NRCRM

वार्षिक प्रतिवेदन
Annual Report

1994-95

भाकृ अनुप
ICAR

राष्ट्रीय सरसों अनुसंधान केन्द्र
(भारतीय कृषि अनुसंधान परिषद)
सेवर, भरतपुर 321 303 (राजस्थान)

National Research Centre on Rapeseed-Mustard
(Indian Council of Agricultural Research)
Sewar, Bharatpur 321 303 (Rajasthan)

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PREFACE

I have pleasure in bringing out the Second Annual Report of the NRCRM, which has made a good headway in terms of creation of infrastructural facilities and conduct of research experiments in breeding and agronomy. Efforts to maintain more than 2200 germplasm lines has paid rich dividends in identification of suitable genotypes for late sown conditions and donors for economic traits. The breeder seed production programme undertaken, yielded 7000 Kg seed. This gave an income of Rs. 2.35 lakhs in comparison to Rs. 83,374 during the previous year.

I express my deep sense of gratitude to Dr. R. S. Paroda, Secretary, DARE and Director-General, ICAR for his kind guidance and keen interest in rapid development of the centre. The valuable suggestions and encouragement received from Dr. E. A. Siddiq, DDG (CS); Dr. D. P. Singh, the then ADG (OP); Dr. N. B. Singh, ADG (OP) and Dr. Mangala Rai, ADG (Seeds) has helped enormously in giving the present shape to the centre.

The help rendered by Dr. Dhiraj Singh, Scientist (Plant Breeding); Dr. Hari Singh, Scientist (Entomology); Dr. Hari Ram Rohilla, Scientist (Entomology) and Dr. Naveen Chandra, Research Associate of CCSHAU, Hisar; Dr. Arvind Kumar, Professor of Agronomy, GBPUA&T, Pantnagar and Dr. Bhoori Singh, Sr. Scientist (Agronomy) of NRCRM is duly acknowledged.

The untiring efforts of office and technical staff namely, Messers Mohan Singh, L. K. Sharma, O. P. Verma, J. L. Sharma, Sanjay Kumar and R. C. Meena are appreciated.

P. R. Kumar

(P. R. Kumar)
Director

MANDATE

- National repository of rapeseed-mustard genetic resources and information.
- Basic, strategic and applied research to improve the productivity and quality of oil and seed meal.
- Development of ecologically sound and economically viable agro-production and protection technologies for different situations.
- Generation of location specific inter-disciplinary information based on multi-location testing and co-ordination.
- Establishment of linkages and promotion of co-operation with national and international agencies to achieve above objectives.
- To extend technical expertise and consultancies.

CONTENTS

सारांश

राष्ट्रीय सरसों अनुसन्धान केन्द्र ने स्थापना वर्ष अक्टूबर, 1993 में ही मूलभूत सुविधाओं को जुटाने व प्रयोग परीक्षणों को खेत में लगाने में उल्लेखनीय प्रयास किये जबकि फरवरी, 1995 तक कोई भी वैज्ञानिक न था। 40 उन्नत किस्मों का प्रदर्शन व समन्वित परियोजना एकक द्वारा अधिक उपज वाली कुछ विशिष्ट किस्में लगायीं ताकि अच्छी उपज क्षमता का समुचित प्रदर्शन हो। अखिल भारतीय समन्वित परियोजना की पादप प्रजनन शाखा के ग्यारह प्रयोग परीक्षण लगाये गये। मुख्य भवन की चहारदीवारी बनायी गयी और केन्द्र के सम्पूर्ण प्रक्षेत्र (1.5 कि.मी.) की चहारदीवारी का निर्माण कार्य प्रगति पर रहा। मुख्य भवन का जीर्णोद्धार तथा सड़क निर्माण का कार्य अभी प्रारम्भ होना है।

