निदेशालय अनुसंधान सेवाएँ
राजमाता विजयाराजे सिंधिया कृषि विश्वविद्यालय
मेला ग्राउंड के सामने, रेस कोर्स रोड़, ग्वालियर (म.प्र.) 474002

पदवार जानकारी (14.03.2016 के अनुसार)

क्रं.	स्वीकृत पद	वेतनमान (पुनरिक्षित पूर्व)	पदों की संख्या	भरे पदों की संख्या	रिक्त पदों की संख्या	कार्यरत्त अधिकारी/ कर्मचारी
1.	निदेशक अनुसंधान सेवाएं	16400–450–20900 – 500 – 22400	01	01	00	डॉ. एच. एस. यादव
2.	निज सचिव	5500–175–9000	01	01	00	श्री रीतेश जैन
3.	सहनिदेशक अनुसंधान (अनुसंधान)	16400–450–20900 – 500 – 22400	01	01	00	डॉ. एस.एस. तोमर
4.	सहनिदेशक अनुसंधान (बीज उत्पादन एवं प्रक्षेत्र विकास)	16400–450–20900 – 500 – 22400	01	00	01	–
5.	उपसंचालक अनुसंधान (कृषि)	12000–420–18300	01	00	01	
6.	उपसंचालक अनुसंधान (कृषि अभियांत्रिकी)	12000–420–18300	01	01	00	डॉ. रवि गुप्ता
7.	तकनीकी अधिकारी	8000–275–13500	01	01	00	डॉ. एन.एस. भदौरिया
8.	सहायक लेखा नियंत्रक	8000–275–13500	01	00	01	–
9.	अनुभाग अधिकारी	6500–275–13500	01	00	01	–
10.	कनिष्ठ शीघ्रलेखक	4500–125–7000	02	00	02	–
11.	कम्प्यूटर ऑपरेटर	4000–100–6000	01	00	01	–
12.	सहायक श्रेणी –3 सह स्टेनोटायपिस्ट	3050–75–3950 –80–4590	02	00	02	–
13.	भृत्य	2550–55–2660 –60–3200	03	00	03	–
14.	वाहन चालक	3050–4590	02	00	02	–
	योग		**19**	**5**	**14**	

Research Highlights

DIRECTORATE OF RESEARCH SERVICES

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior-474 002

A. INTRODUCTION

1. About the Directorate

The Directorate of Research services is a nodal office to coordinate location specific, strategic and anticipatory research focused on increasing the productivity, profitability and sustainability of agricultural and allied sectors under the area jurisdiction of the university. The directorate is responsible for administration, planning, budgeting, coordination, evaluation, monitoring and publication of research outputs of need based production oriented agricultural research with maintenance breeding of crop varieties, production of breeder seed and quality planting materials.

The research program of the Directorate envisages developing improved varieties and technologies through applied research as well as promoting research on basic and strategic areas to meet the national and international challenges. The major research disciplines include agriculture, horticulture, veterinary sciences and animal husbandry, post-harvest management, and basic sciences. Besides this, thrust on organic farming, floriculture, medicinal and aromatic plants, biotechnology, bio-control, nano technology, information technology etc. is emphasized to promote farming as entrepreneurship.

2. Mandates

- Coordination of fundamental and applied research.
- Administration, planning, budgeting, monitoring, evaluation of research projects and programmes running at different centers.
- Publication of research reports, highlights, research papers and research bulletins.
- Maintenance breeding of notified crop varieties and production of breeder seed, hybrid seed and planting materials.
- Resource generation through consultancy processing cell.
- Strengthening of national and international linkages to improve the research quality and quantity.
- Facilitating HRDs through national and international exposures.

3. Functioning

- To exercise overall control of the planning and prosecution of research conducted by the Vishwa Vidyalaya, excepting research done by students to meet degree requirement and by teachers of the to improve teaching ability.
- To prepare Research Service programmes and annual budget estimates as may be required by the Vishwa Vidyalaya;

- To assist the Dean of Faculty concerned in the supervision over the Members of the College of staff engaged on approved research programmes under the general purview of the research service;
- To require and supervise the compilation of research result, and the proper Publication of the research findings;
- To approve for publication, in consultation with Deans of Faculties concerned, research manuscripts in such general form and such number as may be determined;
- To assign numbers to all publications and to maintain official record of All publications;
- To be responsible to the Vice-Chancellor in exercise of the powers and Discharge of the duties under the Act;
- To undertake teaching work;
- To perform such other duties as may be conferred or imposed on him by Statutes, Regulations or by the Vice-Chancellor with the prior approval of the Board.

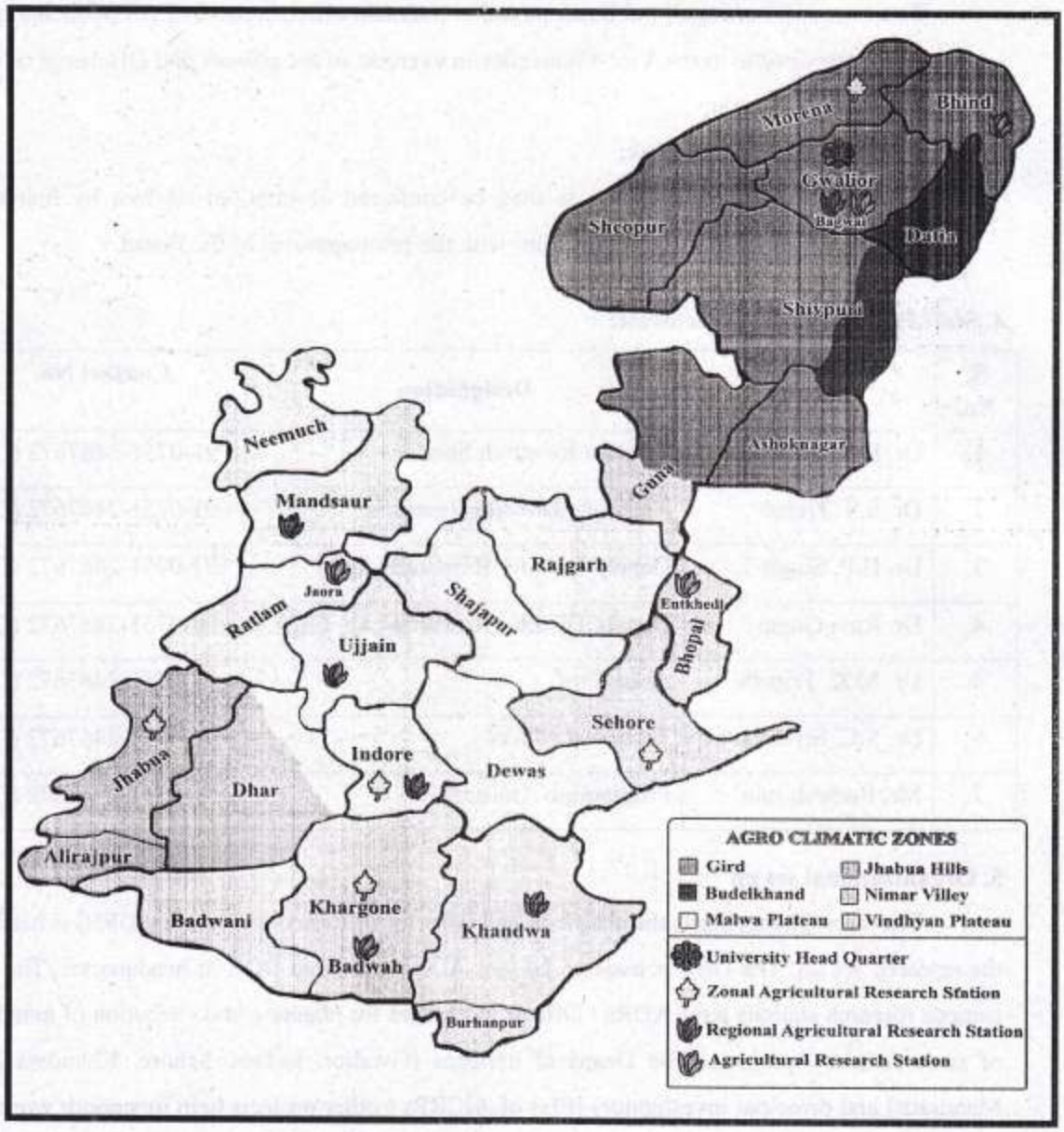
4. Staff Position at the Directorate:

S. No.	Name of the Faculty	Designation	Contact No.
1.	Dr. H.S. Yadava	Director Research Services	+91-0751-2467672 (O)
2.	Dr. S.S. Tomar	Associate Director Research	+91-0751-2467672 (O)
3.	Dr. H.P. Singh	Deputy Director Research (Ag.)	+91-0751-2467672 (O)
4.	Dr. Ravi Gupta	Deputy Director Research (Ag. Engg.)	+91-0751-2467672 (O)
5.	Dr. M.K. Tripathi	Asstt. Prof.	+91-0751-2467672 (O)
6.	Dr. S.C. Srivastava	Technical officer	+91-0751-2467672 (O)
7.	Mr. Reetesh Jain	Programme Assistant	+91-0751-2467672 (O)

