of Environmental & Agriculture Research*. 1(5):20-25.

48. Sirazuddin, Singh, S.P., Singh, V.P. and Mahapatra, B.S. 2015. Effect of establishment methods and weed control measures on broad leaf weeds, yield attributes and harvest index of wheat (*Triticum aestivum* L.). *International*

journal of engineering research and science. 1(6):34-37.

49. Sirazuddin, Singh, S.P., Singh, V.P., Mahapatra, B.S. and Verma, Himanshu. 2015. Effect of Weed-Control Measures on Yield, Weed Control, Economics, Energetics and Soil Microflora under Different Establishment Methods of Wheat (*Triticum aestivum* L.). *International Journal of Bio-resource and Stress Management*. 6(6). P736-743

50. Tandon Shishir and Sand N.K. 2015. Rapid estimation of pyroquilon from its formulations by RP-HPLC. *Pestology* 39(8):32-34 (2015).

51. Chauhan Monika, Singh V.P., Bhatnagar Amit, Prajapati Brijkishore and Kewalanand.2016. Studies on integrated weed management practices in turmeric (*Curcuma longa* L.).Progressive Research: *An International Journal*. 11(V):3010-3014.

52. Joshi Neeshu, Singh V.P, Dhyani V.C, Singh S.P. and Tej Pratap 2016. Effect of geometry and weed management practices on crop growth and yield of direct seeded (Aerobic) rice (*Oryza sativa* L.) *Ecology, Environment and conservation* 22 (April suppl.) pp.(S371-S376) ISSN0971-765X.

53. Sharma A.R., Bhullar Makhan S., Singh, V. Pratap, Singh, Mandeep and Das, T., K. 2016. Harnessing Weed-Fertiliser-Water Interactions for Higher Crop Productivity and Resource-use Efficiency. *Indian Journal of Fertilizers*, 12 (11), pp.114-130.

54. Singh V. Pratap, Pareek Navneet, Kumar A. Satyawali Kavita,Banga Akshita, Bisht Neema & Singh, D.B.2016.Efficacy of ACM-9 (Clodinafop Propargyl +Metribuzin)on weeds, Growth and yield of wheat. *Journal of environment bio. Sci*..29 (2): pp361-366.

55. Singh, V. Pratap, Joshi Neeshu, Bisht Neema, Kumar, A., Satyawali Kavita. 2016. Impact of various doses of butachlor on weed growth, crop yield of rice, microbial population and residual effect on wheat crop. *International Journal of science, Environment and Technology.* 5, pp.3106-3114.

56. Singh,V. Pratap, Pratap Tej, Singh S.P., Kumar A., Satyawali Kavita, Banga Akshita, Bisht Neema & Singh R.P. 2016. Weed Management in black gram with Pre-mix herbicides. *Indian journal of Weed Science*.48 (2): pp 178-181.

57. Paliwal Arunima, Singh V. Pratap, Joshi Neeshu and Bhimwal Jai Prakash.2016. Weed Management in Direct - Seeded Rice [*Oryza Sativa*]: A review. *J. Env. Bio-Sci*., 2016: Vol. 30 (2):533-539.

58. Singh,R, Rekha, Gupta, A, Tej Pratap, Kumar S and Kumar A.2016. Evaluation of Azimsulfuron 50 DF against sedges in transplanted rice 2016.*Indian Journal of Weed Science* 48 (3)

59. Tandon Shishir, Mehra P and Sand NK. 2016. Leaching behaviour of metsulfuron – methyl. *Indian Journal of Weed Science* 48(2): 230-.232

60. Pratap, Tej, Singh, V. Pratap, Singh, S.P. and Rekha. 2016. Herbicides combination for control of complex weed flora in transplanted rice (*Oryza sativa* L.). *Research on Crops*. 17(4): 657-661.

61. Shalini, Singh, Virendra Pratap and Jangid, Brijbhooshan. 2017. Yield and economics in direct seeded rice using organic manures and micronutrients. *International Journal of Chemical Studies*. 5(3): 105-109.

62. Paliwal Arunima, Singh V Pratap, Guru SK, Pratap Tej, Singh SP, Chandra Subhash and Kumar Rajeew. 2017. Soil physical properties as influenced by different conservation agriculture practices in rice-wheat system. *International Journal of Chemical Studies*. 5(4): 757-761.

63. Chilwal Aaradhana, Singh S.P., Singh V.P., Mahapatra B.S. and Shukla D.K. 2017 Determination of allelopathic effect of winter weeds on nutrient content and uptake in wheat. *Journal of Pharmacognosy and Phytochemistry*. 6(6): 1121-1125.

64. Chilwal Aaradhana, Singh S.P., Singh V.P.,

Mahapatra B.S., Shukla D.K. and Shirazzudin. 2017. Potential allelopathic interference of aqueous extracts of winter weeds on yield and yield attributing characters of wheat (*Triticum aestivum* L.). *Journal of Pharmacognosy and Phytochemistry*. 6(6): 1117-1120.

65. Chilwal Aaradhana, Singh S.P., Singh V.P., Mahapatra B.S., Shukla D.K. and Kaushik Vasundhara. 2017. Allelopathic assessment of aqueous extracts of winter weeds on growth of little canary grass (*Phalaris minor* Retz.) and wheat (*Triticum aestivum* L.). *International Journal of Current Microbiology and Applied Sciences*. 6(12): 6(12):978-983

66. Chilwal Aaradhana, Singh S.P., Singh V.P., Mahapatra B.S., Shukla D.K. and Verma Himanshu. 2017. Allelopathic effect of winter weeds on little canary grass (*Phalaris minor* Retz.) and wheat (*Triticum aestivum* L.). International Journal of Current Microbiology and Applied Sciences. 6(12): 6(12):984-989

67. Singh, V. Pratap, Singh S.P., Bisht Neema, Kumar A., Satyawali Kavita and Paliwal Arunima. 2017. Assessment of post-emergence weed management in irrigated direct-seeded rice. *Indian Journal of Weed Science*. 49(3) 211-215.

68. Verma Himanshu, Singh S.P., Singh V.P., Mahapatra B.S., Sirazuddin, Joshi Neeshu, Chilwal Aaradhana. 2017. Weed dynamics of aerobic rice (*Oryza sativa* L.) under chemical and non-chemical weed management practices in irrigated system. *Int. J. Curr. Microbiol. App. Sci*. 6(12): 3159-3165.

69. Verma Himanshu, Singh S.P., Singh V.P., Mahapatra B.S., Sirazuddin, Joshi Neeshu, Chilwal Aaradhana. 2017. Nutrient uptake and soil health under chemical and non-chemical weed management practices in irrigated rice ecosystem. *Int. J. Curr. Microbiol. App. Sci*. 6(12): 3152-3158.

70. Singh A, Tandon Shishir and Sand NK. 2017. Dissipation kinetics study of clopyralid herbicide in water. *Asian Journal of Chemistry*. 29(2): 271-273

71. Pratap Tej, Singh V.P., Singh S.P. and Rekha. 2016. Effect of herbicides and their combinations on weed growth and yield of transplanted rice. *Indian Journal of Weed Science.* 49(4): 356-359

72. Pratap Tej, Singh V.P. and Rekha, 2017. Chemical control of weeds in dry seeded rice. *Indian Journal of Weed Science*. 49(1): 98-99

73. Pratap Tej, Rekha and Singh Mahavir 2017. Effect Propanil on control of complex weed flora in direct seeded rice. *Journal of Hill Agriculture.* 8(2): 191-194.

