



2012-18

IGKV
&
ICAR

**ALL INDIA CO-ORDINATED RESEARCH PROJECT
ON
IRRIGATION WATER MANAGEMENT**
(Sponsored by Indian Council of Agricultural Research)

PROGRESS REPORT

2012-18

BILASPUR CENTRE



**INDIRA GANDHI KRISHI VISHWA VIDYALAYA
BARRISTER THAKUR CHEDILAL
COLLEGE OF AGRICULTURE AND
RESEARCH STATION
SARKANDA, BILASPUR-495001
CHHATTISGARH**

THEMES

SN	(As per letter of DMW/AICRP/WM-GWU/2012 dated 18/11/2014)	Work assigned
01	Assessment of surface, ground water and waste water availability and quality at regional level and to evolve management strategies using decision support system (DSS) for matching water supply and demand in agricultural production system.	Raipur
02	Design, development and refinement of surface and pressurized irrigation system including small holders system for enhancing water use efficiency and water productivity for different agro-eco systems. (Surface water and Pressurized water)	Bilaspur Raipur
03	Management of rain water for judicious use and to develop and evaluate groundwater recharge technologies for augmenting groundwater availability under different hydro-geological conditions.	Raipur
04	Basic studies on soil-water-plant-environment relationship under changing scenarios of irrigation water management including waste water irrigation.	Bilaspur
05	To evolve management strategies for conjunctive use of surface and groundwater resources for sustainable crop production.	Bilaspur

SANCTIONED POST AND STAFF POSTED

SN	Name of the Post	Pay	Specialization	Sanc-tioned	Posted	Vacant	Name of the Staff & Designation
01	Senior Scientist	37400-67000+9000	Soil & Water Engineering	01	01	0	Dr. Devesh Pandey Principal Scientist
02	Senior Scientist	37400-67000+9000	Soil Science	01	01	0	Shri P.K. Keshary Scientist
03	Scientist	15600-39100+6000	Agronomy	01	01	0	Dr. Geet Sharma Scientist
04	Assistant Class-2	5200-20200+2400		01	0	01	Vacant
05	Field Extn. Officer-3	5200-20200+2200		01	01	0	Shri A.P. Goswami
06	Field Extn. Officer-3	5200-20200+2200		01	0	01	Vacant
07	Lab Attendant	5200-20200+1800		01	0	01	Vacant
08	Total			07	04	03	

STAFF ENGAGED IN THE RESEARCH

Dr. Devesh Pandey - A Profile



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Dr. Devesh Pandey

Designation

Principal Scientist (Agricultural Engineering)

Present place of Posting

IGKV, TCB College of Agriculture & Research Station

Bilaspur-495 001, Chhattisgarh, India

Degree

1. B. Tech. (Agricultural Engineering) , JNKVV Jabalpur
2. M. Tech. (Soil & Water Engineering) , JNKVV Jabalpur
3. Ph. D. (Soil & Water Conservation Engineering) , IIT Kharagpur
4. P.G. Diploma in Computer Application, GGCU, Bilaspur

Field of Specialization

Irrigation Water Management

Publications-

1. No. of Research Papers – 60
2. Extension Publication- 24

Experience (No. of Years)

1. Research & Extension - 32 Years
2. Teaching - 18 Years

Dr. Geet Sharma - A Profile



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Dr. Geet Sharma

Designation

Scientist (Agronomy)

Present place of Posting

IGKV, TCB College of Agriculture & Research Station

Bilaspur-495 001, Chhattisgarh, India

Degree

1. M. Sc. (Ag.) Agronomy
2. Ph. D. (Agronomy)

Field of Specialization

Sowing techniques & Nutrient Management in Agricultural & medicinal crops

Publications-

1. No. of Research Papers – 14
2. Practical manual- 02
3. Bulletins – 12
3. Popular Articles - 25

Experience (No. of Years)

Research & Extension - 16 Years

Teaching - 10 Years

P.K. Keshry - A Profile



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P.K. Keshry

Designation

Scientist (Soil Science)