सरसों के जननद्रव्यों के समुचित संग्रहण हेतु भण्डार गृह निर्माण के लिए केन्द्रीय लोक निर्माण विभाग द्वारा कार्यवाही की गयी। तीन नये नलकूप के खनन व भूमिगत सिंचाई व्यवस्था हेतु प्राक्कलन मूल्य जमा किया गया। उपलब्ध कार्यालय व प्रयोगशाला भवन में समुचित विद्युत व्यवस्था हेतु प्राक्कलन का अनुमोदन किया गया। मुख्य कार्यालय व प्रयोगशाला भवन, आवासीय प्रखण्ड तथा अतिथि गृह निर्माण हेतु नक्शा आदि बनाने का कार्य प्रगति में रहा।

दो वर्ष के छोटे से अन्तराल में जबकि कोई भी वैज्ञानिक व तकनीकी कर्मचारी न था फिर भी केन्द्र ने अपने कार्य से राष्ट्रीय व अन्तर्राष्ट्रीय दोनों ही स्तरों पर एक अमिट छाप बनायी। 24 विशिष्ट व्यक्तियों ने केन्द्र की उपलब्धियों को सराहा है जिनमें देश के व विदेशी (केन्या, कनाडा, आस्ट्रेलिया) के व्यक्ति भी सम्मिलित है। प्रस्तुत वार्षिक प्रतिवेदन के समय में केन्द्र द्वारा सात तकनीकी बुलेटिन/रिपोर्ट बनायी गयीं। अनुसन्धान कार्य मुख्य रूप से प्रजनन विज्ञान व शस्य विज्ञान के प्रयोगों तक ही सीमित रहा। चूँकि केन्द्र में कोई शस्य विज्ञानी नियुक्त न था अतः गोविन्द बल्लभ पन्त कृषि विश्वविद्यालय, पंतनगर के डॉ. अरविन्द कुमार, प्रोफेसर शस्य विज्ञान व प्रमुख अनुसन्धानविद्, शस्य विज्ञान की मदद से अनुसन्धान कार्य किया गया।

पादप प्रजनन विभाग में 2282 जननद्रव्यों को मूल्यांकन हेतु लगाया गया। 209 जननद्रव्यों का चुनाव सघन मूल्यांकन हेतु किया गया जिनमें 47 सरसों, 56 भूरी सरसों, 57 पीली सरसों और 50 गोभी सरसों की प्रजातियाँ थीं। संकरण के प्रयोगों में 432 संकर का मूल्यांकन एफ-1 पीढ़ी में किया गया परन्तु उनमें कोई भी दक्ष रूप से रेस्टोर नहीं थीं। विभिन्न सी. एम. एस. सिस्टम को बनाये रखा गया। विभिन्न जननद्रव्यों जिनमें "0" व "00" गुण विद्यमान थे उन्हें भी खेत में लगाकर व संग्रहीत किया गया। 50 अच्छी सन्ततियों को लगाकर अच्छी उपज वाले पौधों को चुना गया। प्रजनन बीज उत्पादन कार्यक्रम के अन्तर्गत 25.55 हेक्टर में सरसों की विभिन्न जातियाँ-रजत (पी. सी. आर. 7), आर. एच. 30, वरुणा और टी. 27 को लगाया गया। दो शस्य विज्ञान के प्रयोगों जैसे सल्फर व नत्रजन का प्रभाव तथा विभिन्न तकनीकों का विलम्ब से बोने में प्रभाव, को पुनः सम्पुष्टि हेतु लगाया गया।

द्वितीय सरसों विज्ञान मेला 14 मार्च, 1995 को आयोजित किया गया जिसमें उत्तर प्रदेश, मध्य प्रदेश और राजस्थान के किसानों व जम्मू-काश्मीर, मध्य प्रदेश व उत्तर प्रदेश के वैज्ञानिकों ने भाग लिया। एक तकनीकी बुलेटिन **'सरसों'** का विमोचन भी इस अवसर पर किया गया। केन्द्र द्वारा उच्च गुणवत्ता का बीज विक्रय कर 2.35 लाख रुपये की आय अर्जित की गयी।

SUMMARY

The NRCRM which came into operation in October, 1993, has made a good headway in terms of the creation of infrastructure, construction and conduct of experiments even though there was no scientific staff till Feb. 1995. Nearly 31 hactares out of 38.7 hactares was brought under cultivation during the year under report. A field demonstration with 40 high yielding released varieties and newly developed strains of the then PC Unit, HAU, Hisar was laid to elucidate the potential of high yielding genotypes. Eleven All India Co-ordinated Trials under plant breeding discipline were conducted. The construction of the boundary wall of the main building was completed and the construction of the boundary wall of the farm area (1.5 km), is in progress. The main building is under renovation. Construction work of the approach road is yet to start.