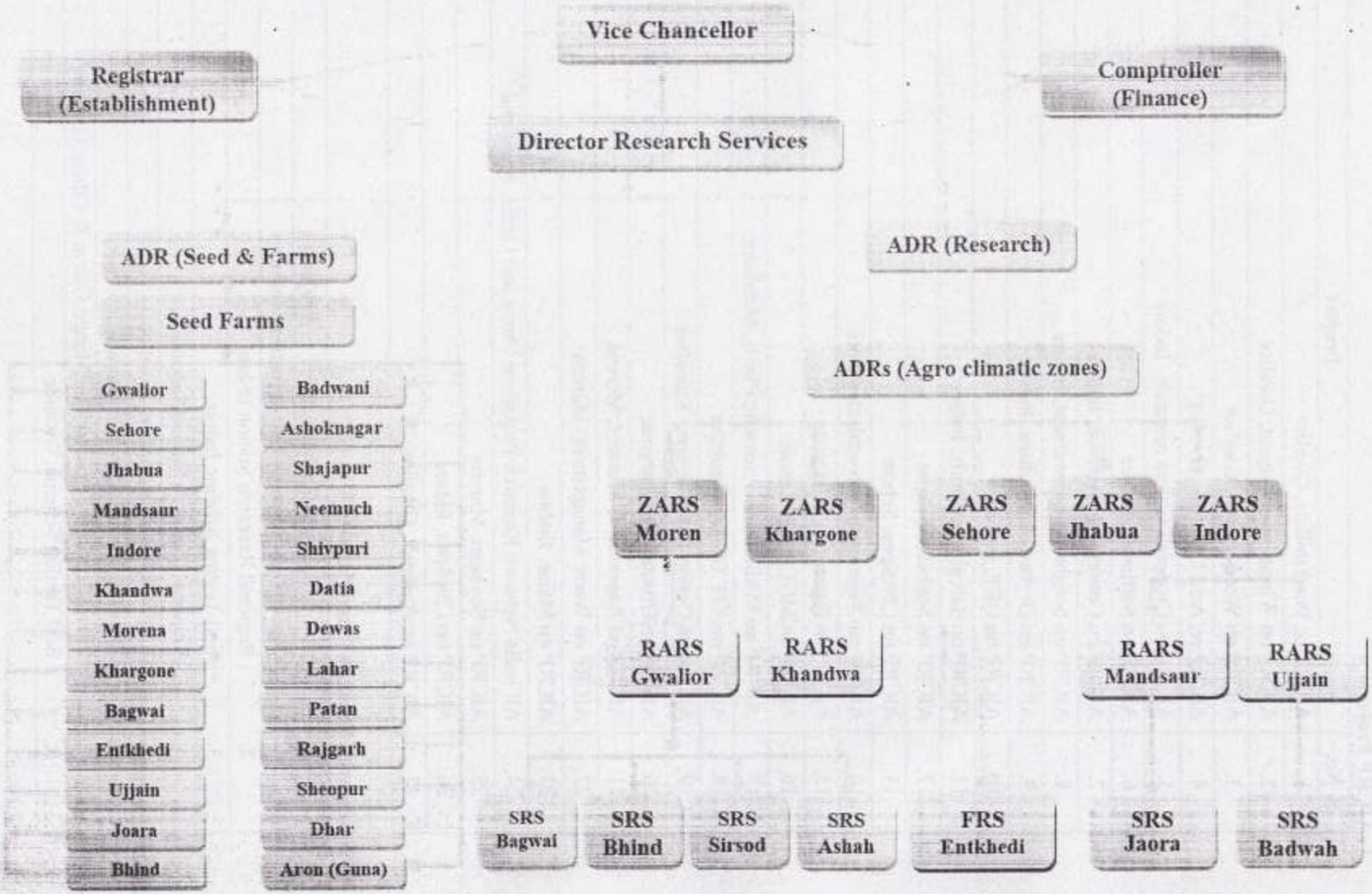
5. Organizational set up

The Vice-Chancellor is the chairman and Director of Research Services (DRS) is head of the research set up. The DRS is assisted by two ADRs and three DDR at headquarter. The off campus research stations have ADRs / Officer in charges for planning and execution of mandate of such centers / projects. The Deans of colleges (Gwalior, Indore, Sehore, Khandwa and Mandsaur) and principal investigators (PIs) of AICRPs / other projects help in smooth working of research programmes. The comptroller in association with accounts officials/ staff takes care of financial management of the directorate. The organizational set-up is presented in flow chart given on next page.

The research network of the university spreads over 6 agro-climatic zones and cover 25 revenue districts of the State. At present, it has 5 colleges (four agriculture and one horticulture), 5 Zonal Agricultural Research stations (ZARS), 4 Regional Agricultural Research Stations (RARS), 5 Special Research Stations (SRS), 19 Krishi Vigyan Kendras (KVKs), 23 All India Coordinated Research Projects (AICRPs), 31 Ad-hoc research projects, and 32 state funded plan, non-plan and tribal sub-projects. In addition, various P.G. departments of constituent colleges also conduct research for the postgraduate and doctoral degree programmes.



ORGANIZATIONAL SETUP



6. Projects

1. AICRP Projects

S. No.	Project
1.	AICRP on Pearl millets, Gwalior
2.	AICRP on Wheat Improvement, Gwalior
3.	AICRP on Weed control, Gwalior
4.	AICRP on Arid Legumes, Gwalior
5.	AICRP on Cropping system research , Indore
6.	AICRP on Safflower, Indore
7.	AICRP on Cotton Improvement, Indore
8.	AICRP on Sorghum Improvement, Indore
9.	AICRP on Dryland Agriculture, Indore
10.	AICRP on ORP, Indore
11.	AICRP on Salt affected soils, Indore
12.	AICRP on Soybean, Sehore
13.	AICRP on Chickpea, Sehore
14.	AICRP on Pigeonpea (sub centre), sehore
15.	AICRP on Pigeonpea, Khargone
16.	AICRP on MULLaRP, Sehore
17.	AICRP on Medicinal & Aromatic Plants, Mandsaur
18.	AICRP on STF Grape, Mandsaur
19.	AICRP on Cotton Improvement, Khandwa
20.	AICRP on Groundnut, Khargone
21.	AICRP on Rapessed & Mustard, Morena
22.	AICRP on Water Management, Morena
23.	AICRP on Maize, Jhabua
24.	All India Network Research Project on Onion and Garlic, Mandsaur
25.	AICRP on Soybean, Morena
26.	AICRP on Chickpea, Indore
27.	AICRP on Agromet, Gwalior

2. Research Schemes (Non Plan)

S. No.	Project
1.	Agriculture Research Lab & Institute Indore
2.	Regional Research Station Indore
3.	Soil Testing Scheme Indore
4.	Regional Research Station Sehore
5.	Regional Research Station, Gwalior
6.	Regional Research Station, Bagwai
7.	Intensification of Research on Mango Guava & Citrus, Gwalior
8.	Soil Testing Scheme, Gwalior

S. No.	Project
9.	Intensification of Research on Mango, Guava & Citrus, Enthkedi
10.	Horticulture Research Scheme (Seed Production), Joara
11.	Sugarcane Research Scheme, Indore
12.	Potato aphid research, Sehore

3. Seed Farms (Non Plan)

S. No.	Project
1.	Agriculture Research Farm, Mandsaur
2.	Agriculture Research Farm, Khargone
3.	Agriculture Research Farm, Khandwa
4.	Agriculture Research Farm, Bagwai
5.	Agriculture Research Farm, Gwalior
6.	Agriculture Research Farm, Ujjain
7.	Agriculture Research Farm, Joara
8.	Agriculture Research Farm, Indore
9	Agriculture Research Farm, Sehore
10.	Live Stock Farm, Gwalior
11.	Live Stock Farm, Sehore
12.	Live Stock Farm, Indore

4. Research Schemes (Plan)

S. No.	Project
1.	Fodder Research Scheme Gwalior
2.	Strengthening of MP Agriculture Research Institute Khargone
3.	Productivity Improvement of crops under Rainfed Area Indore
4.	National Agricultural Research Project , Sehore
5.	Director of Extension Education Sehore
6.	National Agricultural Research Project ,Ujjain
7.	College of Horticulture, Mandsaur

5. Research Scheme (Tribal Sub Plan)

S. No.	Project
1.	Improvement of Millets, Gwalior
2.	Propagation of Aonla & Ber for Tribal, Khandwa
3.	Intensive Extension Research Project, Gwalior
4.	Intensive Extension Research Project, Sehore
5.	Intensive Extension Research Project, Khandwa
6.	Intensive Extension Research Project, Indore
7.	Intensive Extension Research Project, Khargone

S. No.	Project
8.	National Agricultural Research Project , Morena
9.	National Agricultural Research Project Khargone
10.	National Agricultural Research Project Khandwa
11.	National Agricultural Research Project Jhabua
12.	Seed Production Programme at KVK Farms [Shajapur, Dhar, Dewas, Bhind, Rajgarh, Aron (Guna), Badwani, Neemuch, Shivpuri, Ashok Nagar, Sheopur]
13.	College of Agriculture Khandwa

6. India Meteorological Department (GOI)

S. No.	Project
1.	Agromet Advisory Services Morena
2.	Agromet Advisory Services Khargone
3.	Agromet Advisory Services Jhabua
4.	Agromet Advisory Services Sehore
5.	Agromet Advisory Services Indore

All India Coordinated Research Project's

Discipline	Project title	No. of centers
Crop Improvement	Wheat, Sorghum, Maize, Pearl Millet, Gram, Tuar, MULLaRP, Arid legume, Soybean, Rapeseed & Mustard, Safflower, Groundnut and Cotton	18
NRM	Dryland agriculture, Weed science, Water management, SAS, CSRP, ORP and Agro meteorology	07
Horticulture	Grape and MAP	02
	Total	**27**

Table : Varieties Notified

Crop	Variety (Noti. No.& Date)	Maturity days	Avg. yield (kg/ha)	Special Characteristics	Adaptability zone
Chickpea	JG 6 (SO 449 (E) 11.02.2009)	113	2000-2100	Resistance to *Fusarium* wilt, MR to DRR and Tolerant to infestation of pod borer.	M.P., Chhattisgarh, Maharashtra, Gujarat, U. P. and Rajasthan
	RVKG 101 (SO 456(E) 16.03.12)	109	1500 - 1800	Whitish bold seeded variety (40.6 g/100 seed)	Madhya Pradesh