74. Pratap Tej, Singh V.P. and Rekha 2016. Efficacy of herbicidal to control weeds in direct dry seeded rice. *Indian Journal of weed science.* 48(3):1-5.

75. Kumar N., Guru SK. 2016. Herbicide resistance mechanism of Phalaris minor in Uttarakhand. *Journal of Crop and Weed*. 12 (2):129-133.

76. Bhandari K and Guru S.K. 2017. Inhibitory effects of rice straw on the germination and seedling growth of some major weeds of wheat. *Indian Journal of Weed Science*. 49(2)

Papers presented in seminar/ conferences/ symposia

1. Agarwal Charu and Guru, S.K. 2012. Comparative performance of various herbicides and eucalyptus oil for weed management in rice (*Oryza sativa* L.). *In*: National Seminar of Plant Physiology, ANGRAU, Hyderabad, December 12-14,2012, pp. 99.

2. Banga, A. Singh, V.P., Kumar, A. and Yadav, V. 2012. Integrated weed management- A sustainable approach for weed control. *In*:.International conference on "Sustainable Agriculture for food and livelihood security". Punjab Agricultural University, Ludhiana. Nov.27-29, 2012. pp877-879.

3. Dubey, R. and Singh, D. 2012. Effect of rice establishment techniques on crop productivity and weed dynamics under different weed control methods in Uttarakhand. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. April,19-20, 2012, Kerala Agriculture University, Thrissur.43pp.

4. Guru,S.K., Patni, B., Gope, P.C. and Singh, V.P.2012. Competitive ability and allelopathic potential of some rice genotypes against weeds. *In*: abstracts, National Symposium on "Rice-based Farming systems for livelihood security under changing climatic scenario" 27-29 February, 2012. College of Agriculture, OUAT, Chiplima, Sambalpur. pp.116.

5. Joshi, N., Singh, V.P. and Banga, A. 2012. Direct seeded rice and zero tillage as an alternative of conservation agriculture. *In*: "International conference on Sustainable Agriculture for food and livelihood security". Punjab Agricultural University, Ludhiana. Nov.27-29, 2012, pp27-29.

6. Kumar Sujeet and Guru, S.K.2012. An investigation into the physiological and biochemical aspects of herbicide resistance in *Phalaris minor In:* National Seminar of Plant Physiology, ANGRAU, Hyderabad, December 12-14, 2012, pp. 113.

7. Kumar, J., Singh, D., Singh, R. and Singh, B. 2012. Effect of weed management practices on direct seeded dry rice under different sowing dates. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment". 19-20 April, 2012, Kerala Agriculture University, Thrissur.73pp.

8. Pratap, T., Singh, R. and Rampal.2012. Effect of application rate of anilofos granules with or without emulsifier on transplanted rice and associated weeds. . *In*: Third international congress, Agronomy Ecology and Climate Resilience. New Delhi, Dec, 26-31,2012. Vol (2):179-180.

9. Pratap, T., Singh, S.P., Singh, V.P. and Singh, R.2012. Bio-efficacy of herbicides for weed control in direct dry seeded rice under *tarai*-agro climatic region of Uttarakhand. Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment." 19-20 April,2012, Kerala Agriculture University, Thrissur.105pp.

10. Sharma P, Tandon, S. and Sand, N.K. 2012. Analysis of butachlor herbicide in texturally different soils by GC-ECD at UCOST Dehradun. December, 2012.

11. Singh, R., Srivastav, S.K., Pratap, T., Singh, V.P., Singh, S.P., Kumar, J. and Pathak, A. 2012.Bio-efficacy evaluation of trisulfuron against weeds in rice. Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment19-20 April,2012, Kerala Agriculture University, Thrissur.82pp.

12. Singh, D. and Punetha, P. 2012. Efficacy of pinoxaden(5 EC) alone and in combination with different herbicides in wheat. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April,2012, Kerala Agriculture University, Thrissur.88pp.

13. Singh, D., Kumar, V. and Kumar, J. 2012. Integrated weed management in wheat crop. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April,2012, Kerala Agriculture University, Thrissur.89.pp.

14. Singh, D., Saini, S.K., Singh, V. and Kumar, J. 2012. Weed management studies in sugarcane ratoon crop. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April,2012 ,Kerala Agriculture University, Thrissur.108pp.

15. Singh, D., Saini, S.K. and Singh, V. 2012. Studies on the control of *Ipomea* spp. in spring planted sugarcane. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to

Agriculture, Biodiversity and environment. 19-20 April,2012, Kerala Agriculture University, Thrissur.141pp.

16. Singh, D., Kumar, A. and Kumar, J. 2012.Integrated weed management in soybean. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20, Kerala Agriculture University, Thrissur. 142pp.

17. Shukla, D.K., Pratap, T., Malik, N. and Prasad, B.2012. Evaluation of productivity potential of rice bean based intercrops under mid hills rainfed condition of Uttarakhand. *In:* Third international congress, Agronomy Ecology and Climate Resilience. .IARI, New Delhi, Dec., 26-31,2012. Vol(2): 531-532.

18. Singh, R., Kumar, J., Kumar, P. and Singh, V.K. 2012. Performance of spring planted sugarcane under different management practices. . *In*: Third international Agronomy congress on Agriculture diversification, Climate change Management and Livelihood held at IARI, New Delhi, Nov.,26-30,2012.Vol.II:1053-1054.

19. Singh, R., Kumar, J., Singh, V.P., Pratap, T., Shyam, R. and Rampal. 2012. Bio efficacy evaluation of paraquat dichlouride against weeds in potato crop. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April, 2012, Kerala Agriculture University, Thrissur.131pp.

20. Singh, R., Pratap, T., Singh, S.P., Pathak, A. and Guru, S.K. 2012. Major weeds and their management in Uttarakhand. *In:* .Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April, 2012 Kerala Agriculture University, Thrissur.16pp.

21. Singh, R., Singh, P., Singh, V.K., Singh, V.P. and Pratap, T. 2012. Effect of different herbicides on weeds dry matter and yield of wheat. *In*: Third international Agronomy congress on Agriculture diversification, Climate change Management and Livelihood held at IARI, New Delhi, Nov.,26-30,2012.Vol.II:138-139.

22. Singh, S.P., Singh, V.P., Banga, A. and Kumar, A.2012. Effect of monsoon and weed management on weed growth and yield of direct (dry) seeded rice. *In:*. Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April, 2012,Kerala Agriculture University, Thrissur.75pp.

23. Singh, V.P., Guru, S.K., Singh, S.P., Pratap, T., Banga, A. and Kumar, A. 2012. Studies on bio-efficacy of Tembotrione+ surfactant against mixed weed complex in maize. *In* proceeding of Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April, 2012, Kerala Agriculture University, Thrissur.104pp.