The construction of module room for medium term storage of germplasm has been finalised by the CPWD. Payment for the construction of the underground channel and for three new tubewells has been made. The estimate for electrical line, repair, fitting of new connections, points, etc., in the existing office-cum-laboratory building was approved. The architectural design and the lay out plan for the main office-cum-laboratory, residential complex and guest house is at advance stage of finalization.

The research work was confined to breeding and agronomic experiments. In plant breeding, 2282 germplasm lines were evaluated and maintained. Two hundred ten germplasm lines comprising Indian Mustard (47), Brown Sarson (56), Yellow Sarson (57) and Gobhi Sarson (50) were selected for further evaluation. In an experiment on the development of hybrids of mustard, a total of 432 F_1 hybrids were evaluated. But none of the lines showed perfect restoration. Different CMS systems were maintained. Germplasm lines possessing '0' and '00' characters were assembled and maintained. More than 60 progeny-rows were grown and plants with desirable traits were selected. Breeder Seed Production Programme was undertaken in 25.7 hactares with mustard varieties Rajat (PCR-7), RH-30, Varuna, and T 27. More than 7000 Kg seed was produced. Since there was no agronomist posted, the research work was carried with the help of Dr. Arvind Kumar, Professor of Agronomy, G. B. Pant University of Agriculture and Technology, Pantnagar and Principal Investigator,

Agronomy for AICRPRM. The two agronomic experiments, viz., effect of sulphur and nitrogen fertilisation and contribution of different technology component under late sown conditions were repeated to confirm the findings.

The **Second Sarson Vigyan Mela** was organized on March 14, 1995 which was inaugurated by Prof. R. B. Singh, Director, Indian Agricultural Research Institute, New Delhi. Farmers from Rajasthan and neighbouring states of M.P. and U.P., and scientists from Jammu & Kashmir, M.P. and U.P. participated in the Mela. A technical bulletin entitled, **"Sarson"** was released on this occassion. In a short span of less than 2 years with virtually no scientific and technical staff in position, the NRCRM has made sizeable impact at the national and international level. Twenty four dignitaries from India and abroad (UK, Kenya, Canada and Australia) visited the centre. The centre has also brought out technical bulletins and reports from time to time. During the year under report seven technical bulletins/reports were brought out. An income of Rs. 2.35 lakhs was generated under resource mobilization by way of selling the quality seeds produced at the farm.

CROP IMPROVEMENT

Genetic Resource Management

Maintenance

During the year under report, a total of 2282 accessions of Indian Mustard, Brown Sarson, Yellow Sarson and Gobhi Sarson were maintained following appropriate mating system : selfing / sibbing.

Evaluation

Observations on 12 agro-morphological traits and oil content were recorded on Indian mustard (1840 accessions), (Table 1), Brown Sarson (215 accessions) (Table 2), Yellow Sarson (155 accessions) (Table 3) and Gobhi Sarson (72 accessions) (Table 4). Five hundred and ten plants with desirable traits were selected for further evaluation.

Table 1 : Range and five promising accessions of *B. juncea* for different agro-morphological traits