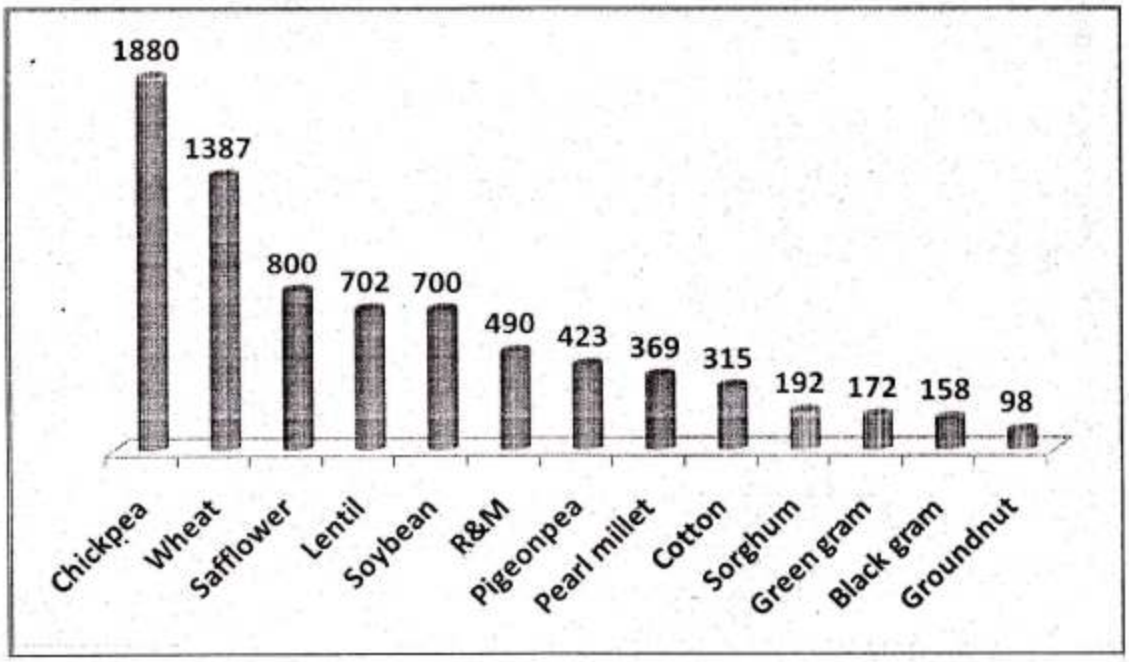
	RVG 201 (SO 456(E) 16.03.12)	101	2000-2500	Resistance to *Fusarium* wilt, moderately resistant to dry root rot and tolerant to *Helicoverpa armigera*	Madhya Pradesh
	RVG 202 (SO 268 (E) 28.01.2015)	100-105	1800 - 2000	Large seeded Desi chickpea variety and resistance to Fusarium wilt, MR to dry root rot and color rot	M.P., Chhattisgarh, Maharashtra, Gujarat, U. P. and Rajasthan
	RVG 203 (SO 176(E) 01.02.13)	100	1900-2000	Moderately resistant against *Fusarium* wilt and dry root rot	M.P.,Maharashtra, Gujarat, U.P. and Rajasthan
Pigeonpea	TJT 501 SO 2187 (E) 27.08.2009	145-155	1800-2000	Resistant to Fusarium wilt and tolerant to Phytophthora blight	M.P.,Maharashtra, Gujarat, U.P. and Rajasthan
Pigeonpea (Hybrid)	RVICPH 2671 SO (1146(E) 24.04.14)	164-184	2276 - 2852	Resistant to wilt and SMV and possess high *dal* protein	Madhya Pradesh
Wheat	MP 1203 (SO 454 (E) 12.02.2009)	110	4000-4500	Early maturing, High yielding, Resistance against brown and black rust	Madhya Pradesh
	RVW 4106 (SO 456(E) 16.03.12)	105-110	5035	Resistant to black and brown rusts	Madhya Pradesh
Groundnut	JGN 23 (SO 449 (E) 11.02.2009)	140	1600-1800	Tolerant to Tikka disease of groundnut	Madhya Pradesh
Rapeseed & Mustard	RVM 2 (SO 2815(E) 19.09.13)	125-130	2000-2200	oil content 39.2 %, moderately resistant to white rust	J&K, Punjab, Haryana, Delhi and Rajasthan
Soybean	RVS 2001-04 (SO 1146(E) 24.04.14)	92-95	2495	2-3 seeds/pod, oval shaped yellows color seed with brown hilum	Madhya Pradesh
Lentil	RVL 31 (SO 1146(E) 24.04.14)	107	1200 - 1300	Bold seeds (2.4g/100 seeds). Being early maturity, it escapes the drought	Madhya Pradesh

Table 2: New varieties developed and released

Crop	Variety/ Status	Maturity days	Average Yield (kg/ha)	Special Characteristics	Adaptability zone
Chickpea	RVSJKG 102 SVRC, 10.12.10	104	1200 - 1500	First whitish extra bold Kabuli variety with average seed size of 58.0 g/100 seed.	Madhya Pradesh
Pigeonpea	RVA 28 SVRC, 10.12.10	147-157	1734	Early maturity, Resistant to wilt.	Madhya Pradesh

Safflower	RVS 113 SVRC 10.12.10	125-130	1600-1800	Spineless with early maturity, Oil content 29-30%, Resistant to lodging and shattering	Madhya Pradesh
Safed Musali	RVSM 414 SVRC, 10.12.10	85-100	1656 - 2370	Root powder contains 6.2 % steroidal saponine and 1.21 % sapogenine, Resistant to Fusarium moniliforme	Madhya Pradesh
Ashwagandha	RVA 100 SVRC, 10.12.10	160	600 - 700 (Dry root)	Early maturity, Resistant to Alternaria blight.	Madhya Pradesh
Kalmegh	RVK 1 SVRC, 10.12.10	150-180	5500 - 6000	Suitable for three cutting	Madhya Pradesh
Sarpgandha	RVSP 1 SVRC, 10.12.10	150-180	2700-2800	-	Madhya Pradesh
Sorghum hybrid	RVICSH 28 SVRC , 27.05.15	110	65-68 t/ha	High sugar content (17 %) Resistance to lodging and ability to tolerate the drought	Madhya Pradesh
Cotton	RVK 67 SVRC , 27.05.15	145-160	16-20	Tolerance against jassid and bollworms	Madhya Pradesh
Mustard	RVM 1 SVRC , 30.06.15	98-121	14-20 q/ha	Moderately resistant to Alternaria, powdery mildew, downy mildew and *Sclerotinia* stem rot .	Madhya Pradesh
Sorghum	RVJ 1862 SVRC , 30.06.15	111	35-40 q/ha(grain) and Fodder yield is 118 q/ha	Tolerance to leaf spot and moderately tolerant to grain mold and Moderately tolerant to shoot fly and stem borer.	Madhya Pradesh

Germplasm maintained

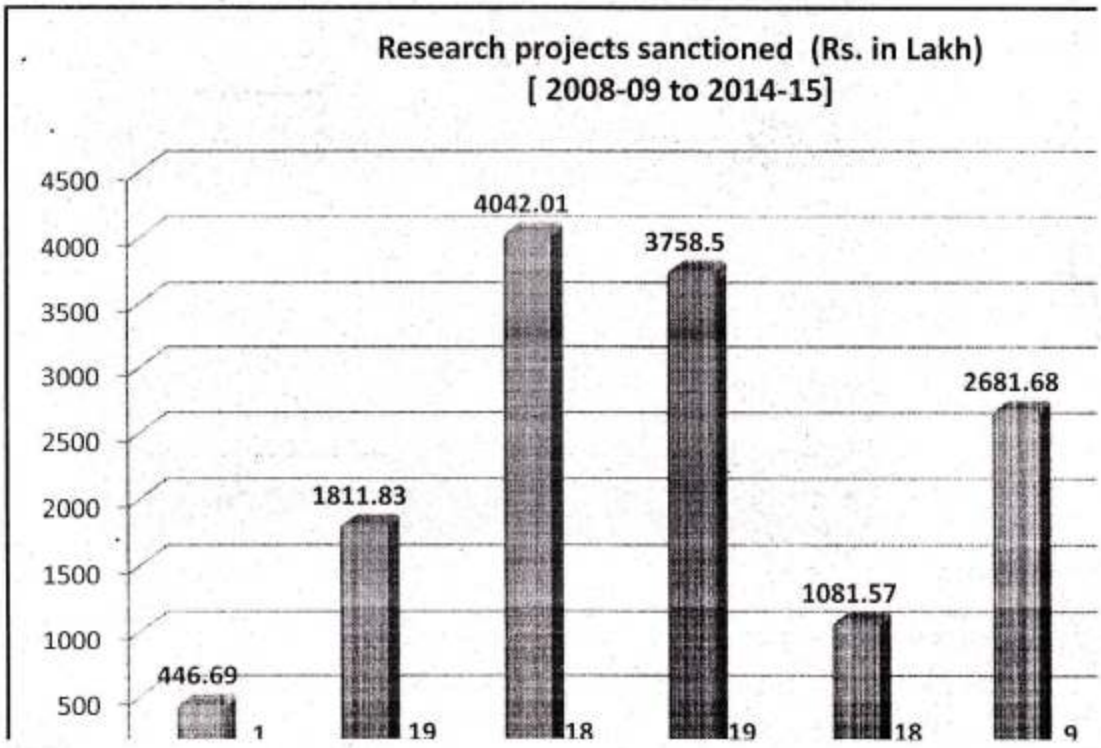


Germplasm registered in PPV&FR, New Delhi

Crop	Varieties	Registration number
Chickpea	JG 11	102/2012
	JG 16	126/2013
	JAKI 9218	337/2014
Pigeonpea	JKM 189	78/2011
Wheat	M.P. 4010	77/2009
Sorghum	JJ 1041	17/2012
	JJ 1022	754/2014
	Indore 12	463/2014
	CSH 18	34/2009
Pearl millet	JBV 2	63/2009
Rapeseed & Mustard	JM 2	353/2014
	JM 3	352/2014
Cotton	J. Tapti	34/2011
	JK 5	93/2013

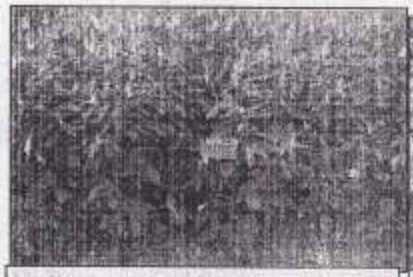
Germplasm registered in NBPGR, New Delhi

Crop	Varieties	National Identity
Pigonpea	TJT 501	IC 566652
	Parents of CMS based hybrid RVICPH 2671	IC587378
	RVA 28	IC587379
Chickpea	JG 6	IC 560679
	RVKG 101	IC587380
	RVSJKG 102	IC587381
	RVG 201	IC587382
	RVG 202	IC590133
	RVG 203	IC590134
Soybean	RVS 2001-04	IC587383
Wheat	MP 1203	IC 566544
	RVW 4106	IC587060
Safflower	RVS 113	IC587061
Lentil	RVL 31	IC587062
Safed musli	RVSM 414	IC587063
Ashwagandha	RVA 100	IC587064
Kalmegh	RVK 1	IC587065
Sarpgandha	RVSP 1	IC587066
Rapeseed and mustard	JMWR 941-1-2 (JM 2)	IC 471177
	JMM 915	IC 471178
	JMM 991	IC 569215
Groundnut	JGN 23	IC 560683