24. Singh, V.P., Singh, R., Singh, S.P., Pratap, T., Banga, A. and Kumar, A. 2012. Bio-efficacy studies of oxadiargyl 80 WP (Top star) on weed growth and seed yield of sunflower. *In*: Third international Agronomy congress on Agriculture diversification, Climate change Management and Livelihood held at IARI, New Delhi, Nov.,26-30,2012.Vol.II:. 372-374.

25. Singh, V.P., Singh, S.P. and Banga, A. 2012. Weed management in zero tillage in India: current scenario and prospectus. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April, 2012. Kerala Agriculture University, Thrissur.19pp.

26. Singh, V.P., Singh, S.P., Tripathi, N., Kumar, A. and Banga, A. 2012. Studies on bioefficacy and phytotoxicity of penoxsulam for weed control in direct seeded rice. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April,2012, Kerala Agriculture University, Thrissur.72pp.

27. Singh, V.P., Pandey, S,T., Singh, S.P., Banga, A. and Kumar, A.2012. Evaluation of oxyflurofen

for weed control in mentha. *In:*.Biennial Conference of Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April, 2012, Kerala Agriculture University, Thrissur.126pp.

28. Tandon S. 2012. Dissipation of oxyflourfen in soil and its residue analysis in rice crop at harvest. *In* :Binneial conference on Weed threat to agriculture, biodiversity and Environment, at Kerala Agricultural University, Thrissur, 19-20 April, 2012. p165.

29. Yadav, V. R., Singh, V.P., Singh, S.P. and Banga, A. 2012. Resource management through conservation agriculture in rice - wheat cropping system of Indo Gangetic plains. *In:*.International conference on Sustainable Agriculture for food and livelihood security. Punjab Agricultural University, Ludhiana. Nov.27-29, 2012 :pp813-814.

30. Yadav, V.R. and Singh, V.P. 2012. Integrated weed management in rice:future prospective. *In:*.Biennial Conference OF Indian society of weed science on "Weed Threat to Agriculture, Biodiversity and environment. 19-20 April,2012, Kerala Agriculture University, Thrissur.98pp.

31. Yadav,V.R., Singh,V.P.,Banga, A. and Neeshu.2013. Natural resource management through rice- wheat cropping system.National seminar on "Green technology for sustainable environmental management. Doon university, Dehradun-March22-23.pp.155.

32. Joshi,N., Singh,V.P., Banga, A. and Yadav,V.R.2013.Consevation of natural resources through zero tillage. National seminar on "Green technology for sustainable environmental management. Doon university, Dehradun-March22-23.pp.167.

33. Banga,A.,Yadav,A., Singh.,V.P., Tripathi, N. and Yadav, V.R. Role of forest management in sustaining livelihood. National seminar on "Green technology for sustainable environmental management. Doon University, Dehradun-March22-23.pp.192.

34. Singh,V.P., Tripathi,N.,Banga,A., and Yadav,V.R.2013.Conservation agriculture-A sustainable system. . National seminar on "Green technology for sustainable environmental management. Doon University, Dehradun-March22-23.pp.152.

35. Tripathi,N., Singh,V.P., Banga,A., Kumar,A. and Yadav,V.R.2013.Natural resource management through zero tillage. National seminar on "Green technology for sustainable environmental management. Doon University, Dehradun-March22-23.pp.164.

36. Singh, V.P.,Banga.A. and Yadav.V.R.2013.Opportunities and challenges in conservation agriculture agriculture in India.National seminar on "Enhancing water productivity in agriculture" BHU. Varanasi.March 8-9.pp 436-439.

37. Banga.A., Singh,V.P., Rekha.,Neeta.,Neeshu and Vimal.2013.Benefits and characteristic features of Bacopa monnieri. National seminar on "Innovations in traditional agriculture" on November15-16 at G.B.P.U.A.&T, Pantnagar. pp131.

38. Yadav,V.R.,Singh,V.P., Chandra,S., Banga, A. and Yadav,U.2013. Role of residue management in controlling soil erosion. National seminar on "Innovations in traditional agriculture" on November 15-16 at G.B.P.U.A.&T, Pantnagar. pp106.

39. Singh, V.P., Singh S.P., Dhyani, V.C., Tripathi, N., Banga, A. and Yadav, V.R. 2013. Effect of establishment methods on shifting of weed flora in rice-wheat cropping system. 24th APWSS conference. "The role of weed Science in supporting food security by 2020".Padjadjaran University Convention Hall, Bandung, West Java, Indonesia, October 22-25. pp119.

40. Singh, Rohitashav., Panwar, Suman, Pratap, Tej and Yadav, Subhash. 2013. Effect of intergrated weed management practices in spring planted sugarcane. *In:* Procc. of National seminar on technological interventions for sustainable Hill

Development held at 15-17 June. G.B.P.U.A. & T, Pantnagar. Pp33.

41. Singh, Rohitashav., Pratap, Tej Yadav, Subhash, Rampal, Singh, Virpal and Rawat, Anand Singh. 2013. Bio-efficacy of Ethoxysulfuron (Sunrice 15WG) for control of *Cyperus rotundus* in sugarcane. *In:* Procc. of National seminar on technological interventions for sustainable Hill Development held at 15-17 June. G.B.P.U.A. & T, Pantnagar. pp29.

42. Yadav, Vimal Raj; Singh, V. Pratap; Banga, Akshita and Joshi, Neeshu. 2013. Water Management In Rainfed and Irrigated Cropping System. In: Procce. of National Seminar on Enhancing Water Productivity in Agriculture held at Department of Agronomy, I.Ag.Sc., Banaras Hindu University, Varanasi on March 8-9, 2013. pp 338-340.

43. Singh, V. Pratap; Banga, Akshita and Yadav, Vimal Raj. 2013. Opportunities and Challenges in Conservation Agriculture in India. In: Procce. of National Seminar on Enhancing Water Productivity in Agriculture held at Department of Agronomy, I. Ag. Sc., Banaras Hindu University, Varanasi on March 8-9, 2013. pp 436-439.

44. Bhandari, K., Chandola, P. and Guru, S.K. 2014. Effect of rice straw on seedling growth and germination of major weeds in wheat (*Triticum aestivum* L.). In: Suhilkumar *et. al*. (Eds) Extended Summary, ISWS Biennial Conference on "Emerging Challenges in Weed Management", Jabalpur, 15-17 February, 2014.pp.272.

45. Chandola, P., Bhandari, K. and Guru, S.K. 2014. Effect of Weed Management practices on crop physiology, weed growth and soil microflora of rice". In: Suhilkumar *et. al*. (Eds) Extended Summary, ISWS Biennial Conference on "Emerging Challenges in Weed Management", Jabalpur, 15-17 February, 2014.pp.226.

46. Chandola, P., Kumar, N., Bhandari, K., Bharti, K., Bartwal, A. and Guru, S. K. 2014. Impact of long term chemical weed management on soil microflora in cropping systems. 1st International Congress on Ecological Integrity and Environmental Ethics: Living for sustainable future. GBPUAT, Pantnagar, 8-10 Nov, 2014.

47. Guru, S.K. and Singh, V.Pratap. 2014. Herbicide Resistance: magnitude, mechanisms and management. In: Suhil Kumar et. al. (Eds) Extended Summary, ISWS Biennial Conference on "Emerging Challenges in Weed Management", Jabalpur, 15-17 February, 2014.pp.17.