Character	Range		Accessions
Days to flowering	23 CSR-88	98 CSR-168	CSR-168 (98), CSR-326 (83), CSR-327 (81), CSR-430 (75), CSR-171 (70)
Days to maturity	118 JMG-204	148 CSR-279	CSR-279 (148), CSR-278 (147), CSR-280 (146), CSR-317 (144), CSR-319 (142)
Plant height (cm)	106.6 JMG-274	222.0 CSR-261	CSR-261 (222.0), CSR-114 (214.4), CSR-326 (206.5), CSR-297 (201.6), CSR-213 (200.0)
Primary branches/ plant (no.)	2.8 JMG-236	11.2 JMG-343	JMG-343 (11.2), CSR-98 (11.0), CSR-261 (11.0), CSR-269 (10.6), CSR-347 (10.4)
Secondary branches/ plant (no.)	2.6 JMG-27	37.6 JMG-99	JMG-99 (37.6), CSR-213 (32.7), JMG-279 (29.6), CSR-181 (28.0), CSR-363 (25.6)
Main shoot length (cm)	32.0 JMG-240	102.6 CSR-14	CSR-14 (102.6), JMG-365 (101.8), JMG-239 (98.4), CSR-213 (97.3), CSR-52 (96.6)
Siliquae on main raceme (no.)	15.6 CSR-336	62.4 CSR-57	CSR-57 (62.4), CSR-57 (61.0), CSR-326 (60.0), CSR-28 (60.0), JMG-410 (56.6)
Siliqua/ length (cm)	2.6 JMG-262	5.0 JMG-116	JMG-116 (5.0), JMG-154 (4.7), JMG-128 (4.6), JMG-37 (4.5), JMG-36 (4.5)
Seeds / siliqua (no.)	7.6 CSR-430	20.0 JMG-80	JMG-80 (20.0), JMG-205 (18.4), JMG-160 (17.8), CSR-82 (16.7), JMG-31 (15.6)
1000-seed weight (g)	2.6 BACR-24	8.2 JMG-419	JMG-419 (8.2), RC-155 (7.2), CSR-955 (6.1), CSR-396 (5.7), BACR-54 (5.8)
Seed yield/ plant (g)	3.9 BSC-54	17.9 BSC-181	CSR-825 (17.9), CSR 188 (14.8), JMG-363 (12.3), JMG 464 (13.7), CSR-173 (12.8)
Oil content (%)	36.0 CSR-250	43.7 CSR-3	CSR-3 (43.7), JMG-117 (42.6), JMG-111 (42.8), JMG-425 (43.0), CSR-880 (42.6)

* Figure within parenthesis under accessions is the mean value.

Table 1 : **Range and five promising accessions of *B. juncea* for different agro-morphological traits**

Character	Range		Accessions
Days to flowering	23 CSR-88	98 CSR-168	CSR-168 (98), CSR-326 (83), CSR-327 (81), CSR-430 (75), CSR-171 (70)
Days to maturity	118 JMG-204	148 CSR-279	CSR-279 (148), CSR-278 (147), CSR-280 (146), CSR-317 (144), CSR-319 (142)
Plant height (cm)	106.6 JMG-274	222.0 CSR-261	CSR-261 (222.0), CSR-114 (214.4), CSR-326 (206.5), CSR-297 (201.6), CSR-213 (200.0)
Primary branches/ plant (no.)	2.8 JMG-236	11.2 JMG-343	JMG-343 (11.2), CSR-98 (11.0), CSR-261 (11.0), CSR-269 (10.6), CSR-347 (10.4)
Secondary branches/ plant (no.)	2.6 JMG-27	37.6 JMG-99	JMG-99 (37.6), CSR-213 (32.7), JMG-279 (29.6), CSR-181 (28.0), CSR-363 (25.6)
Main shoot length (cm)	32.0 JMG-240	102.6 CSR-14	CSR-14 (102.6), JMG-365 (101.8), JMG-239 (98.4), CSR-213 (97.3), CSR-52 (96.6)
Siliquae on main raceme (no.)	15.6 CSR-336	62.4 CSR-57	CSR-57 (62.4), CSR-57 (61.0), CSR-326 (60.0), CSR-28 (60.0), JMG-410 (56.6)
Siliqua/ length (cm)	2.6 JMG-262	5.0 JMG-116	JMG-116 (5.0), JMG-154 (4.7), JMG-128 (4.6), JMG-37 (4.5), JMG-36 (4.5)
Seeds / siliqua (no.)	7.6 CSR-430	20.0 JMG-80	JMG-80 (20.0), JMG-205 (18.4), JMG-160 (17.8), CSR-82 (16.7), JMG-31 (15.6)
1000-seed weight (g)	2.6 BACR-24	8.2 JMG-419	JMG-419 (8.2), RC-155 (7.2), CSR-955 (6.1), CSR-396 (5.7), BACR-54 (5.8)
Seed yield/ plant (g)	3.9 BSC-54	17.9 BSC-181	CSR-825 (17.9), CSR 188 (14.8), JMG-363 (12.3), JMG 464 (13.7), CSR-173 (12.8)
Oil content (%)	36.0 CSR-250	43.7 CSR-3	CSR-3 (43.7), JMG-117 (42.6), JMG-111 (42.8), JMG-425 (43.0), CSR-880 (42.6)

* Figure within parenthesis under accessions is the mean value.