Present place of Posting

IGKV, TCB College of Agriculture & Research Station

Bilaspur-495 001, Chhattisgarh, India

Degree

1. M. Sc. (Ag.) Soil Science

Field of Specialization

Soil Microbiology

Publications-




1. No. of Research Papers – 07
2. Bulletins – 05
3. Popular Articles - 06





Experience (No. of Years)

Research & Extension - 09 Years

Teaching - 06 Years

BRIEF OUTCOME OF 2012-2018:

Sl	Year	Technology/Methodology developed	Relevant Photographs
01	2013	<p>IRRIGATION METHOD AND SCHEDULE FOR POTATO -</p> <p>Irrigation with each furrow method at 40% CPE produced higher tuber yield of potato (172.83 q/ha.) with 472.8 kg/ha.-cm Water Expanse Efficiency which gave net return of Rs. 72391/ha.</p>	
02	2014	<p>LEVELS OF IRRIGATION AND FERTILITY FOR LATE SOWN WHEAT-</p> <p>Under late sown conditions in Chhattisgarh plain wheat gives higher yield (38.71 q/ha) with 125 kg/ha-cm of water expanse efficiency and maximum net return of Rs. 35180/ha by providing 5 irrigations and fertilizer dose of 100:60:40 (N: P: K) kg/ha</p>	
03	2014	<p>IRRIGATION SCHEDULE AND INTERCULTURE FOR RICE UNDER SRI SYSTEM</p> <p>In SRI system of rice cultivation, irrigation at 3 days after disappearance of ponded water (after tillering stage) and inter-culture with Ambika paddy weeder at 20 and 40 days after transplanting produces maximum yield (64.56 q/ha) with higher net return of Rs.63277/ha. Technology saves 12-13 % of irrigation water without any loss in yield as compared to continuous shallow submergence (5±3 cm ponded water) after tillering.</p>	

04	2014	<p>MOISTURE CONSERVATION PRACTICES AND INTEGRATED NUTRIENT MANAGEMENT FOR PRODUCTIVITY OF RAINFED MAIZE</p> <p>Furrow ridge bed cultivation of <i>kharif</i> maize with application of 75% RDF + 25% N through FYM and paddy straw mulch produces higher grain yield (42.01 q/ha). This technology conserves 18.53% moisture for <i>rabi</i> crops.</p>	
05	2016	<p>LEVEL OF IRRIGATION AND MICRO NUTRIENT FOR ONION</p> <p>Higher bulb yield of onion (240.59 q/ha) was recorded with irrigation at 60% CPE and application of micro nutrient - Zinc 5 kg per ha + Sulphur 20 kg /ha. The technology provide water expanse efficiency of 585.84 kg/ha- cm with net return of Rs 1, 93,565 per ha.</p>	
06	2016	<p>LEVELS OF IRRIGATION AND MULCH FOR CAPSICUM (<i>CAPSICUM ANNUM VAR. GOSSUM L.</i>) UNDER DRIP ENVIRONMENT-</p> <p>Irrigation at 100% PE with mulch (50 micron LLDPE) black film produced higher fruit yield (59.06 q/ha) of capsicum with water expanse efficiency of 259.55 kg /ha cm.</p>	
07	2017	<p>IRRIGATION SCHEDULING AND SPACING FOR RICE UNDER SRI (MEDAGASKAR) SYSTEM-</p> <p>Irrigation at 3 days disappearance of ponded water and transplanting at 20 cm x 20 cm spacing, recorded maximum rice grain yield (69.17q/ha) and maximum net return of Rs. 77634/ha.</p>	

Major Achievements

AGRICULTURAL ENGINEERING

A Micro Irrigation System:

1 Tomato -The drip irrigation (alternate day) at 0.6 PE with Boron @ 2.0 kg/ha gives maximum tomato (var. Pusa ruby) yield (381.16 q/ha.) while comparing other drip irrigation treatments (irrigation at 1.0, 0.8 and 0.4 PE) and increased 74% yield and 45.45% saving of water over traditional surface (alternate furrow) irrigation. Cost economics of the technology: Irrigation scheduling for tomato gives Benefit cost ratio 1.8:1.0

2 Sugarcane - The drip irrigation at 80 % PE with paired row planting 60 cm is recommended, for sugarcane (var. CO-1305), it gives maximum yield (132.6 t/ha.) with increased in yield 24.8% and 43.3% saving of water over traditional surface irrigation.