48. Guru, S.K., Kumar, N. and Singh, V. Pratap. 2014. Resistance of little seed canary grass to isoproturon in Uttarakhand and its management. In: Sushil Kumar et. al. (Eds) Extended Summary, ISWS Biennial Conference on "Emerging Challenges in Weed Management", Jabalpur, 15-17 February, 2014.pp.266

49. Guru, S.K., Chandola, P. and Singh, V.Pratap. 2014. Effect of Chemical weed control methods on physiology of transplanted rice and soil microbiology in a rice –wheat cropping system. In: Abstracts, National Conference of Plant Physiology, November 23-25, 2014, OUAT, Bhubaneswar. P.164.

50. Guru, S.K., Chandola P and Singh, V.Pratap. 2014. Phalaris minor resistance to isoproturon in Uttarakhand and its management with alternate herbicides. In: Abstracts, National Conference of Plant Physiology, November 23-25, 2014, OUAT, Bhubaneswar. P.167.

51. Pratap, Tej., Kabdal, P., Singh, V.Pratap., Singh, R. and Kumar, A.2014. Effect of herbicide combination for control of complex weed flora in transplanted rice. In:. Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management". February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India. 258pp.

52. Pratap, Tej., Singh, S.P., Singh, V. Pratap. and Singh, R. 2014. Bio-efficacy of herbicides to control weeds in direct dry seeded rice under tarai ecosystem of Uttarakhand. National Symposium on "ECM" Technology for safe,

secure and profitable food production Oct. 10.11, 2014, Deptt. Of Agronomy, GBPUA & T. Pantnagar PP 109

53. Pratap, Tej., Singh, R., Chaturvedi, S., Jodhpal and Rekha. 2014. Pre and post-emergence herbicides for control of weeds in transplanted rice. National Symposium on "Agricultural Diversification for Sustainable livelihood and Environmental Security" November 18-20, 2014 at PAU, Ludhiana. PP 411-412.

54. Singh, D. and Dubey, R.2014. Productivity and profitability influenced by establishment methods and weed management practices in rice (*Oryza sativa* L.). NASA 2014 International Symposium on New-Dimensions in Agrometerology for Sustainable Agriculture. GBPUA&T Pantnagar- October 16-18.pp.279.

55. Singh, D., Hamid mir, N. and Singh, N. 2014. Efficacy of Furiflex 25% for total weed control in soybean (*Glycine max* L. Merrill). In: Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management". February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India.239pp.

56. Singh,D., Maken D.K., Singh, V. and Yadav, R.D. 2014. Strategies to maximize the cane yield through proper weed management in sugarcane (*Saccharum officinale* L.). *In*: Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management". February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India. 240pp.

57. Singh, R., Rekha, Pratap, Tej., Pal, R., Singh, A.P. and Singh, V.P. 2014. Evaluation of Pretilachlor 6%+ pyrazosulfuron Ethyl 0.15 % for control of complex weed flora in transplanted rice. In the National Workshop on "Retrospective and Prospective Analysis of Indian Agriculture: The Roadmap A head" held at GB Pant University of Agriculture & Technology , Pantnagar , India during 17-18 November,2014.

58. Singh, R., Rampal, Pratap, Tej., Rekha and Singh, G. 2014. Evaluation of metribuzin 42 % + clodinafop propargyl 12% WG for control of complex weed flora in wheat. National Symposium on "ECM" Technology for safe, secure and profitable food production Oct. 10.11, 2014, Deptt. Of Agronomy, GBPUA & T. Pantnagar. pp 111.

59. Singh, V.Pratap., Banga, A., Guru, S.K., Kumar, A., Neeta and Singh, R.P. 2014. Efficacy of Penoxulam on weed growth, and grain yield of transplanted rice. In: Suhilkumar *et. al.* (Eds) Extended Summary, ISWS Biennial Conference on "Emerging Challenges in Weed Management", Jabalpur, 15-17 February, 2014.pp.214.

60. Singh, S.P., Singh, V.Pratap., Banga, A. and Bisht, N .2014. Compatibility of penoxsulam + Cyhalofop with insecticide, fungicide and urea 2% in direct seeded rice. National symposium on "ECM Technology for Safe, Secure and Profitable Food Production." GBPUA&T Pantnagar- October 10-11.pp.90.

61. Singh, V.Pratap., Pareek, N., Kumar, A., Bisht, N., Banga,A. and Tripathi, N. 2014. Impact of herbicides on weed density and soil micro flora in transplanted rice under tarai region of Uttarakhand. National symposium on "ECM Technology for Safe, Secure and Profitable Food Production." GBPUA&T Pantnagar- October 10-11.pp.90.

62. Singh, V.Pratap., Pratap, Tej., Kumar, A., Tripathi, N., Singh, R.P. and Singh, D.B.2014.Performance of post emergence herbicides on weed flora and yield of soybean (*Glycine max* L.). National symposium on "ECM Technology for Safe, Secure and Profitable Food Production." GBPUA&T Pantnagar- October 10-11.pp.89.

63. Singh, V.Pratap., Pareek, N., Kumar, A., Shikhar, Tripathi, N., Banga,A. and Bisht, N. 2014. Impact of herbicides on weeds and soil micro flora in soybean. NASA 2014 International Symposium on New-Dimensions in Agrometerology for Sustainable Agriculture.

GBPUA&T Pantnagar- October 16-18.pp.185.

64. Singh, V.Pratap., Joshi, V., Pratap, Tej., Kumar, A. and Rekha.2014. Bio-efficacy studies of butachlor in transplanted rice under foothills of Uttarakhand. In:. Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management" . February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India.215pp.

65. Singh, V.Pratap., Rekha., Singh, S.P., Kumar, A., Joshi, V. and Singh, R.P. 2014. Post-emergence application of penoxsulam+cyhalofop-butyl on growth and yield of direct (dry) seeded rice. In:. Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management" . February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India.216pp.

66. Singh, V.Pratap., Tripathi, N., Kumar, A. and Banga, A.2014. Use of herbicide mixtures for weed control in transplanted rice. In:. Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management" . February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh,India.217pp.

67. Singh, V., Singh, R., Rekha., Singh, R., Mahavir and Pratap, Tej. 2014. Evaluation of eros (Pretilachlor 6% + Pyrazosulfuron Ethyl 0.15%) for control of complex weed flora in transplanted rice. National Symposium on "Agricultural Diversification for Sustainable livelihood and Environmental Security" November 18-20, 2014 at PAU, Ludhiana. PP 427-428.

68. Singh, S.P., Singh, V.Pratap., Banga, A., Rekha., Joshi, V., Tripathi, N. and Kumar, A. 2014. Effect of rice based cropping systems on weed dynamics and crop productivity. In:. Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management". February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India. 219pp.

69. Yadav, V.R., Singh, V.Pratap. and Kumar, A. 2014. Integrated weed management in transplanted rice. In:. Biennial Conference of Indian society of weed science on "Emerging Challenges in Weed Management". February 15-17, 2014. Directorate of Weed Science Research, Jabalpur, Madhya Pradesh, India. 225pp.

70. Guru, S.K., Chandola, P. and Kumar, N. 2015. Distribution of *Physalis* species in Uttarakhand and Uttar Pradesh states of India. In: Proceedings, Volume III (Poster Papers). 25th Asian-Pacific Weed Science Society Conference, 13-16 October, 2015, Hyderabad, India. *Indian Society of Weed Science*, Jabalpur, pp.16.