Table 2 : Range and five promising accessions of *B. campestris* var. Brown Sarson for different agro-morphological traits

Character	Range		Accessions
Days to flowering	20 BSC-74	60 BSC-41	BSC-41 (60), BSC-91 (45), BSC-122 (38), BSC-54 (36), BSC-148 (36)
Days to maturity	116 BSC-83	136 BSC-159	BSC-159 (136), SC-191 (130), BSC-176 (130), BSC-142 (130), BSC-121 (130)
Plant height (cm)	112.2 BSC-116	189 BSC-120	BSC-120 (189.0), BSC-89 (185.2), BSC-76 (184.8), BSC-51 (184.2), BSC-154 (179.4)
Primary branches/ plant (no.)	3.8 BSC-67	12.5 BSC-80	BSC-80 (12.5), BSC-52 (11.4), BSC-94 (9.6), BSC-202 (10.0), BSC-159 (9.4)
Secondary branches/ plant (no.)	2.8 BSC-95	25.5 BSC-80	BSC-80 (25.5), BSC-45 (16.0), BSC-62 (16.4), BSC-111 (18.6), BSC-189 (16.2)
Main shoot length (cm.)	43.2 BSC-142	89.4 BSC-194	BSC-194 (89.4), BSC-190 (84.6), BSC-153 (84.0), BSC-90 (84.8), BSC-144 (80.4)
Siliquae on main raceme (no.)	24.8 BSC-142	64.8 BSC-58	BSC-58 (64.0), BSC-49 (49.0), BSC-90 (51.8), BSC-115 (48.0), BSC-152 (51.2)
Siliqua length (cm.)	2.44 BSC-191	5.8 BSC-151	BSC-151 (5.8), BSC-193 (5.24), BSC-182 (5.78), BSC-144 (5.4), BSC-82 (5.7)
Seeds/siliqua (no.)	2.44 BSC-191	23.6 BSC-182	BSC-182 (23.6), BSC-95 (23.2), BSC-60 (22.2), BSC-193 (21.2), BSC-144 (22.0)
1000 Seed weight (g)	2.11 BSC-159	6.21 BSC-80	BSC-80 (6.21), BSC-194 (5.82), BSC-58 (5.67), BSC-96 (4.99), BSC-152 (4.50)
Seed yield/ plant (g)	6.28 BSC-54	24.48 BSC-181	BSC-181 (24.48), BSC-122 (19.41), BSC-41 (18.18), BSC-159 (18.28), BSC-115 (17.70)
Oil content (%)	38.0 BSC-76	42.9 BSC-186	BSC-186 (42.9), BSC-45 (42.7), BSC-82 (42.4), BSC-171 (41.8), BSC-137 (41.3)

* Figure within parenthesis under accessions is the mean value.

Table 3 : Range and five promising accessions of *B. campestris* var. Yellow Sarson for different agro-morphological traits