3 Banana - The 387.78 q/ha yield of banana was recorded under drip at 80% PE with 43.62% increase in yield and 27.63% saving of water as compared to surface irrigation. When compared with the mulch, 20.3% more water saving is observed.

4 Pomegranate - The drip irrigation at 3 days interval is recommended, for pomegranate (var. Ganesh-4), its gives maximum fruit yield (7.64 kg/plant) with 45.45% saving of water over traditional surface irrigation.

5 Potato and Onion - The sprinkler irrigation on onion and potato under ORP trial cum experimentation gave maximum yield 235 q/ha of Onion and 222 q/ha of Potato with increase in yield of 26% and 18% and saving of water 42% and 36% over surface irrigation respectively.

6 Wheat - Sprinkler irrigation up to vegetative stage with surface irrigation afterwards produced significantly higher grain yield (29.02 q/ha), net return (Rs 25796), with lower WE (17.27 cm) and higher WEE (167.01 kg/ha-cm) as compared to border strip method of irrigation.

B Determination of crop coefficients for Chhattisgarh Plains

Wheat (Arpa) - The total crop evapotranspiration (ETc) of late sown wheat variety - Arpa is measured 29.23 cm. The crop coefficient (Kc) ranges 0.35-1.09 with average value of 0.80 for cropping period of 112 days.

S. No.	Crop	Variety	Duration (day)	Yield (q/ha)	Crop ET (cm)	Potential ET (cm)	Crop Coefficient (Kc)		
							Min	Max	Avg.
1	Safflower	JSF-1	132	15.35	21.78	38.28	0.21	0.85	0.49
2	Chickpea (gram)	JG-315	110	25.41	13.20	24.28	0.13	0.75	0.55
3	Mustard	Pusa bold	121	7.53	21.26	27.08	0.21	1.02	0.79
4	Lathyrus	Local	109	10.42	18.91	26.01	0.20	0.89	0.56
5	Green gram (summer moong)	Malviya	84	14.93	30.94	38.30	0.40	1.09	0.79
6	Sunflower (summer)	Jwala-mukhi	97	18.28	37.75	46.20	0.30	1.30	0.75

AGRONOMY

Buch - Buch (*Acorus Calamus*) a high value medicinal crop can be grown with spacing of 30x20 cm with a amount equal to 48 irrigations, each of 6 cm depth after 1 DADPW produced maximum yield of 89.1 q/ha with net return of Rs. 1.72 lac/ha. Buch can be well adopted in water logged areas.

Summer Rice - Continuous submergence of water in summer rice produced significantly higher grain yield (63.7 q/ha.) followed by irrigation at one DADPW (57.4 q/ha.). Total water expense in continuous submergence was 180.0 cm and WEE 35.81 kg/ha-cm, where as in one DADPW the water expense was 156 cm and WEE 37.18 kg/ha-cm.

Kharif Rice - Under SRI system of rice cultivation with 3 cm irrigation after 3DAPDW after tillering produced 58 q/ha yield which was about 8 % higher with 15 % saving of water as compared to continuous submergence. In addition application of 25-50 % organic manures (FYM) gave better results

Rabi Sunflower - Irrigation scheduling based at IW/CPE = 1.2 (with 4 irrigations) is recommended for rabi sunflower which produced higher seed yield (11.51 q/ha.) with 29.80 kg/ha-cm WEE as compared to irrigation scheduling based on critical growth stages (3 irrigation) yielded 8.46 q/ha. with 25.90 kg/ha-cm of WEE.

Summer Groundnut - The IW/CPE ratio = 0.9 (or 8-9 irrigations) is recommended for summer groundnut which gave 30.96 q/ha yield with 56 kg/ha-cm of water expense efficiency.