71. Guru, SK. 2015. Crop Weed interactions under changing management practices. In: Souvenir and Extended Summary, "National seminar on Emerging Weed problems and their management in field crops", October 8-9, 2015, Bhubaneswar, India .pp.41-49.

72. Kumar, N, Ramola, P. and Guru, S.K. 2015. Biochemical characterization of *P. minor* resistance to isoproturon in Uttarakhand. In: Proceedings, Volume III (Poster Papers). 25th Asian-Pacific Weed Science Society Conference, 13-16 October, 2015, Hyderabad, India. *Indian Society of Weed Science*, Jabalpur, pp. 416.

73. Pratap Tej, Singh V.P., Singh R and Singh S.P. 2015 Chemical management of weeds in direct dry seeded rice. Paper Presented in 25th Asian Pacific weed Science for Society Conference on "Weed Science Sustainable Agriculture, Environment and Bio-diversity. Hyderabad, India during 13-16 October, 2015. P.43."

74. Prinsa, Kumar N and Guru S.K. 2015. Efficacy of different herbicides on three problematic weed species of winter season In: Proceedings, Volume III (Poster Papers). 25th Asian-Pacific Weed Science Society Conference, 13-16 October, 2015, Hyderabad, India. *Indian Society of Weed Science*, Jabalpur, pp. 348.

75. Singh, S.P., Singh, V.P., Pratap, Tej, Banga, A,

Kumar, A. and Bisht, Neema .2015 Efficacy of different herbicides for controlling weeds in Black gram. Paper Presented in 25th Asian Pacific weed Science for Society Conference on "*Weed Science Sustainable Agriculture, Environment and Bio-diversity"*. Hyderabad, India during 13-16 October, 2015. P.227.

76. Singh, V.P., Singh, S.P., Pratap, Tej, Kumar, A, Banga, A and Bisht, Neema 2015. Weed management and Conservation Practices in rice-wheat Cropping System. Paper Presented in 25th Asian Pacific weed Science for Society Conference on "*Weed Science Sustainable Agriculture, Environment and Bio-diversity"*. Hyderabad, India during 13-16 October, 2015. P.336

77. Tandon Shishir, 2015. Dissipation of ethofumesate in soil and residue analysis in sugarbeet at harvest. In Proceeding of 25th Asian-Pacific Weed Science Society Conference on Weed Science for Sustainable Agriculture, Environment and Biodiversity at PJT State Agricultural University, Rajendranagar, Hyderabad, 13-16 October, 2015 vol 3, pp 434.

78. Tandon Shishir, 2015. Dissipation of Ethofumesate in soil and residue analysis in sugarbeet at harvest. In 25th Asian-Pacific Weed Science Society Conference on Weed Science for Sustainable Agriculture, Environment and Biodiversity at PJT State Agricultural University, Rajendranagar, Hyderabad, 13-16 October, 2015

79. Bisht Neema, Singh V. P., Tej Pratap, Kumar A. and Satyawali Kavita 2016. Use of 2,4-D amine at various doses against BLW's to enhance Maize production in Tarai region of Uttarakhand. Paper presented in National Conference on Hill Agriculture in Perspective from Feb. 26-28, 2016 at GBPUA & T Pantnagar, U. S. Nagar, Uttarakhand.

80. Guru S.K. & Patna B: 2016: competitive ability of rice cultivars against Weeds: National Symposium on: Recent Advances in Weed Management. Nov 29-30,2016 NIPHM, Hyderabad.

81. Singh, S.P., Singh, V.P., Pratap, Tej, Satyawali, K., Bisht, N., Joshi, N. and Paliwal, A. 2017. Efficacy of atrazine on weed growth and yield of maize crop. Biennial Conference of the Indian Society of Weed Science on "Doubling Farmers' Income by 2022: The Role of Weed Science" during March 1-3, 2017 at MPUA&T, Udaipur. pp-193.

82. Singh, V.P., Paliwal, A., Pratap, Tej, Singh, S.P. and Guru, SK. 2017. Impact of crop establishment on weed shift and yield of rice and wheat in rice-wheat cropping system. Proceedings of Biennial Conference on *"Doubling Farmers' Income by 2022: The Role of Weed Science"*, 1-3 March, 2017, Udaipur. Indian Society of Weed Science, Jabalpur, India. Pp.223.

83. Bisht, N., Singh, V.P., Singh, S.P., Satyawali, K., Joshi, N. and Arunima. Assessing the efficacy of cyhalofop butyl against weeds in direct (dry) seeded rice under irrigated ecosystem. Biennial Conference of the Indian Society of Weed Science on "Doubling Farmers' Income by 2022: The Role of Weed Science" during March 1-3, 2017 at MPUA&T, Udaipur. pp-103.

Popular articles:

1. Guru, S.K., Ansari, M.W. and Shukla, A. 2012. *GM phsalon dwara uttam kheti ke ayam* (Hindi). Pantnagar Kisan Diary, pp.203-205.

2. Rampal.and Singh, R. 2012. *Makka ki phasal me kharpatwaro par kaise payee kaboo? Kisan Bharati*. 43 (9): 25-26.

3. Rampal, Singh, R. and Kumar, J., 2012. *Aaloo ki phasal me uchit kharpatwar niyantran. Kisan Bharati*. 43(12): 12-13.

4. Rampal, Singh, R., Singh, V.P. and Singh, S. 2012. *Gaihoo ki phasal me kharpatwar niyantran. Kisan Bharati*. 44 (1): 12-13 .

5. Singh, R., Kumar, J., Kumar, P. and Rampal. 2012. *Kharif va jayad ki phasalo me kharpatwar niyantran. Kisan Bharati*. 43 (7): 17-19.

6. Singh, R., Kumar, J., Rampal and Singh, D. 2012. *Ganne ki phasal me kharpatwaro ka niyantran. Kheti*. 65 (4): 28-29.

7. Singh, R., Kumar, J., Rampal and Singh, M. 2012. *Dhan ki phasal me kharpatwar niyantran. Kisan Bharati*. 43 (11): 17-18.

8. Singh, R., Kumar, J., Kumar, P. and Rampal. 2012. *Rabi ki phasalo me kharpatwar niyantran. Kisan Bharati*. 44 (1): 27-29.

9. Singh, V. P., Singh, S. P., Tripathi, N., Kumar, A. and Singh M.K. 2011. Weed management in pulses and oil seed crops. *Indian Farmers, Digest.* 44(8):11-15.

10. Singh, V. P., Kumar, A., Tripathi, N. and Banga, A. 2011. *Mausam ka fasaloutpadan se he atut sambandh*. *Kisan Bharati*. November 2011:pp.11-14.

11. Singh, V. P., Singh, N. , Tripathi, N., Kumar, A. and Akshita. 2012. *Uttarakhand main vibhinn fasalon ki sthitiyan*. *Kisan Bharati*. January 2012:pp.37-40.

12. Singh, V. P., Singh, S.P. and Kumar, A. 2012. *Vibhinn fasalaon me Kharpatwar niyantran hetu shaknashiyon ka prayog.* Pantnagar Kisan Diary 2012: pp189-191.