Character	Range		Accessions
Days to flowering	36 YSPG-287	64 YSC-67	YSC-67 (64), YSC-126 (60), YSC-21 (58), YSC-91 (59), YSC-42 (58)
Days to maturity	108 YSC-7	136 YSC-12	YSC-12 (136), YSC-8 (132), YSC-4 (132), YSC-56 (136), YSC-70 (133)
Plant height (cm)	91 PYS-842	188.2 YSC-138	YSC-138 (188.2), YSC-3 (185.0), YSC-92 (187.4), YSC-14 (186.4), YSC-30 (186.6)
Primary branches/ plant (no.)	4.2 YSC-6	18.8 PYS-386	PYS-386 (18.8), YSC-59 (14.5), YSC-65 (14.0), YSC-111 (16.2), YSC-140 (12.8)
Secondary branches/ plant (no.)	2.0 PYS-842	22.5 YSSC-59	YSC-59 (22.5), YSPG-287 (11.2), YSC-74 (14.6), YSC-34 (13.2), YSC-140 (9.8)
Main shoot length (cm)	39 PYS-386	88.2 YSC-112	YSC-112 (88.2), YSC-116 (79.2), YSC-3 (79.2), YSC-70 (73.8), YSC-59 (72.5)
Siliqua on main raceme (no.)	20 PYS-842	57.6 YSPG-842	YSPG-842 (57.6), YSC-10 (50.8), YSC-89 (50.1), YS-8 (52.8), YSC-102 (48.2)
Siliqua length (cm)	3.1 PYS-842	5.8 YSC-17	YSC-17 (5.8), YSPG-186 (5.2), YSC-45 (5.3), YSC-123 (5.3), YSCN-11 (5.0)
Seeds/siliqua (no.)	8.6 YSC-108	40.4 YSPG-842	YSPG-842 (40.4), YSCN-12 (35.4), YSC-93 (31.2), YSC-563 (30.2), YSC-38 (35.2)
1000-seed weight (g)	3.25 YSC-449	6.03 YSC-17	YSC-17 (6.03), YSC-13 (5.92), YSC-102 (5.49), YSC-9 (5.13), YSC-112 (5.83)
Seed yield/ plant (g)	2.9 YSC-37	23.4 YSC-111	YSC-111 (23.4), YSCG-387 (21.8), YSPG-104 (13.8), YSC-105 (13.4), YSC-38 (10.6)
Oil content (%)	42.9 YSC-30	45.3 YSC-30	YSC-39 (45.3), NDYS-921 (45.3), YSCN-3 (44.7), YSC-3 (44.3), YSC-147 (44.0)

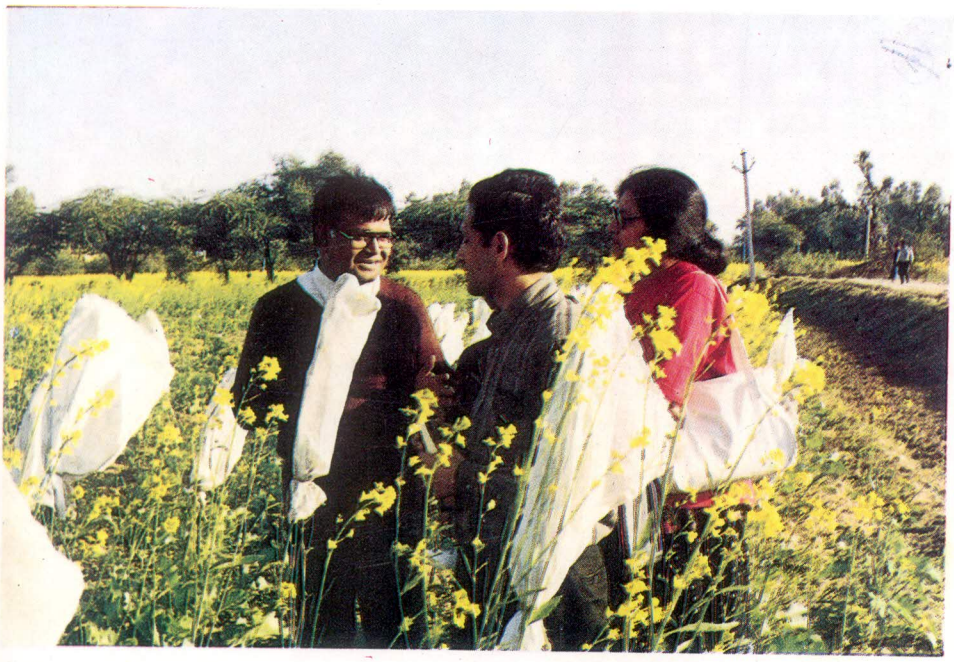
* Figure within parenthesis under accessions is the mean value.