Summer sesame: The IW/CPE ratio = 0.6 (or 5-6 irrigations) is recommended for summer sesame (Till) which gave 10.44 q/ha yield with 32 kg/ha-cm of water expense efficiency.

Summer Cucurbits -: The summer cucurbits (red pumpkin and bottle guard) were found more remunerative as compared to summer moong with higher water expense efficiency.

Wheat - The IW/CPE ratio = 0.9 (or 5-6 irrigations) is recommended for wheat which gave 40.10 q/ha yield with 152 kg/ha-cm of water expense efficiency.

S No.	Crop	IW/CPE ratio	Irrigation (DAS)	No. of irrigations	Yield (q/ha)	Water expense	WEE (kg/ha-cm)
1	Wheat	0.9	18, 34, 54, 72, 88,104	5-6	40.10	36.67	109.3
2	Gram	0.6	24,90	2	22.13	24.2	91.48
3	Sunflower	0.8	25, 54, 82, 102	4	22.90	24.5	93
4	Sesame (summer)	0.6	24, 41, 54, 67, 80	5	10.44	32.0	32.6
5	Maize (summer)	0.8	Every 10days	11	37.47	68	55
6	Groundnut (summer)	0.8	Every 10days	9-10	30.96	49.2	56

SOIL SCIENCE / SOIL PHYSICS

Rice -

1. The application of NPK – 80:50:30 kg/ha with ZnSO₄ @ 20kg/ha to rice gave the significantly better yield.
2. Application of copper sulphate @ 5.00 kg/ha checked the growth of green algae and grain yield of rice was increased by 32% over control at farmers field.

Soyabean- In soybean, either soil application or seed fortification of lime (3q/ha) or Ammonium molybdate (75 gm/ha) increased the grain yield about 36-44% over control (7.43 q/ha).

Black Gram- In black gram, either soil application or seed fortification of lime (3q/ha) or Ammonium molybdate (75 gm/ha) increased the grain yield about 16-40% over control (9.41q/ha).

Gram- In gram, either soil application or seed fortification of lime (3q/ha) or Ammonium molybdate (75gm/ha) increased the grain yield significantly over control (4.41q/h).

TECHNICAL PROGRAMME 2018-19

THEME 2: DESIGN, DEVELOPMENT AND REFINEMENT OF SURFACE AND PRESSURIZED IRRIGATION SYSTEM INCLUDING SMALL HOLDERS SYSTEM FOR ENHANCING WATER USE EFFICIENCY AND WATER PRODUCTIVITY FOR DIFFERENT AGRO-ECO SYSTEMS.

Experiment No.	:	2.1
Title	:	Effect of level of irrigation and nutrient management on growth and yield of chick pea.
Objectives	:	1. To study the effect of level of irrigation on yield and yield attributing characters of chick pea. 2. To study the effect of nutrient management on yield of Gram.
Treatments		TREATMENTS: A. Main plot: Levels of Irrigation by Sprinkler (4) I ₁ :Irrigation at 48 mm CPE I ₂ :Irrigation at 42 mm CPE I ₃ :Irrigation at 36 mm CPE I ₄ :Irrigation at 30 mm CPE B: Sub plot: Nutrient Management (3) N ₁ : Farmers Practice (20:50:0 NPK kg/ha.) N ₂ : 20:50:20 NPK kg/ha. N ₃ : 20:50:20 NPK kg/ha. + 2% foliar spray of 19:19:19 NPK Soluble fertilizers Depth of Irrigation 03 cm. by sprinkler
Investigators	:	Dr. G. Sharma, Dr. Devesh Pandey and Shri P. K. Keshry
Year of commencement	:	2015 (conducted 2015-16, 2016-17 and 2018-19)
Design	:	Split plot,
Replication	:	4
Location	:	Agricultural farm, Sarkanda, Bilaspur
Variety	:	JG 74