3. Technologies Developed

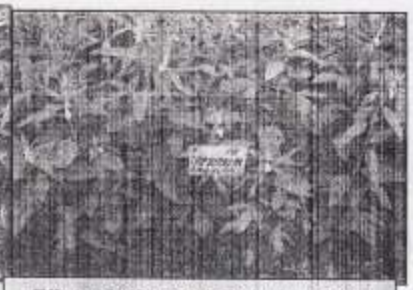
1. **Response of nutrient in sorghum production:** Among the sorghum genotypes, CSH 16 hybrid gave the maximum yield and return followed by CSV 15 and CSH 23. All the genotypes responded up to 150 % RDF (120: 60: 60 kg N: P_2O_5:K_2O/ha). The highest fertilizer use efficiency was recorded in case of hybrid CSH 16 followed by sorghum variety CSV 15.
2. **Response of tillage in sorghum:** Among the tillage practices, reduced tillage and conventional tillage were statistically at par with each other and gave significantly higher yield and return as compared to minimum tillage. The 75% RDF (60:30:30 kg N: P_2O_5: K_2O/ha) along with application of 5 t FYM/ha and 100% RDF (80:40:40 kg N: P_2O_5: K_2O/ha) recorded statistically similar yield and return which were significantly higher over other levels of nutrient management.
3. **Integrated weed management in sesamum:** Application of quizalofop ethyl 50 g/ha as post emergence or trifluralin 0.75 kg/ha as pre plant or pendimethalin 0.75 kg/ha alone or in combination with one hand weeding at 30 DAS may be used for effective control of weeds, higher yield and net return in sesame.



Effect of trifluralin 0.75 kg/ha + 1 hand weeding in Sesamum crop

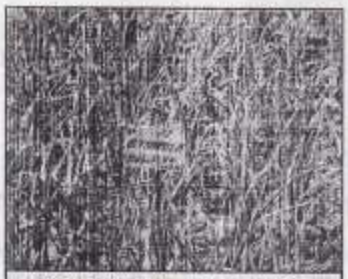
Effect of quizalofop ethyl 50 g/ha POE + 1 hand weeding in Sesamum crop

Effect of Pendimethalin 0.75 kg/ha + 1 hand weeding inSesamum crop



Effect of trifluralin 0.75 kg/ha PPI in Sesamum crop

4. **Integrated weed management in sorghum:** Application of atrazine @ 0.5 kg a.i. with one hand weeding at 25 DAS was found effective weed management practices for sorghum. CSH 16 and SPV 1616 showed the better weed suppressing ability as compared to other sorghum genotypes.
5. **Integrated weed management in onion:** Three hand weeding at 30, 45 and 60 DAT (weed free) or pre emergence application of oxadiargyl at 90 g/ha with one hand weeding at 45 days after transplanting (DAT) or oxyfluorfen 250 g/ha + one hand weeding at 45 DAT result in higher bulb yield and net returns.



Effect of Oxydiargyl 90 g/ha PE + 1 hand weeding in Onion crop

Unweeded plot of Onion crop

Effect of oxyfluorfen 250 g/ha (PE) + 1 hand weeding in Onion crop

6. **Testing of hybrids of opium poppy:** Hybrid MOH 2 recorded significantly higher latex yield (50.71 kg/ha) followed by MOH 1 (48.28 kg/ha) as compared to check JOP 540 (46.84 kg/ha).

7. **Testing of new herbicides in soybean:** Haloxyfop - ethyl 10 EC @ 75 g/ ha was found effective against grasses and produced higher grain yield in soybean in comparison to other recommended herbicides for grassy weeds.
8. **Grafting for root stock in grapes:** Fifty one varieties of grapes covering seedless, seeded table, table purpose, wine purpose, white wine purpose and juice purpose were grafted on 3 root stocks i.e Dogridge, Salt Creek and 110-R. Among them Dogridge root stock were found better than the other root stocks.
9. **New molecule for insect control:** Lembda cyhalothrin 5 EC @ 300 ml/ ha was found effective against girdle beetle and semilooper and gave 20% more yield and 15% ICBR in soybean.
10. **Identification of donor for *Myrothecium* leaf spot:** AMS 1 and SI 688 were identified as donor for *Myrothecium* leaf spot in soybean.
11. **Seed treatment with bio agent in soybean:** Seed treatment with *Tricoderma viride* and *Pseudomonas fluorescence* @ of 5 g/ kg and 10 g/ kg, respectively increased plant growth by promoting microbes 30 days after sowing as compared to chemical seed treatment.
12. **Disease management in mustard:** For the control of *Alternaria* blight and white rust, the seed treatment with metalaxyl (apron 35 SD) @ 6 g/kg seed is recommended while sowing of carbendazim treated seed @ 1g/kg seed or spraying of carbendazim @ 0.5 g/liter of water at 50 DAS after sowing is recommended for the control of *Sclerotinia* stem rot.
13. **Pearl millet-mustard cropping sequence:** In IPNM for pearl millet-mustard cropping sequence in sandy loam soil, application of 75% RDF through chemical fertilizer + 25% through organic manure was good combination to achieve the highest yield (3063 and 1991 kg/ha) in both the crops.
14. **Sulphur application in garlic:** Application of 40 kg sulphur/ha with 0.7 IW/CPE ratio gave the highest bulb yield (9233 kg/ha, sulphur uptake (38.99 kg/ha), net returns of Rs. 74948/ha and WUE of 219 kg/ha/cm in garlic under alluvial soil.
15. **Optimization of seed rate, row spacing and nutritional schedule on soybean**: Newly released soybean varieties JS 95-60 performed better at 30 cm row spacing and 75 kg/ha seed rate while JS 97-52 performed better at 45 cm row spacing and 65 kg/ha seed rate.
16. **New mutants of soybean:** New mutant of soybean namely, RVSM 1, RVSM 2, RVSM 3, RVSM 4, RVSM 5, RVSM 6, RVSM 7, RVSM 8, RVSM 9 and RVSM 10

have been developed having good plant types, early maturity (80-85 days) and resistance to major diseases from extent variety NRC 37 and Bragg.

17. **Chickpea based cropping system:** Cultivation of soybean in *kharif* followed by wheat (I year) - chickpea (II year) was identified as best cropping system in medium black vertisols. Application of RDF (20:17:20:20 NPKS kg/ ha) recorded significantly higher seed yield (2149 kg/ ha) as compared to vermi compost @ 2 t/ ha + biofertilizer (1867 kg/ ha). Thus, soybean followed by wheat (I year) and chickpea (II year) cropping system with RDF in chickpea is recommended for general cultivation.
18. **FYM application in chickpea:** Application of FYM @ 5 t/ ha gave significantly higher grain yield of chickpea (1640 kg/ ha) in comparison to control (no fertilizer application).This increase was to the tune of 7%. Basal application of 60 kg P_2O_5/ ha and 20 Kg sulphur/ha showed 31 and 17 percent more grain yield over control, respectively.
19. **New pathogen of chickpea:** A new threat to chickpea cultivation was detected in soybean-chickpea cropping system at Sehore, causing severe mortality in early sown crop. The pathogen was identified as *Colletotricum dematium*. Some of the known wilt resistant varieties like JG 315 were susceptible to this pathogen causing 40-50 % losses.
20. **New *Fusarium* wilt resistant genotypes in chickpea:** Chickpea genotypes namely, IPC 2005-79, JG 923974, IC 552241, GJG 0920, IPC 09-160, IPCK 09-85, Phule 0302-7, JG 14 and IPC 2006-84 were identified as resistant to *Fusarium* wilt in sick plots.
21. **Yield assessment of newly bred hybrids in pearl millet:** Fourty eight single cross hybrids of pearl millet were evaluated for seed yield (kg/ha) during *Kharif* 2010. Out of these, four hybrids *viz*. 93222A×DPR-42, 96222A×11719, 863A×DPR-10 and 96222A×GBI-75 were found higher seed yielder than checks GHB 744 and JK 2B.
22. **Screening of disease resistant hybrids varieties in pearl millet:** Among 101 tested genotypes with local susceptible checks and infactor rows of 7042 S, 22 M H lines with saburi were found completely free from the downy mildew during the entire crop season. Maximum incidence of downy mildew was in between 20.02 to 33.80% and 95.7 to 100% in susceptible checks and infactor rows at dough stage of crop, respectively.
23. Under artificial inoculation, none of the tested genotype was found free from the smut but MH 1740, MH 1755 and 1756 showed least incidence of 1%. The

genotypes MH 1754, 1727, 1721, 1762, 1737, 1746, 1733, 1720, 1716, 1717, 1708 and 1703 exhibited less than 5% incidence of smut.

24. Blast incidence in the all tested genotypes was in between 3.0 to 35%. The genotypes MH 1712 showed least blast incidence (3%) followed by MH 1710, MH 1724, MH 1744, MH 1732 and GHB 744 (7.5%).

25. **Performance of pigeonpea hybrids:** Among twelve tested CMS based hybrids of pigeonpea, ICPH 3461 recorded 35.2% higher seed yield in comparison to check variety Asha. ICPH 3494 ranked second followed by ICPH 3491.

26. **Heterosis in medium duration pigeonpea hybrids:** Standard heterosis ranged between -15.5 to 35.2% in eleven new medium duration hybrids (170-180 days). ICPH 3461 showed maximum heterosis followed by ICPH 3494 and ICPH 3491.

27. **Wild sources of resistant for *Phytophthora* blight in pigeonpea:** Four wild species namely *Cajanus albicans*, *Cajanus platycarpus*, *Cajnaus scarabaeoides* and *Rhyncosia bracteata* were evaluated for testing their resistant against *Phytophthora* blight of pigeonpea in sick plot along with susceptible check ICPL 87119. The incidence of Phytophthora blight was ranged between 0.0 to 66.08%. *Cajanus platycarpus* was found immune to the *Phytophthora* blight while, *Rhyncosia bracteata* showed resistance with 7.14% incidence. *Cajanus albicans* and *Cajanus platycarpus* showed moderate degree of resistance against it. Thus, these can be used as wild source of resistant against *Phytophthora* blight in pigeonpea.

28. **Promising genotypes of mustard:** RMWR 8-3 and RMT 8-7 have shown superiority in seed yield over national check in AICRP trials under late sown conditions and timely sown conditions, respectively.