13. Tripathi, N., Singh, V.P., Kumar, A. and Banga, A. 2011. *Gaihaun ki fasal me kharpatwar niyantran. Kisan Bharati*. November 2011: pp.7-10.

14. Dubey A, Tandon Shishir, and Verma A. 2013. Millets: Good nutraceutical source. Indian Farmer Digest.46(3):20-21,40 (2013)

15. Kumar A., Singh V.P., Banga A. and Rekha 2013: rabi fasalon ke pramukh kharpatwar evam unka prabandhan. Kissan Jyoti (3): 23-34.

16. Rampal., Singh, R., Singh,V.P. and Kumar, J.,2014. Aaloo ki fasal me kharpatwarop ka prabandhan (66) 12-14

17. Rampal., Singh, R., Pratap,Tej. and Singh,V.P.2014. Dhan ki kheti me kharpatwar prabandhan. Kisan Bharti.45(11)4-6

18. Rampal., Singh, R., Singh, J. and Singh,M .2014.Jayad evam *Kharif* ki Tilhano ko kharpatwaro se bachaye .Kisan Bharti.45(11)10-12.

19. Singh, R., Rampal. and Pratap,Tej. 2014. *Rabi* ki fasalon me kharpatwar prabandhan. Kheti Vol. 10, Jan. 2014, PP 3-7

20. Singh. R., Rampal., Pratap,Tej., Kumar, J. and Rawat, A.S. 2014. Dhan ki fasal me kharpatwaron ka prabandhan. Kheti. Vol. 7, Oct. 2014, PP 35-37

21. Singh, V.Pratap., Joshi, V., Kumar, A., Tripathi, N. and Banga, A. 2014. Weed management in summer vegetable crops. *Indian Farmers Digest.* 47(3):27-29.

22. Singh, V.Pratap., Kumar, A. and Tripathi, N. 2014. Vibhinn fasalo me kharpatwar niyantran taknik. *Kisan Diary*, pp. 219-225.

23. Singh, V.Pratap., Priti., Kumar, A., Tripathi, N., Banga, A. and Bisht, N.2014. Rabi fasalo me kharpatwar niyantran hetu shaknashiyon ka prayog. *Kisan Bharati.* No.10. pp.19-22.

24. Guru, S.K. 2015. Goats eating Parthenium weed in Uttarakhand, India, July 2015. *International Parthenium Weed Newsletter*, No. 11:14-15.

25. Singh, V.P, Singh, S.P, Guru, S.K and Dubey, R.P. 2015. Weed Management in organic farming systems. *Indian Farming*, 65 (7):14-18.

26. Singh, V.P., Bisht, Neema and Kumar, Abnish. 2015. Use of recommended herbicides to control weeds in *rabi* crops. *Indian Farmers Digest*. 48:31-34.

27. Verma, A.K, Dubey, A. and Tandon Shishir 2015. Sugar poison. *Indian Farmer Digest.* 48(2):37-38

28. Tej Pratap and Rekha 2017: Weed management in major Rabi crops. *Indian Farmer's Digest*. January 51(01):11-15.

29. Tej Pratap, Shahi M and Rekha 2017. Efficient weed management in direct seeded rice. *Indian Farmer's Digest*. July 50(07):6-9.

30. Tej Pratap, Rekha and Shahi Munna 2017. Parvatiya kshetron me Gehu ki unnat shashya vidhiyan. *Kisan Bharti*. October 49(01): 6-10.

31. Tej Pratap and Rekha 2017: Weed management in major Rabi crops. *Indian Farmer's Digest*. January 51(01):11-15.

32. Tej Pratap, Shahi M and Rekha 2017. Efficient weed management in direct seeded rice. *Indian Farmer's Digest*. July 50(07):6-9.

33. Tej Pratap, Rekha and Shahi Munna 2017. Parvatiya kshetron me Gehu ki unnat shashya vidhiyan. *Kisan Bharti*. October 49(01): 6-10.

Proceedings/ Trainings:

1. Guru, S.K.2012.Physiological and biochemical responses of crop plants to elevated carbon dioxide levels and temperature. In procc. of 26th training course on " Crop management strategies under changing climate" conducted by CAFT, Deptt. of Agronomy. Held at G.B.P.U.A.&T., Pantnagar. October 9-29,2012.pp.219-223.

2. Singh, R.2012. Agriculture adaptation through management practices under changing climate. In procc. of 26th training course on " Crop management strategies under changing climate" conducted by CAFT, Deptt. of Agronomy. Held at G.B.P.U.A.&T., Pantnagar. October 9-29,2012.pp.234-248.

3. Singh, S.P.2012. Designing climate smart production technology for resource management. In procc. of 26th training course on " Crop management strategies under changing climate" conducted by CAFT, Deptt. of Agronomy. Held at G.B.P.U.A.&T., Pantnagar. October 9-29, 2012.pp.327-335.

4. Singh, V.P., Banga, A. and Yadav, V.R.2012. Effect of advances in production technology in rice-wheat system, effects on carbon sequestration and Green House Gas emissions. In procc. of 26th training course on " Crop management strategies under changing climate" conducted by CAFT, Deptt. of Agronomy. Held at G.B.P.U.A.&T., Pantnagar. October 9-29, 2012. pp.266-272

5. Guru S.K., Chandola P. and Kumar N. 2013. Root physiology for improving nutrient use efficiency. *In*: Proceedings of training course on "Exploring Rhizosphere for increasing input efficiency", Centre of Advanced Faculty Training, Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar. October 11-31, 2013. pp. 218 - 224.

6. Singh.S.P. 2013. Allelopathy a new vista for weed management. *In*: Proceedings of training course on "Exploring Rhizosphere for increasing input efficiency", Centre of Advanced Faculty Training, Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar. October 11-31, 2013.

7. Singh, V. Pratap., Tripathi, Neeta and Banga, Akshita.2013. Rhizosphere health in relation to mode of weed management practices. *In*: procc. of 28th trainning course on "Exploring rhizosphere for increasing input efficiency" conducted by CAFT, Deptt of Agronomy. Held at G.B.P.U.A.&T, Pantnagar. October11-31,2013. pp 131-135.

8. Singh, V. Pratap., Tripathi, Neeta, Banga, Akshita and Yadav, Vimal Raj.2013. Impact and adoption of resource conservation practices in present agriculture. *In*: procc.of 27th trainning course on "Resource Conservation For Shapping Future Agriculture" conducted by CAFT, Deptt of Agronomy. Held at G.B.P.U.A.&T, Pantnagar. February15-March7,2013. pp 305-311.

9. Singh, R. 2014. Diversification and resource conserving technologies of rice-wheat cropping system for sustained production. In Training on "Bestowing food security and soil health through crop diversification" conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. January 8-28,2014.pp 80-88.

10. Singh, V.Pratap., Tripathi, N., Banga, A. and Joshi, V.2014. Integrated weed management in intensive cropping. In Training on "Bestowing food security and soil health through crop

diversification conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. January 8-28,2014.pp 238-243.