Experiment No.	:	2.2
Title	:	Effect of irrigation levels and crop geometry on rabi pigeon pea in unbunded clay soil of Chhattisgarh plains under drip.
Objectives	:	<ol style="list-style-type: none"> 1. To study the performance of rabi pigeon pea under different irrigation management practices. 2. To study the effect of crop geometry rabi pigeon pea. 3. To work out the economics.
Justification	:	<p>Chhattisgarh plain climate is suitable for cultivation of rabi pigeon pea, a crop whose demand and price are increasing day by day in the state and the country and country is using foreign exchange in importing the pigeon pea from other countries. Pigeon pea is primarily grown in Chhattisgarh in kharif, however a few progressive farmers are growing rabi pigeon pea.</p> <p>A light of the above it is proposed to undertake an experiment on levels of irrigation and crop geometry on rabi pigeon pea.</p>
Treatments	:	<p>Strip A: Levels of irrigation</p> <p>I₁: 80% PE</p> <p>I₂: 60% PE</p> <p>I₃: 40 % PE</p> <p>I₄: Furrow irrigation</p> <p>Strip B: Crop geometry</p> <p>S₁: 60 cm x 10 cm</p> <p>S₂: 45 cm x 10 cm</p> <p>S₃: 30 cm x 10 cm</p>
Year of commencement	:	2016-17 (conducted 2016-17, 2017-18 and 2018-19)
Design	:	Strip plot
Replication	:	3
Location	:	Agricultural farm, Sarkanda, Bilaspur
Variety	:	Rajeev Lochan
Observations	:	<ol style="list-style-type: none"> 1. Vegetative parameters like plant height, girth, primary and secondary branches /plant etc 2. Yield attributing character like no of pods/plant, pod length. seeds/pod, test weight etc and grain and straw yield (q/ha) 3. Evaporation, water expenses and water use efficiency.

Experiment No.	: 2.3
Title	: Effect of level of irrigation and fertigation on yield of drumstick in Chhattisgarh region.(On Going)
Objectives	: 1. To find out the effects of levels of irrigation and fertigation on drumstick. 2. To study the water and nutrient interaction under drip system. 3. To work out the economics.
Justification:	: Drumstick is a more remunerative crop for Chhattisgarh region as its prizes remain always higher than other vegetables. Due to its medicinal value, its demand is always more than supply. To promote the crops and enhance yield among the cultivators, present study is proposed.
Treatments	Strip A: Levels of irrigation I ₁ : 80% PE I ₂ : 60 % PE I ₃ : 40 % PE I ₄ : Control (Farmers practice- ring method) Strip B: Fertigation levels F ₁ : 50:50:50 kg NPK at planting + 50:50:50 kg NPK through soil application every six month F ₂ : 50:50:50 kg NPK at planting + 37.5:37.5:37.5 kg NPK through drip during six month interval F ₃ : 50:50:50 kg NPK at planting + 25:25:25 kg NPK through drip during six month interval
Year of commencement	: 2018-19
Design	: Strip plot
Replication	: 3
Specing	: 2.5 m X 2.5 m
Variety	: PKM1
Location	: Agricultural farm, Sarkanda, Bilaspur
Observations	: 1. Effect of irrigation level, fertilizer dose and their interaction on Vegetative growth of Moringa like Plant height, girth etc. 2. Yield attributing characters like no of pods/plant, weight/pod, dia/pod etc and yield e.g. yield/plant and yield of pod/ha 3. Evaporation, water expenses and water use efficiency

THEME 4: BASIC STUDIES ON SOIL-WATER-PLANT-ENVIRONMENT RELATIONSHIP UNDER CHANGING SCENARIOS OF IRRIGATION.