29. **Donors identified in soybean:** New donors identified for different traits are RVS 88-66 for high yield, RVS 93-73 for rapid and high germination, RVS 205 for early maturity, EC 309722 for late maturity, RVS 209 for multiple disease resistance and EC 251457 for multiple disease and pest resistance in soybean.

30. **Newer insecticide for soybean:** Metaflumizone 22% SC @ 600 ml/ha and Flubendamide 48 SC @ 600 ml/ha were found effective against lepidoterous defoliatiors like green and grey semi loopers in soybean.

31. **Soybean genotypes showing high nodulation ability**: Among the sixty genotypes tested for their nodulation ability, genotype JS 2006-54 and JS 97-52 showed high nodulation number (49/plants) and high nodule dry weight (310 mg/plant), respectively.

32. **Identification of heat tolerant lentil genotypes:** Two hundred eighty nine lentil accessions were tested for identification of heat tolerant lines under DAC-ICARDA-ICAR research programme. Accession IG 5080 followed by IG 3327 produced maximum number of total pods and filled pods per plant and recorded the highest yield of 11.75 g/plant. The high yielding genotypes viz., IG 3221, IG 3120 and IG 3196 were also early in maturity (103 days). The ratio of filled pods to total number of pods per plant was in between 0.83 to 0.95 in these heat tolerant genotypes.

33. **Integrated weed and nutrient management in soybean-wheat:** IWM +RDF recorded highest yield in soybean crop while, IPNM gave maximum yield in wheat. Highest wheat equivalent yield was noted in IPNM (Rs 4866 kg/ha). The net monetary return (Rs 36545) and benefit cost ratio (2.21) were observed highest in IWM + RDF in comparison to other tested four modules.

34. **Optimum sowing time in sorghum:**. Sowing on 15th June is recorded 108.3 % higher grain yield in comparison to sowing on 30th June that was also superior to sowing on 15th July.

35. **Integrated weed management in black gram:** Pre-emergence application of pendimethalin 30 EC + imazethapyr 2 EC @ 0.75 kg/ha found effective in reducing the intensity of monocot and dicot weeds and recorded significantly superior seed yield of 1222 kg/ha over control (600 kg/ha) in black gram

36. **Herbicidal weed management in pearl millet–wheat cropping system:** Application of atrazine @ 0.5 kg/ha PE + one hand weeding at 30 DAS recorded lowest weed intensity and dry weight of weeds which was at par to weed free treatment. The weed control efficiency (82.42%) was noted in atrazine @ 0.5 kg/ha PE + one hand weeding at 30 DAS. Maximum net return of Rs. 18645/ha was noted in atrazine @ 0.5 kg/ha PE + FYM 10 t / ha with B: C ratio 2.83 followed by atrazine @ 0.5 kg/ha PE + one hand weeding at 30 days (Rs. 18200 /ha) with 2.53 B: C ratio and atrazine @ 0.5 kg/ha PE (Rs. 17250 /ha) with 1.65 B:C ratio. Two year results of hebicidal influence in wheat showed that application of isoproturan @ 0.75 kg/ha with one hand weeding recorded the weed control efficiency of 88.77%, net return of Rs. 30124 /ha and B:C ratio of 2.80.

37. **Integrated weed management in sesame:** In sesame, application of pre and post emmergence weedicides effectively reduced the population and dry weight of weeds over weedy check. The lowest weed density and weed dry weight was observed in the weed free treatment i.e. two hand weeding at 15 and 30 days after sowing followed by quizalofop ethyl @ 0.05 kg/ha as early post emergence application with

one hand weeding at 30 days after sowing. Application of trifluralin @ 0.75 kg/ha as PPI and pendimethalin @ 0.75 kg/ha as PE with one hand weeding at 30 DAS in both reduces the weed intensity effectively. Maximum net return of Rs. 15079 /ha was noted in weed free situation with B:C ratio of 2.13 followed by quizalofop ethyl 0.05 kg/ha POE (Rs 10273 /ha net return and 2.15 BCR) and quizalofop ethyl 0.05 kg/ha POE + one hand weeding (Rs. 11734/ ha net return and 2.02 BCR).

38. **Resistant to stem fly in soybean:** Soybean genotypes, DSb 16 and MACS 1140 were identified as source of resistance against stem fly, *Melangromyza sojae* while, MACS 1039, MACS 1140, MACS 1281 and NRC 80 were found resistance against major pest complex of soybean.

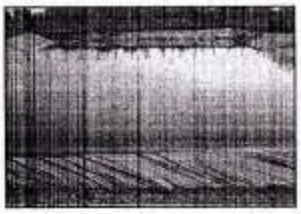
39. **Efficient use of rainwater for enhancing water productivity in micro-watershed:** Rainfall and runoff water was collected in a water harvesting tank of 1200 cubic meter water storage capacity at the dryland research farm, Indore. Cropping system models were evaluated by utilizing the collected water in the tank for irrigating crops by drip system during long dry period in *Kharif* and life saving irrigation in *Rabi* season successfully, like wise sweet corn-tomato, soybean- potato and soybean–chickpea crops were evaluated utilizing harvested rain water to irrigate the *Rabi* crops through drip irrigation system. The cropping sequence of sweet corn–tomato exhibited the highest net return of 1,15676/- per ha and B:C ratio of 2.65 followed by soybean–potato which has recorded net return of Rs.79,394/-per hectare and B:C ratio of 2.36. The lowest net return and B:C ratio (Rs 13915/ha ;1.58:) were observed in soybean–chickpea cropping sequence on account of adverse climatic conditions during *kharif* and disease infestation during *Rabi.*

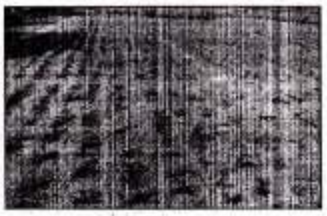
40. **Drip fertigation with marginally saline water in horticultural crops:** Drip fertigation with marginally saline well water is feasible and economically viable for cost intensive cultivation of horticultural crops in Vertisols under sub-tropic semi-arid climate. Drip fertigation with marginally saline water (EC value 0.92 and 1.15 dS/m) showed salt accumulation in irrigated area around drippers as number of irrigation applied progresses. The salt accumulation can be duly taken care of by simply practicing one surface irrigation after a period of 75-90 days or may be by Monsoon rain in natural course.

41. **Survey and characterization of underground irrigation water in Neemuch district of M. P.:** A ground water survey of the Neemuch district was conducted by Salt Affected Soils Project, College of Agriculture, Indore during 2010-11. Four hundred five ground water samples were collected from different villages of the district. Out of these 405 samples, 294 (72.6 %), 98 (24.2 %), 02 (0.5 %), 03 (0.7 %), 02 (0.5 %) and 06 (1.5 %) belongs to category 'A', 'B_1', 'B_2' , 'B_3', 'C_1' and C3' respectively. A ground water quality map was generated by the use of water quality data obtained from the laboratory analysis, ground truth and geographical situation of the sampling sites. The map was prepared with the help of remote sensing and GIS soft ware (ERDAS IMAGINE 8.7) belongs to category.

42. **Characterization and delineation of typical profiles of salt affected soils using remotely sensed data and ground truth of Mandsaur district:** A salt affected soils map was prepared using data of soil analysis, features identified showing salinity/ sodicity problem on digital satellite data of Resourcesat-1 LISS-III through visual interpretation of the digital image using Remote Sensing Software (ERDAS IMAGINE 8.7) and ground truth. Geographical position of the identified points was recorded using RS software and soil samples were also collected from identified points with the help of GPS for ground truthing. During the traversing of the area, soil samples were also collected from locations other than identified one, showing salinity/ alkalinity problem and there GPS points were recorded. On the basis of degree of salinity and alkalinity, the soils were classified and map of the district was generated. According to salinity and alkalinity hazards, the soil was classified in to three different categories of salinity (slight (ECe 4-8 dS/m), moderate (EC_e 8-15 dS/m) and high (EC_e>15 dS/m) and alkalinity (slight (ESP 15-25), moderate (ESP 25-40) and high, (ESP > 40). Most of the salt affected area come under the category of slightly saline and highly alkali (7854 ha) followed by slightly saline and moderately alkali (7006 ha) and slightly saline and slightly alkali (577 ha). The total area of salt affected soils in Mandsaur district is 15437 ha.

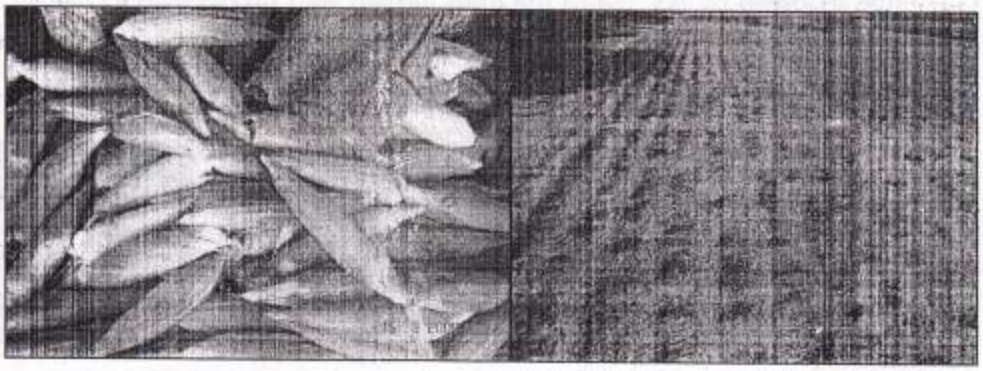
43. **Efficient use of rainwater for high returns:** Study on cultivating crop utilizing stored runoff water during winter season indicate that highest net return of Rs 86358 /ha was obtained through cultivation of potato with productivity of 16420 kg /ha, followed by Rs 35423 /ha from tomato with productivity of 10053 kg/ha and Rs 19782 /ha from chickpea with productivity of 1399 kg/ha. The maximum B: C ratio of 2.92 was also obtained with Potato crop.