11. Singh,S.P., Singh, V.Pratap. and Shukla, D.K.2014. Prospects of allelopathy under organic weed management. *In*: procc.of 29th training course on "Augmentation of soil and crop productivity through organics" conducted by CAFT, Deptt of Agronomy. Held at G.B.P.U.A.&T, Pantnagar. Sept.26-October 16,2014. pp 199-215.
12. Guru S.K. Enhancing physiological efficiencies of crops in diversified rhizosphere. Bestowing food security and soil health through crop diversification conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. January 8-28, 2014.pp.222-226.
13. Tej Pratap.2014. Shifting of Weed flora in crops and cropping systems *In*: Procc. training course on "Augmentation of soil and crop productivity through organics" conducted by CAFT, Deptt of Agronomy. Held at G.B.P.U.A.&T, Pantnagar. Sept.26-October 16,2014 pp 189-198.
14. Pratap Tej, 2015. Non chemical Weed management for better crop production. "Tillage and nutrient dynamics for better crop production conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. October 10-30, 2015.pp 108-112.
15. Pratap Tej, 2015. Weed management options for under privileged farming systems. In Training on "Management of Underprivileged agriculture conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. February, 6-26 2015.pp 96-103.
16. Singh, V. Pratap, Banga, A. and Neema. 2015. Conservation agriculture based management practices in Rice-wheat cropping system. In Training on "Management of Underprivileged agriculture conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. February 6-26, 2015.pp 44-51.
17. Singh, V. Pratap, Banga, A. and Neema. 2015. Conservation Impact of tillage and nutrient management practices on weed incidence in rice-wheat system. In Training on "Tillage and nutrient dynamics for better crop production conducted by CAFT. Held at G.B.P.U.A.&T., Pantnagar. October 10-30, 2015.pp 101-107.
18. Tandon Shishir, L.S., Bisht and N.K., Sand. 2015. Effect of pH and organic matter on adsorption-desorption of metribuzin in soils. In National Symposium on Agrochemicals for Food and Environment Safety at IARI, New Delhi, 28-30 January, 2015
19. Pratap Tej.2016. Efficient Weed Management in different crops and cropping system. "Revitalization Soil and crop productivity for secured Agriculture" conducted by CAFT. Held at GBPUA&T., Pantnagar, February 03-23, 2016.
20. Singh S.P.2016. Allelopathy for sustainable weed management."Revitalization Soil and crop productivity for secured Agriculture" conducted by CAFT. Held at GBPUA&T., Pantnagar, February 03-23, 2016.
21. Singh V. Pratap. 2016. Prospects of resource conservation technology in improving crop productivity and soil health."Revitalization Soil and crop productivity for secured Agriculture" conducted by CAFT. Held at GBPUA&T., Pantnagar, February 03-23, 2016.
22. Singh V. Pratap and Sirazuddin. 2017. Integrated weed management (IWM) in intensive cropping system."*Crop Management Strategies for Augmenting Farmer's Income*" conducted by CAFT at GBPUA&T., Pantnagar, September 13 to October 3, 2017. pp. 186-190.
23. Tej Pratap 2017. Delivered training lecture on Efficient weed management practices in abiotic stress condition under the training organized on "Crop management strategies for augmenting farmer's income" on 29.09.2017 conducted by CAFT, Deptt. of Agronomy, GBPUA & T. Pantnagar.
24. Tej Pratap 2017. Imparted training to agriculture extension officers and farmers of Himanchal Pradesh on augmenting farmer's income by

intercropping of different crop with sugarcane organized by SAMETI Uttarakhand, Pantnagar on 20 Aug. 2017.

25. Tej Pratap: on mote anajon ka Jaivik utpadan takniki on 7.3 .2017 organized by Directorate of Extension Education, GBPUA&T, Pantnagar.

Technical bulletins published for state farmers

Singh, V. P., Pratap, Tej, Guru, S.K., Singh, S.P. and Kumar, A. 2003. Direct seeding of rice. G.B.P.U.A&T, Pantnagar, Bulletin No. 135.

Singh, V. P., Pratap, Tej, Guru, S.K., Singh, S.P. and Kumar, A. 2003. धान की सीधी बोआई G.B.P.U.A&T, Pantnagar, Bulletin No. 136.

Singh, V. P., Pratap, Tej, Guru, S.K., Singh, S.P. and Kumar, A. 2005. सिंचित धान में सीधी बोआई एवं खरपतवार प्रबन्धन. G.B.P.U.A&T, Pantnagar.

Guru, S.K., Tripathi, S. S., Singh, R. 2008. गाजर घास का प्रकोप एवं प्रबन्धन. AICRP on Weed Control, GBPUAT, Pantnagar. 4 p.

Guru, S.K., Singh, R. and Singh, V. P. 2009. गाजर घास का प्रकोप एवं प्रबन्धन. AICRP on Weed Control, GBPUAT, Pantnagar. 4 p.

Guru, S.K. and Singh, V. P. 2010. गाजर घास : प्रकोप, प्रबन्धन एवं सही उपयोग. AICRP on Weed Control, GBPUAT, Pantnagar. 4 p.

Singh, V. P., Singh, D., Singh, R., Pratap, Tej, Guru, S.K. , Tandon, S. and Singh, S.P. 2012. गाजर घास : प्रकोप एवं प्रबन्धन. AICRP on Weed Control, GBPUAT, Pantnagar. 4 p.

Singh, V.P., Pratap, Tej, Guru, S.K., Singh, S.P. and Kumar, A. 2013. रबी फसलो मे खरपतवार नियंत्रण.6p.

Singh, V.P., Pratap, Tej, Guru, S.K., Singh, S.P. and Kumar, A. 2013. खरीफ फसलों मे प्रभावी खरपतवार प्रबन्धन. 6p

Singh, V.P., Guru, S.K., Singh, S.P., Pratap, Tej, Kumar, A. and Tripathi, N. 2014. Weed Management in vegetable crops. Directorate of Experiment Station (Publisher), GBPUAT, Pantnagar. 12p.

Singh, V.P., Pratap, Tej, Singh, S.P., Guru, S.K., Kumar, A. 2014. धान की सीधी बोआई उत्पाद तकनीक एवं खरपतवार प्रबन्धन. Directorate of Experiment Station (Publisher), GBPUAT, Pantnagar. 20p.

Singh, V.P., Paratap, Tej, Guru, S.K., Singh, S.P., Kumar, A. 2015. प्रमुख फसलों में खरपतवार प्रबन्धन Directorate of Experiment Station (Publisher), GBPUAT, Pantnagar. 60p

Singh, V. P., Pratap, Tej, Singh, S.P. and Kumar, A. 2015. Production technology of direct seeded rice G.B.P.U.A&T., Pantnagar Bulletin No. 8.

Singh, V. P., Pratap, Tej, Singh, S.P. and Kumar, A. Direct seeding and weed management of irrigated rice. G.B.P.U.A&T, Pantnagar.

Singh, V. P., Pratap, Tej, Singh, S.P. and Kumar, A. Direct seeding of rice and weed management in the irrigated rice-wheat cropping system of Indo-Gangetic plains. G.B.P.U.A&T, Pantnagar.

Singh, V. P., Pratap, Tej, Singh, S.P. and Kumar, A. Zero-Tillage in rice-wheat cropping systems. G.B.P.U.A&T, Pantnagar, Bulletin No. 137.