Experiment No.	: 4.1
Title	: To study the effect of change of micro-environment on wheat crop by sprinkler irrigation.
Objectives	: <ol style="list-style-type: none"> 1. To study the change of micro-environment element (RH, Temp, etc.) 2. To study the effect of level of irrigation in change of micro-environment. 3. To study the impact of seed rate on wheat yield under varying micro-environment. 4. To study the effect of different micro-environment on growth and yield of wheat.
Justification	: The yield of wheat is very less in Chhattisgarh plain agro-climatic zone in comparison to national level. The main reason behind low level of yield is steep rise in temperature after 1 st week of February, which means that only on an average initial 60 days are favourable for growth of wheat. By providing frequent irrigation through sprinkler after 60 days of growing wheat crop may help to enhance the yield of wheat, due to change of micro-environment. In such climate the seed rate plays major role in influencing wheat yield. Hence it is proposed to study the different levels of irrigation and seed rate under changing micro environment.
Treatments	(First three irrigation with 30 mm CPE are common by sprinklar) Strip A: Levels of irrigations (4) I ₁ :Sprinkler after 30 mm CPE I ₂ :Sprinkler after 24 mm CPE I ₃ :Sprinkler after 18 mm CPE I ₄ :Sprinkler after 12 mm CPE Strip B:Foliar spray of bio regulator (3) S ₁ : KCL -0.2% S ₂ : CaCl ₂ -0.1% S ₃ : Tricontinol
Year of commencement	: 2015-16 (conducted 2015-16, 2016-17 and 2018-19)
Design	: Strip plot
Replication	: 3
Location	: Agricultural farm, Sarkanda, Bilaspur
Variety	: HD 2932
Spacing	: 20 cm x10 cm
Fertiliser dose	: 100:60:40 kg NPK/ha

PUBLICATIONS

Year wise (2012-2018)

NATIONAL AND INTERNATIONAL JOURNAL

Tiwari, R.K.S., Das, K., **Pandey, D.**, Tiwari, R.B., and Dubey, J. (2012). Rhizome yield of sweet flage (*acorus calamus L.*) as influenced by planting season, harvesting time and spacing. *Intenational Journal of Agronomy*.

Sahu, A.K., and Mal B.C. (2013). Hydraulic behavior of multiple leaky aquifers: Finite difference algorithms for simulating steady state flow with bottom aquifer partially penetrated. *CSVTU Research Journal*, Bhilai, Vol. 6: 1-8p.

Tiwari, R. B., Pandey, T.D., **Sharma, Geet** and Chaure. N.K., (2013). Effect of weed control measures on yield, weed control, economics and energetic of rice (*Oryza-sativa*)- wheat (*Triticum aestivum*) cropping system. *Indian Journal of Agronomy*, Vol (58) 4: 465-468.

Agrawal, A.P., Pandey, Dinesh and **Pandey, Devesh** (2014). Variation parameters for heat tolerance index of wheat. *Journal of Wheat Research*, Vol.6, No.1, 37-40pp.

Kumar, A., **Keshry, P.K.**, Goswami, R.G., and Panda, A. (2014). The role of silicon in suppressing rice disease. *Asian Journal of Multidisciplinary Studies*, Vol.2, 172-176pp.

Ravishankar, **Pandey Devesh**, Kumar Jhalesh, Jangre Nilima, and Sahu Harishankar (2018). Simulation of the model for proper rabi crops planning: A case study on Nawagarh Distributary of Janjgir Branch Canal, District-Janjgir-Champa (Chhattisgarh, India). *Trends in Biosciences*, 11(6), 887-893 pp.

Ravishankar, **Pandey Devesh**, Pali A. K., and **Sahu A. K.** (2018). Assessment of demand-supply gap of an irrigated command: A case study on summer rice (*Oriza Sativa L.*). *Trends in Biosciences*, 11(6), 899-904 pp.

Ravishankar, **Pandey Devesh**, Sinha Jitendra, Sahu Gangasharan, and Singh K.K. (2018). Calibration and validation of the canal simulation model: A case study on Nawagarh Distributary of Janjgir Branch Canal, District-Janjgir-Champa (Chhattisgarh, India). *Journal of Farmacognosy and Phytochemistry*, 7(2), 06-13 pp.

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ABSTRACT OF SEMINAR/SYMPOSIUM/WORKSHOP

Agrawal, H.P., **Sharma Geet**, Patel, J.R., Chaure N.K. and Gupta, C. R. (2012). Technology for enhancing wheat yield through rice establishment method and wheat sowing techniques. Paper presented in National Conference on “Demonstrated Options for Improved Lively hood in Disadvantaged Areas of India” held on 20-21 Jan. 2012 organized by NAIP & Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G).