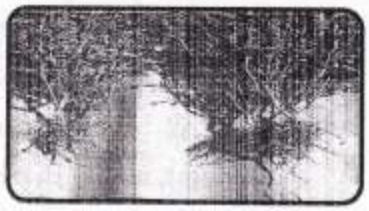


44. **Rainwater harvesting:** About 40-60 % of the rain water lost as runoff during high intensity rain fall. With a view to collect this runoff water in the water harvesting tank at suitable site, a pond (40m x 23m x 4.3m)) was excavated at farmers field with farmers' participation in Nignoti (District –Indore) village adopted under NICRA project . The pond have the capacity to store about 3000 cubic meter water which can be utilized for life saving irrigation to *Kharif* and *Rabi* crops.
45. **Relative efficacy of distillery and sugar industry waste on reclamation and crop production in sodic vertisols:** Six treatments (T_2 -Gypsum @ 75 % GR, T_3 - Raw Spent Wash (RSW) @ 5 lakh L/ha, T_4 - Lagoon Sludge (LS) @ 10 t/ha, T_5 - Press Mud (PM) @ 5 t/ha, T_6 - Lagoon Sludge (LS) 5 t/ha + Raw Spent Wash (RSW) @ 2.5 lakh L/ha and T_7 - Press Mud (PM) @ 2.5 t/ha + Raw Spent Wash (RSW) @ 2.5 lakh L/ha)) and one control were tested to know the efficacy of distillery and sugar industry waste on reclamation and production in sodic vertisols. In rice (cv CSR 30) – wheat (cv HI 1077) cropping sequence, the first season study indicates significant increase in tillers per hill, plant height, panicle length, grain and stover yield of rice due to application of amendments over control. Application of LS 5 t/ha + RSW @ 2.5 lakh L/ha significantly increased the plant height, grain and stover yield of paddy as compared to gypsum @ 75 % GR as well as LS @ 10 t/ha and PM @ 5 t/ha application. Highest number of tillers per hill (28.4), plant height (127.1 cm), length of penicle (23.4 cm), grain (2.44 t/ha) and stover (7.33 t/ha) yield was recorded in case of LS 5 t/ha + RSW @ 2.5 lakh L/ha application.
46. **Sweet corn – chickpea cropping system for high monetary returns under dryland vertisol conditions:** Chickpea exhibited highest yield of 2248 kg/ ha with

net return of Rs.40466 per ha and B:C ratio of 7.61. For dryland of Malwa region, the most efficient and remunerative cropping sequence identified was sweet corn – chickpea with 12 t/ha FYM + 50% RDF (60:30:10 NPK/ha) applied to sweet corn.



47. **Crop rotation for higher returns:** Twelve crop sequences were tested for their productivity, monetary returns and economic viability. Soybean-onion-okra cropping system produced the maximum gross returns (Rs 1, 85,523) and net returns (1, 19,863) among all tested cropping systems. Maize – wheat system ranked second. Soybean – wheat, a predominant cropping system of the area ranked third in respect to net returns. However, the benefit cast ratio was higher in maize – wheat (3.54) followed by soybean – wheat (3.27) and soybean-onion-okra (2.83).
48. **Sorghum - pigeonpea intercropping**: In sorghum based intercropping system at Indore, the sorghum genotype CSV 15 and CSH 16 were found most suitable for intercropping with pigeonpea under 2:1 rows at 45 cm apart.
49. Application of ammonium molybdate @ 1.0 g/kg seed as seed treatment along with *Rhizobium* +PSB which was found effective and remunerative giving an additional yield and a net return of Rs. 7098/ha over control. Hence, this technology was recommended wherever soil is deficient in molybdenum for obtaining higher yields of chickpea. This technology has got wide popularity among the farmers of the state particularly in soybean – chickpea cropping system.
50. **Biofertilizer application in chickpea**: Application of *Rhizobium* + PSB as seed treatment along with Ammonium molybdate @1g/kg seed gave 26.7% higher chickpea yield under multi location trials in research farms and 25 to 34.8% higher yield at farmer's fields in M.P.



51. **New strain of *Rhizobium*:** New *Rhizobium* strain RVSGRS 114 found to produce 15.9% higher yield and enhance uptake of N by 20 kg/ha over control in chickpea.

52. **New *Rhizobium* strains identified from nontraditional legumes:** Thirty six *Rhizobium* strains were identified from nontraditional legumes, namely, horse gram (18), cowpea (5), black gram (6), soybean (4) and groundnut (3). All the strains were gram negative. The colonies were circular, smooth with creamy and shiny surface. The colour of colonies varied from translucent to opaque. None of the strains survived for 10 days at more than 40^{0}C but R 4 showed moderate growth and survival for 10 days at this temperature. All isolates grew well at 30% PEG concentration. R 1 showed negative test for ammonium bis citrate and positive for ammonium chloride, potassium nitrate and magnesium nitrate. Genomic DNA fingerprints of the selected strains were obtained by ERIC-PCR.

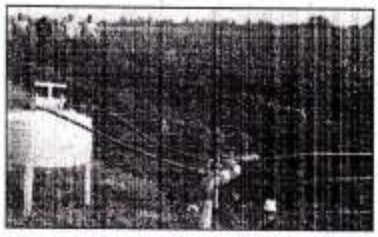
53. **Nutrient management in wheat**: Fertilizers response in irrigated and rainfed wheat varied considerably. In irrigated conditions, GW 173 recorded the highest grain yield of 5600 kg/ha at 150:60:40 kg NPK /ha while, HI 1531 (2990 kg/ha), HW 2004 (2940 kg/ha), HI 1500 (3037 kg/ha) and MP 3288 (2982 kg/ha) showed optimum yield at 60:30 kg NP/ha under rainfed conditions.

54. **Fertilizers for pearl millet -mustard crop sequence:** The recommended dose of NPK (80 : 40 : 20) kg/ha along with 40 kg S/ha was found to be superior and economical for getting higher yield and return in pearl millet -mustard cropping sequence in Gird zone.

55. **Irrigation scheduling and zinc application in soybean- mustard cropping sequence:** The highest seed yield of soybean (18.17 q/ha), production efficiency (20.19kg/ha/day), net returns (Rs. 41917kg/ha/day) and B: C ratio (4.17) was registered with the 100% RDF. The mean response due to 100% RDF was 27.86% and 16.29% in seed yield over 50% and 75% RDF, respectively while in mustard the maximum WUE (122.6 kg/ha-cm), production efficiency (16.19 kg/ ha/ day), seed yield (21.05q/ha) net returns (Rs. 51085/ha) and B:C ratio (4.82) was recorded under irrigation applied at 40 and 70 DAS along.

56. **Micro–irrigation and fertigation system for cotton research:** The availability of irrigation water is expected to come down in coming decades due to competition from urbanization and industrialization. It highlights the need for economization and

proper management of available water in crop production. In order to standardize the technologies to save the water with its effective and optimum uses, micro-irrigation and fertigation system was established with financial support from RKVY for promoting the research on these aspects in cotton.



57. **Irrigation and fertilizer management in cluster bean-wheat cropping sequence:** The highest seed yield (23.73q/ha), production efficiency (17.08kg/ha/day) net returns (Rs. 26350/ha) and B: C ratio (3.20) of cluster bean (Guar) was obtained with the application of 50% RDF + 5 tonnes FYM + 2.5 tonnes vermi compost/ha while, irrigation applied at CRI, tillering, booting and milk stage produced significantly higher grain yield of wheat (4374 kg/ha) and production efficiency (34.90 kg/ ha/ day) in wheat. However maximum WUE (144.2 kg/ha-cm) was recorded with 3 irrigations applied at CRI, booting and milk stage.
58. **Irrigation response in newly bread wheat varieties:** New wheat variety, HD 2987, responded to two irrigations at CRI and late tillering stage resulting significantly higher grain yield (3760 kg/ha) followed by HI 8627 (3710kg/ha) and HI 1531 (3470 kg/ha). Two irrigations at CRI and late tillering stage, also gave significantly higher grain yield (3100 kg/ha) compared to one (2630 kg/ha) and no irrigation (2030 kg/ha).
59. **Water management in soybean-wheat cropping sequence:** Construction of dead furrows at the interval of 10 rows for safe removal of excess water from soybean field improved the productivity (1566kg/ha), WUE (3.67kg/ha/mm) and (Rs 26.600/-) in vertisolswhile, highest grain yield (4313 kg/ha), WUE (28.75 kg/ha/mm) and net return (Rs. 44241/ha) were recorded in sprinkler irrigation as compared to border strip method of irrigation in wheat.
60. **Irrigation scheduling for micro-irrigation systems in chickpea:** Method and schedule of irrigation significantly influenced seed yield in chickpea in sandy loan soil of Gird region. Highest Water use efficiency, production efficiency and nutrient use were recorded in sprinkler irrigation and 0.6 IW/CPE treatments.

61. **Irrigation method and schedule for turmeric:** Porus pipe irrigation method recorded the highest rhizome yield of 196.3q/ha at 0.8 IW/CPE ratio irrigation

schedule. Yield traits, WUE(232.03 kg/ha-cm) and production efficiency (80.1kg/ha/day) were also significantly enhanced in this method and schedule of irrigation in turmeric. Basin method of irrigation was found least effective having lowest rhizome yield.Net return and additional income was also highest in porus pipe irrigation method (Rs 3.23 lakh/ha) and irrigation schedules of 0.8 IW/CPE (Rs 2.96 lakh/ha) with B: C ratio of 5.63 and 5.22, respectively.

62. **Effect of sowing dates on sorghum yield:** Optimum time for sowing of sorghum was found 15th June which recorded 108.3 % higher grain yield than yield of 30th June sowing. Sorghum genotypes, CSH 16 and CSH 23 were found to be promising.

63. **Integrated weed management in sorghum**: Application of pendimethalin @ 0.50 kg a.i./ hawith one hand weeding at 30 DAS and application of atrazine @ 0.25 kg + pendimethalin @ 0.50 kg a.i. as pre-emergence + 2,4D 0.50 kg a.i./ha as post emergence were found effective weed management practices for sorghum.

64. **Planting method in cotton:** Sowing of cotton on ridge and furrows is beneficial to the farmers and produced 28.6% and 17.8% higher yields as compared to flat system of sowing. The moisture content is also 14% higher in ridge and furrow system of planting in comparison to flat bed system.

65. **Effect of mulching on cotton**: Mulching of green weeds biomass @ 6 t/ ha at 35 DAS was found suitable and recorded 20.9% higher yields than no mulch. Green weed biomass as mulch also noted significantly 17.7% higher moisture content over no mulch crop.