3. Thesis Research:

M.Sc. students- 43

Ph. D. students- 47

4. Awards/ Honours:

1. The Pantnagar centre of AICRP on Weed Management was adjudged the " Best Centre" in the country for two times, 2007 and 2015.
2. The Annual Report of the Pantnagar centre of AICRP on Weed Management was adjudged the " Best Report" in the country for two times, 2006-07 and 2009-10.

Fellowships and Gold Medals:

Indian Society of Weed Science Fellow

i. Dr. Govindra Singh (1997)

ii. Dr. V.P. Singh (2003)

iii. DR. Rohitasv Singh (2012)

Indian Society of Weed Science Gold Medal

i. Dr. Govindra Singh (2003)

ii. Dr. V.P. Singh (2012)

Young Scientist Award-UCOST : 2013

1. **Dr. Pawanika Chandola, Ph D.(Plant Physiology)**: For her research paper on "Assessment of Crop yield and weed growth under the application of pre-emergence herbicides" in the Discipline of Agricultural Sciences (**Advisor: Dr. S. K. Guru**)

Reviewer Excellence Award (2016)

2. **Awarded to Dr. V.P. Singh** by the Indian Journal of Agricultural Research and Legume Research-An International Journal

Award for Best Worker (College of Agriculture)

3. Sh. Hansraj Yadav, Laboratory Attendant: Best Worker, 2014

5. Future Thrusts:

1. Biology and Management of perennial weeds like *Cyprus rotundus, Sorghum halepance, Cynodon dactylon* and *Lantana camera* etc.
2. Monitoring of herbicide resistances
3. Development of integrated weed management packages with emphasis on non-chemical methods
4. Monitoring Shift in weed flora due to weed management practices/ tillage / other management practices
5. Studies on herbicide residues in soil-water-plant system needs to be continued

List of Bio-efficacy Projects conducted

List of Projects grant received

S.No.	Crop	Name of chemical
1.	Wheat	ACM-9
2.	Wheat	Pyroxsulam 9% WDG + Sulfosulfuron 75 %WG
3.	Wheat	Pyroxsulam 9% WDG
4.	Wheat	XDE 729+florosulam
5.	Wheat	Halauxifen-methyl6.95%w/w+Pyroxsulam25%w/w WG
6.	Wheat	2,4-D EE 38% EC2,4-D 58% EC2,4-D 50% SL2,4-D EE 80% EC and 2,4-D EHE 60% EC
7.	Wheat	Metribuzin 70% WP
8.	Wheat	XDE- 729 Methyl Ester 20.85% w/w Florasulam 20.0% w/w WG
9.	Wheat	RIL 066/F1 48% EC (Pendimethalin 30% EC+ metribuzin 70% WP)
10.	Wheat	Dicamba 48% W/V SL
11.	Rice	Invinsa,1-MCP(1-methyl cyclopropone
12.	Rice	Cyhalofop butyl 10% EC
13.	Rice	2,4-D EE 38% EC and 2,4-D EE 80% EC
14.	Rice	Pyrazosulfuron 10% WP
15.	Rice	bispyribac sodium 10% SC
16.	Rice-Direct seeded	Cyhalofop Butyl 10% EC
17.	Rice-Direct seeded	Paraquat Dichloride 24% SL
18.	Rice-Nursery	Penoxsulam 24% SC (Granite)
19.	Rice-Transplanted	Penoxsulam 2.67%w/w (2.5%w/v) OD
20.	Rice-Transplanted	CIL H- 110

21.	Rice-Transplanted	Acetochlor
22.	Rice-Transplanted	Penoxsulam 0.97 % w/w (1.0% w/v) + butachlor 38.8% w/w (40% W/V) SE
23.	Rice-Transplanted	Pretilachlor 50% EC
24.	Rice-Transplanted	XR848 Benzyl Ester 2.5% EC (W/V)
25.	Rice-Transplanted	Butachlor 50% EW (FASTMIX)
26.	Rice-Transplanted	XR- 848 Benzyl Ester 20 g/l + Cyhalofop Butyl 100 g/l EC (w/v)
27.	Rice-Transplanted	XR 848 Benzyl Ester 12.5 g/L + Penoxsulam 20 g/L OD (w/v)
28.	Rice-Transplanted	Clomazone 50% EC and Isoxzaolidinone herbicide SML-N6
29.	Rice-Transplanted	Bispyribac sodium 10% SC
30.	Rice-Transplanted	Butachlor 50% EW & Butachlor 5% Cr
31.	Rice-Transplanted & Direct seeded	Penoxsulam 21.7% SC
32.	Rice-Transplanted (Early post emergence)	CCP-0228
33.	Rice-Transplanted (Post-emergence)	CCP-0228
34.	Rice-Transplanted (Pre-emergence)	CCP-0228
35.	Rice-Transplanted, Direct seeded & Nursery	Bispyribac sodium 10% SC
36.	Paddy	Quinchorac 35% SC
37.	Soybean	Imazethapyr 10% SL
38.	Soybean	Quizalafop 5% EC
39.	Soybean	CIL H- 110
40.	Soybean	CILH- 111
41.	Soybean	Bentazone 48%SL
42.	Soybean	Clomazone50% EC and Isoxazolidinone herbicide SML-N6
43.	Soybean	Immazethapyr 10% SL
44.	Soybean	CCP 0025
45.	Soybean	CCP-1203
46.	Soybean	Metribuzin 70% WP
47.	Soybean	Bentazone 48% SL (BASHAZON)
48.	Maize	Acetochlor
49.	Maize	Atrazine 50% WP (New source)
50.	Maize	2,4-D EE 38% EC and 2,4-D EE 80% EC
51.	Maize	Dicamba 48% W/V SL as DMA salt
52.	Maize	SL- 950 60 D
53.	Maize	SL-573 400 SC
54.	Maize	Atrazin 50% WP
55.	Sugarcane	Halosulfuron methyl 75% WG in combination with CPL-6006 & hlorimuron ethyl 25% WP
56.	Sugarcane	Halosulfuron methyl 75% WG in combination with CPL-1255 & Metribuzin 70% WP
57.	Sugarcane	2,4-D Ethyl Hexyl Ester 60% EC
58.	Sugarcane	Atrazine 50% WP
59.	Sugarcane	SL 160 10% WP
60.	Black Gram	Quizalofop-p-ethyl 5% EC(ELEGANT)

61.	Black Gram	Haloxyrop 10.8% EC
62.	Cabbage	Oxadiagyl 80 WP (Top star 80 WP)
63.	Fresh pea	Diquat 20% SL (DESSICASH)
64.	Groundnut	Immazethapyr 10%SL (SURESHOOT)
65.	Groundnut	Imazethapyr10 %SL
66.	Groundnut	Quizalofop-p-ethyl 5% EC (ELEGANT)
67.	Potato	Oxyflurofen 23.5 EC
68.	Potato	Paraquat Di chloride24%SL
69.	Mentha	Haloxyrop 10.8% EC
70.	Non-Cropped Area	Indaziflam 20 + Glyphosate- 400:420 SC
71.	Onion	Quizalofop-p-ethyl 5% EC
72.	Onion	Oxadiagyl 80 WP (Top star 80 WP)
73.	Onion	Diquat 20% SL (DESSICASH)