Pandey, Devesh, Chaure, N.K. and Gupta, C.R. (2012). Optimal Cropping Pattern for Hasdeo-Bango Major Irrigation Command of Chhattisgarh using Non-Linear Optimization. Paper presented in National Conference on “Demonstrated options for improved livelihood in disadvantaged area of India” held at IKKV, Raipur from January 20-21, 2012, 205pp.

Sahu, A.K. (2012). Assessment and monitoring of water requirement of crop in command areas. Paper presented in National seminar on “Modernization and monitoring of irrigation command” held at JNKVV, Jabalpur MP from Nov.21-22, 2012, 69-73pp.

Sahu, A.K., Verma, V.K., Swarnkar, A.K., Keshry, P. K., Pandey, D., Gupta, C.R., and Nivedita (2012). Remunerative Summer Vegetable Crops of Bilaspur. Paper presented in National Conference on “Demonstrated options for improved livelihood in disadvantaged area of India” held at IKKV, Raipur from January 20-21, 2012, 332pp.

Sahu, A.K., Verma, V. K., Swarnkar, A. K., Pandey, D., Keshary, P. K. and Nivedita (2012). Comparative Study of Rice Based Cropping Sequence including Sustainable Management of Natural Resources for Livelihood Improvement. Paper presented in National Conference on “Demonstrated options for improved livelihood in disadvantaged area of India” held at IKKV, Raipur from January 20-21, 2012, 332pp.

Sharma Geet, Agrawal H.P, Verma S.K, Williams A.J, & Gupta C.R. (2012). Technology to enhance the Yield of hybrid Rice through age of Seedlings and weed management practice. Paper presented in National

Conference on “Demonstrated Options for Improved Lively hood in Disadvantaged Areas of India ” held on 20-21 Jan. 2012 organized by NAIP & Indira Gandhi Krishi Vishwavidyalaya, Raipur(C.G).

- Swarnkar, A.K., Verma, V.K., Keshary, P.K., Pandey, Devesh and Sahu, A.K.**(2012). Response of Irrigations on Different Physiological Growth Stages of Wheat in Sub- Humid Climate. Paper presented in National Conference on “Demonstrated options for improved livelihood in disadvantaged area of India” held at IKKV, Raipur from January 20-21, 2012, 204pp.
- Verma,S.K., **Sharma Geet.**, Williams, Chaure N.K, & Gupta C.R. (2012).Scope and apiculture in Chhattisgarh for sustainable agricultural development. Paper presented in National symposium on” Plant Biology and its Role in Sustainable Food and Energy Production” held on 17-18 March. 2012 organized by Department of Botany GGU (Central University), Bilaspur.
- Verma, S.K., **Sharma Geet** and Gupta C.R. (2012).Conservation of Natural Resources for Lively hood Agriculture. Paper presented in National Conference on” Demonstrated Options for Improved Lively hood in Disadvantaged Areas of India, held on20-21 Jan. 2012 organized by NAIP & Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G).
- Verma, S.K., **Sharma Geet**, Awasthi A.K, & Gupta C.R. (2012).Scope of Biopesticide for Sustainable Lively hood. Paper presented in National Conference on” Demonstrated Options for Improved Live hood in Disadvantaged Areas of India ” held on 20-21 Jan. 2012 organized by NAIP & Indira Gandhi Krishi Vishwavidyalaya, Raipur(C.G).
- Verma, V.K., Swarnkar, A.K., Keshary, P.K., Pandey, Devesh and Sahu, A.K** (2012). Remunerative Cropping Sequence for Disadvantaged Areas of Hasdeo-Bango Major Irrigation Project of Chhattisgarh State. Paper presented in National Conference on “Demonstrated options for improved livelihood in disadvantaged area of India” held at IKKV, Raipur from January 20-21, 2012, 202pp.
- Williams A.J, Verma S.K, **Sharma Geet**, & Gupta C.R. (2012).Bamboo Based Agro Forestry for Income and Employment Generation in Chhattisgarh plain region of central India. Paper presented in National Conference on “Demonstrated Options for Improved Live hood in Disadvantaged Areas of India ” held on 20-

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TECHNICAL BULLETINS

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