66. **Sowing geometry and irrigation in chickpea:** Based on two years study, sowing on BBF + one row of intercropping of wheat resulted in significantly higher grain yield (2428 kg/ha) over flat bed sowing. Two irrigations one each at branching and pod development, gave significantly higher grain yield. Kabuli chickpea variety RVSJKG 102 performed better in closer spacing of 30 x 10cm over wider spacing of 45 x 10cm and gave highest grain yield.

67. **Wheat varieties for different planting time:** Wheat varieties, namely, HD 2932, HI 1077, HI 8498, HI 8381, GW 190, GW 322, GW 366, MP 1203 and HD 2864, were found suitable for timely sowing in the month of November while RVW 4106, DL-788-2, GW-173 & MP 4010 were found to be suitable for late sown condition in M.P.

68. **Plant spacing for new wheat varieties** :A trial was conducted to test the effects of plant spacing on new wheat varieties. HI 1544 (5129 kg/ha) significantly out yielded other varieties followed by GW 266 (5066 kg/ha) over GW 322 (4259 kg/ha) across spacing levels. Close plant spacing of 15 cm gave highest grain yield (5385 kg/ha) followed by 17.5 cm (5007 kg/ha) over spacing of 20 cm (4266 kg/ha).

69. **Development of sick plot for screening of chickpea genotypes against *Fusarium* wilt:** A sick plot for screening of chickpea genotypes for resistance to *Fusarium* wilt has been developed at Indore in addition to Sehore centre. The IVT, AVT lines from AICRP on chickpea, were evaluated in this field. The susceptible variety of chickpea has showed 100% mortality due to infection of wilt pathogen.

70. **Induced host resistance against *R. bataticola*:** Response of chemical elicitors, namely, salicylic acid and isonicotin amide, in imparting resistance to the host rather than directly affecting the pathogen were evaluated against *R. bataticola*. Both chemical elicitors reduced disease incidence. An increasing trend of colony diameter was noted with decrease in concentration of the chemical elicitor compared to normal. The germination of chickpea was not influenced by these chemicals. Seed treatment with 400ppm salicylic acid and foliar application of salicylic acid (400ppm) just after germination of the plants showed minimum incidence of R. *bataticola* and induction of resistance against the disease at different plant stages.

71. **Disease management in chickpea:**Seed Treatment with *Trichoderma harzianum* + Vitavax Power (4:1) was found effective in reducing wilt and root rot diseases of chickpea

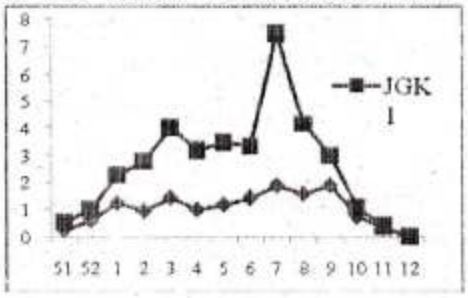
72. **Resistant sources of wilt in kabuli chickpea:** RVSSG 11, CSJK 54 and IPC 06-143 have been identified as resistant source of wilt in *Kabuli*chickpea.

73. **Disease management in mustard:**For the control of white rust and sclerotinia rot, seed treatment with Metalaxyl @ 6 g/kg seed was found effective against white rust while seed treatment with carbendazim @ 1 g/kg seed followed by spraying of carbendazim @ 0.5 g/l of water at 50 DAS was quite effective against Sclerotinia rot. The incidence of Alternaria blight and white rust could be controlled by seed treatment with Metalaxyl (Apron 35 SD) 6 g/kg seed and 1st foliar spray of Mancozeb @ 2.5 g/l of water at 50 DAS and 2nd spray of Ridomil MZ 72 @ 2 g/l of water at 65 DAS.

74. **Integrated pest management in sorghum:** The level of shoot fly incidence was 24 to 80% in late sown crop, while the stem borer infestation was observed to be at moderate level i.e., 15-39 percent. Seed treatment with thiomethxam70 WP followed by spray of lambda cyhalothrin 5% EC was most effective management of sorghum pests.

75. **Susceptibility index of storage pest in chickpea**: In *Desi* chickpea, mean susceptibility index of stored grain pest was low (1.48) and developmental period was high (40.77) as compared to *Kabuli* chickpea in which high mean susceptibility index was 4.47 and development period was 30.80.

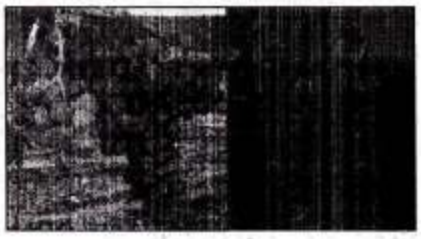
76. **Incidence of *Heliothis armigera* on chickpea:** The *Kabuli* varieties are more susceptible to pod borer in comparison to *Desi* varieties of chickpea. Seasonal incidence of *Heliothis armigera* on chickpea was highest in 7th standard week in *Kabuli* variety (8) as compare to *Desi* chickpea (2). The lowest incidence was observed in the 12th standard week in both *Kabuli* and *Desi* chickpea varieties.



77. **Biological control of aphid in mustard:** Application of predator *Coccinella septempunctata* @ 5000 beetles/ha, minimized the aphid population and gave higher seed yield. The other bio-agent *Verticillium lacanii* followed by Neem oil @ 2% also reduced the aphid population below ETL.

78. **Biological management of downy mildew of opium poppy:** *Trichoderma viride* multiplied on maize for 10 days applied as seed dresser @ 10g/kg on opium seed and soil application @ 1:25 kg before sowing (seed row), reduced the downy mildew infection up to 7.37% as compared to 13.81% in untreated plot. Significant differences were also observed on latex, seed and husk yield in the treated plot.

79. **Root stocks for grape propagation:** Among three roots stock tested for the propagation grape cultivars of table, juicy, wine types and seedless, dogridge identified was as promising having least mortality percentage (6.80%) followed by salt creek (25.97%). Rootstock 110 R recorded the highest mortality of 32.80%. Grape cultivars, Flame seedless,Sarad seedless, A 18-3,KishmishChernyi, Crimson seedless, Medika, Pusanavrang, Arkashyam and Bangalore, blue are early in fruit bearing and have started fruit setting.

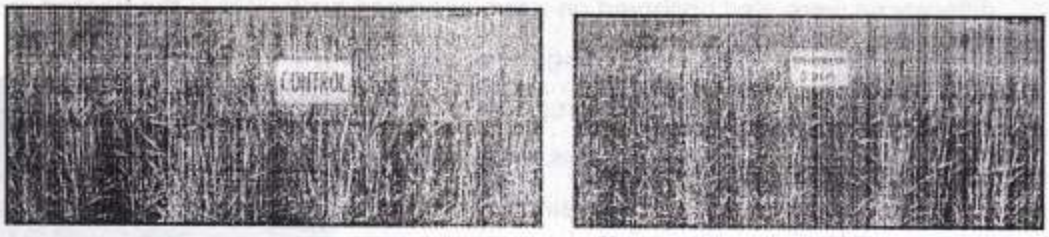


80. **Relative efficacy of distillery and sugar industry waste on reclamation and wheat production in SodicVertisols:** Seven combinations of distillery and sugar industry waste (T_1 – Control, T_2 - Gypsum @ 75 % GR, T_3 - Raw Spent Wash (RSW) @ 5 lakh L/ha, T_4 - Lagoon Sludge (LS) @ 10 t/ha, T_5 - Press Mud (PM) @ 5 t/ha, T_6 -Lagoon Sludge (LS) 5 t/ha + Raw Spent Wash (RSW) @ 2.5 lakh L/ha

and T_7 -Press Mud (PM) @ 2.5 t/ha + Raw Spent Wash (RSW) @ 2.5 lakh L/ha with control and standard control) were tested in rice (CSR 30) – (HI 1077) wheat cropping sequence for reclamation and crop production in Sodic Vertisols at Salinity Research Farm, Barwaha.

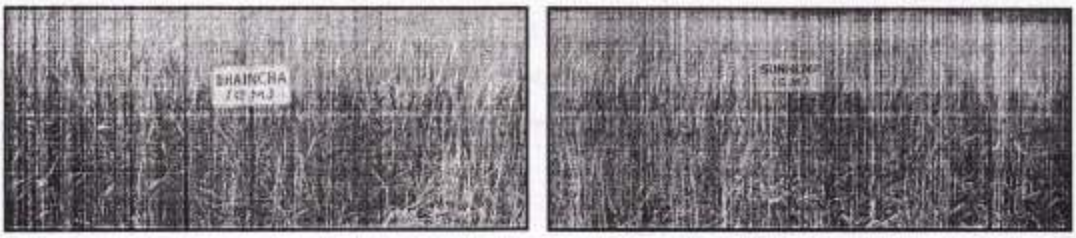
In Rabi season, the grain and straw yield of wheat increased significantly due to application of amendments over control. Application of LS 5 t/ha + RSW @ 2.5 lakh L/ha was found significantly advantageous as compared to gypsum @ 75 % GR as well as LS @ 10 t/ha and PM @ 5 t/ha application with highest grain (3.77 t/ha) and straw (4.17 t/ha) yields.

81. **Performance of soybean and wheat under partially reclaimed SodicVertisols:** An experiment was conducted at SRF, Barwahawith nine treatments viz. Control, FYM @ 5 t ha^{-1}, Vermi-compost @ 5 t ha^{-1}, GR @ 75 %, GR @ 75 % + FYM @ 5 t ha^{-1}, GR @ 75 % + Vermi-compost @ 5 t ha^{-1} Spent wash @ 2.5 cm (2.5 lakh L ha^{-1}), Spent wash @ 5 cm (5 lakh L ha^{-1}) and Spent wash @ 10 cm (10 lakh L ha^{-1}) for three years. The soybean and wheat crops were raised under same plot after three years, without any treatment. Recommended doses of nutrients were given as per the recommendations for sodic soils. The highest grain yield (3.55 t/ha) and straw (4.07 t/ha) of wheat was recorded in 10.0 cm spent wash level but it was statistically at par with 5.0 cm. The application of 5.0 cm spent wash enhanced the grain and straw yield by 63 and 62 per cent, respectively over gypsum treated plots.



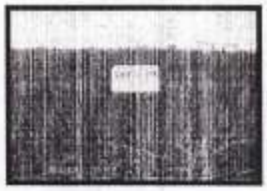
Performance of wheat under control and residual effect of spent wash @5 lakh L/ha

82. **Effect of long-term application of organic/ green manures at different soil ESP in sodicvertisols**: The grain and stover/ straw yield of paddy and wheat decreased significantly with increase in soil ESP. Incorporation of green manure increased the paddy and wheat yields (grain and stover/straw) significantly over control. Highest grain yield of wheat was recorded in case of dhaincha (3.39 t ha^{-1}) followed by sun hemp (3.11 t ha^{-1}) at soil ESP of 25.

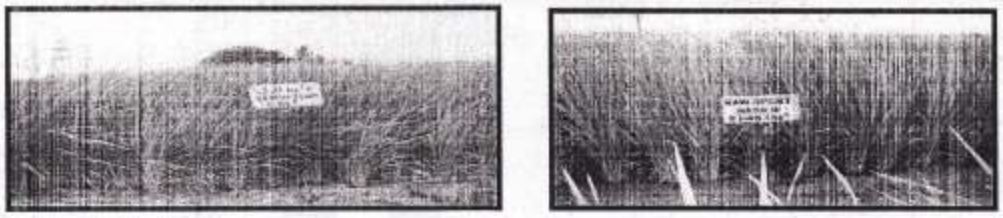


Performance of wheat under green manuring at ESP 25

83. **Effect of long-term application of organic/ green manures at different soil ESP in sodicvertisols:** A study was carried out to know the effect of application of organic/ green manures at different ESP in sodicvertisolswith four treatments viz. Control, FYM @ 10 t ha^{-1},dhaincha and sunhemp. Wheat and paddy yields decreased significantly with increase in soil ESP. Incorporation of dhaincha and sunhemp as green manure increased the paddy yield by 46 and 32 %, respectively over control.



84. **Efficacy of distillery and sugar industry waste on reclamation and crop production in sodicvertisols:** Application of LS 5 t/ha + RSW @ 2.5 lakh L/ha and Raw Spent Wash @ 5 lakh L ha^{-1} as amendment significantly increased the grain yield of paddy by 98.5 and 46.8 % as compared to control at ESP 38.4.

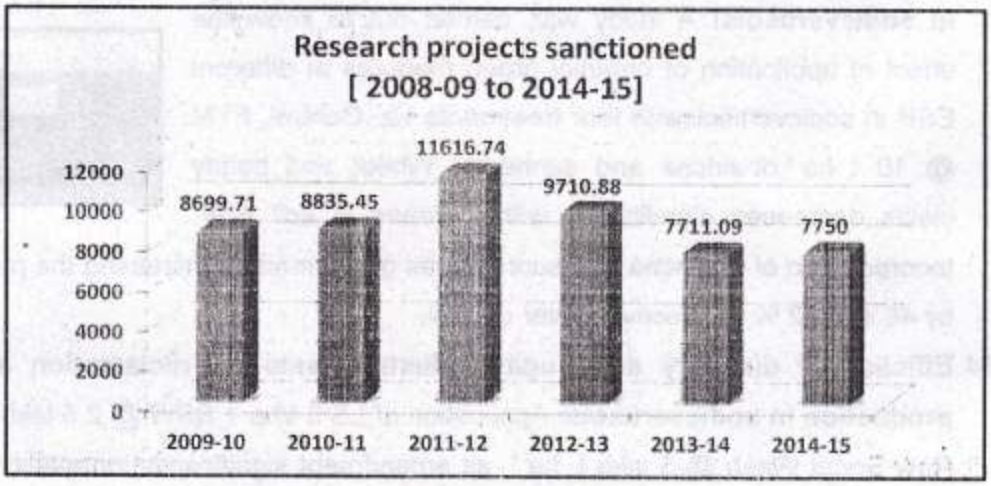


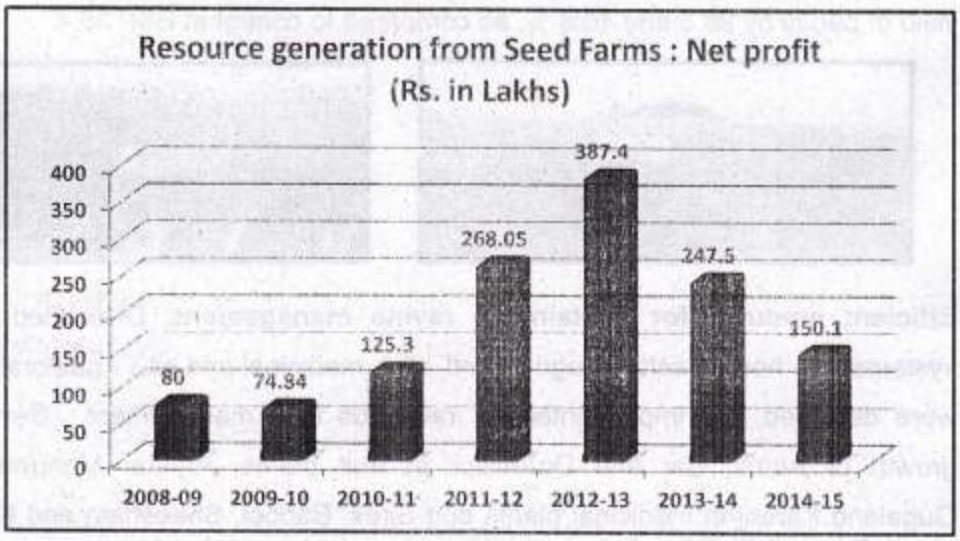
85. **Efficient modules for sustainable ravine management:** Diversified cropping systems viz., horti –pastoral, agri – horti, silvi- medicinal and silvi - pastoral modules were designed and implemented for ravenous land management. Survival and growth of Aonla, Ber and Drumstick in fruit plants, Arjuna, Mahuwa, Neem, Gugaland Karanj in medicinal plants and Siras, Babool, Sheesham and Khamer in forest trees are good.

86. **Molybdenum application in lentil:** The effect of molybdenum on productivity of lentil in soybean based cropping was determined. Seed treatment with Amoniummolybded @ 1.0 g/kg seed + Rhizobium + PSB along with recommended dose of fertilizer recorded 44 % higher grain yield (1328 kg/ha) as compared to rest of the treatments.

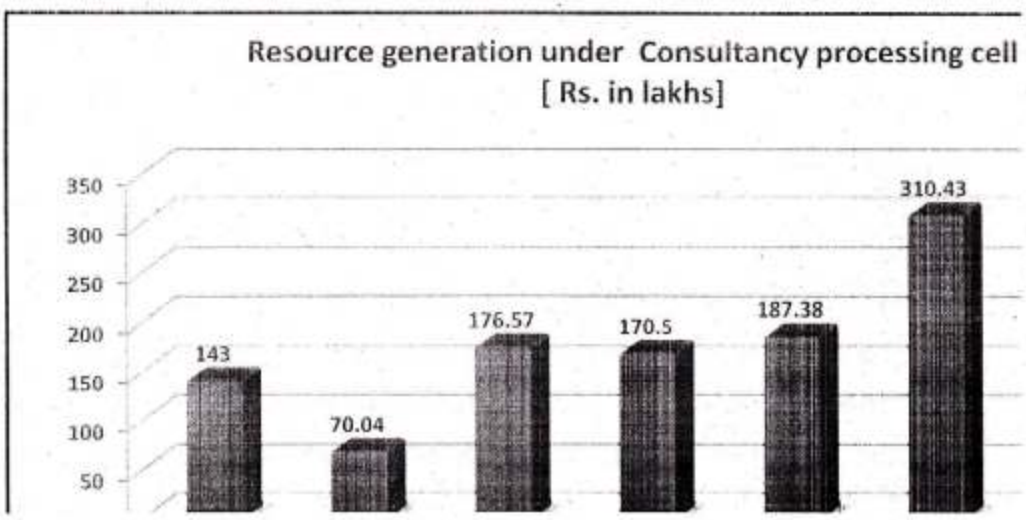
87. **Natural hatching of *Kadaknath*:** Succeeded in natural hatching of local high value poultry race *Kadaknath* eggs by *Desi* bird and rearing of newly borne chicks in the mosquito net. Under this technology, 792 *Kadaknath* chicks were reared and farmers are getting Rs. 175-200 from one *Kadaknath* bird of two months old instead of getting Rs. 60-100 form *Desi* bird.

Breeder Seed Production





Planting materials costing Rs 13.89lakhs was produced at Sehore and Entkhedi



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2. Yadava, H.S., Pandya R.K., Chaterjee, Amit., Dubey, S. K. and **Srivastava, S.C.** (2009) National Seminar on "Organic Farming for Sustainable Agriculture and Livelihood Security **(Abstracts)**" held at RVSKVV, Gwalior.
3. Yadava, H.S., **Srivastava S.C.** and Sudhanshu Jain (2011) "**Annual Farm Report (Seed Production Farms) 2009-10**" Directorate of Research, RVSKVV, Gwalior
4. Yadava, H.S., Singh, B.K., **Srivastava, S.C.** and Sudhanshu Jain (2011) "Research Highlights 2008-10" Directorate of Research, RVSKVV, Gwalior.
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6. Yadava, H.S., Tomar, S.S., Singh, B.K., Gupta, Shobhna, **Srivastava S.C.,** Singh, K.V. and Bhadoria, S.S., (2012) "**Status Report of Research, Extension and education** for XXII[nd] Meeting of ICAR, Regional committee No. VII held on November 9-10, 2012 at Goa" Directorate of Research, RVSKVV, Gwalior.
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8. Yadava, H.S., Sudeep S. Tomar, Roy, A. K. and **Srivastava S.C.,** (2013) **"Success Stories and Recognitions"** of Integrated farming system for

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11. Yadava, H.S., Tomar, S.S., **Srivastava S.C.** and Sudhanshu Jain (2012) **"Achievements of Seed Farms [2009-10 to 2013-14]"** Directorate of Research, RVSKVV, Gwalior.
12. Yadava, H.S., Shailendra S. Kushwah, **Srivastava S.C.,** Mishra Y.D. and Singh K.V., (2014) **"National Symposium on Dry land farming & Food security in India (Souvenir)"** held at RVSKVV, Gwalior, during August 30-31, 2014.
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14. Singh A.K., Yadava, H.S. and **Srivastava S.C.** (2014) **"Proceeding** of the National Symposium on Dry land farming & Food security in India" RVSKVV, Gwalior, during August 30-31, 2014.
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