Table 4 : Range and five promising accessions of *B. napus* for different agro-morphological traits

Character	Range		Accessions
Days to Flowering	26 NECN-13	66 BN-24	BN-24 (66), BN-11 (64), NECN-11 (64), GLS-64 (58), ISN-114 (54)
Days to maturity	148 PBNS-91	159 BN-4	BN-4 (159), BN-41 (159), NECN-2 (158), GSL-64 (154), WW-1507 (154)
Plant height (cm)	80.6 Westar	178.2 GLS-8811	GSl-8811 (179.2), ISN-733 (WF) (177.0), ISN-733 (171.6), BN-10 (167.4), NECN-3 (156.4)
Primary branches/ plant (no.)	3.0 NECN-10	9.0 NECN	NECN-2 (9.0), GSL-8851 (8.8), PCT-01 (8.6) TARANDO (7.6), BN-4 (7.0)
Secondary branches/ plant (no.)	2.6 BN-14	14.6 GSL-8851	GLS-8851 (14.6), BN-8 (13.6), PCT-01 (12.4), KBNS-10 (12.0), Tarando (11.8)
Main shoot length (cm)	25.2 Sevenell	89.4 PBNS-91	PBNS-91 (89.4), Culture-2 (82.4), Culture-1 (80.2), GSL-8811 (70.6), BN-10 (68.6)
Siliquae on main raceme (no.)	19.6 Sevenell	51.4 BN-10	BN-10 (51.4), Culture-2 (49.8), ISN-733 (48.8), GSL-8811 (48.8), NECN-3 (44.6)
Siliqua legnth (cm)	3.6 BN-50	6.92 Culture-2	Culture-2 (6.9), BN-17 (6.0), BN-23 (5.7), BN-16 (5.5), NECN-3 (5.6)
Seeds/siliqua (no.)	9.2 PBN-91	25.4 M-20-12-2	N-20-12-2 (25.4), Culture-2 (25.4), NECN-3 (24.6), NECN-17 (22.2), BN-17 (22.2)
1000-seed weight (g)	3.7 PBGS-93	6.9 GLS-8814	GSL-8814 (6.9), Cult. 2 (5.2), BN-50 (4.8), ISN-602 (4.0), BN-14 (3.8)
Seed yield/ plant (g)	2.1 PBGS-93	13.1 Comet	Comet (13.6), PBGS-91 (10.3), NECN-12 (8.1), NECN-17 (5.2), N-20-12-2 (5.8)
Oil content (%)	38.7 BN-14	40.4 GSL-8814	GSL-8814 (40.4), BN-50 (40.2), Cult. 1 (40.2), BN-41 (39.9), ISN-602 (39.9)

* Figure within parenthesis under accessions is the mean value.

Overseas Development Agency experts looking into the rapeseed-mustard germplasm



Scientists from Pioneer Hibreed, Canada in germplasm maintenance block

Cultivar Development

Quality

To improve the oil and seed meal quality of existing high yielding varieties, the following 30 fresh crosses were made.

Pusa Bold × QM 14	EC 333575 × PCR 3
Pusa Bold × EC 287711	EC 333576 × PCR 3
Rohini × QM 14	EC 333577 × PCR 3
Rohini × EC 287711	EC 333578 × PCR 3
RH 819 × QM 14	EC 333579 × PCR 3
RH 819 × EC 287711	EC 333580 × PCR 3
RL 1359 × QM 14	EC 333581 × PCR 3
RL 1359 × EC 287711	EC 333589 × PCR 3
EC 333591 × PCR 3	EC 333590 × PCR 3
EC 333593 × PCR 3	EC 333575 × PCR 7
EC 333576 × PCR 7	EC 333577 × PCR 7
EC 333578 × PCR 7	EC 333579 × PCR 7
EC 333580 × PCR 7	EC 333581 × PCR 7
EC 333589 × PCR 7	EC 333590 × PCR 7
EC 333591 × PCR 7	EC 333593 × PCR 7

One hundred ninety nine genotypes of rapeseed-mustard having improved quality traits were grown, selfed and further selection were made.

Evaluation

The following segregating and non-segregating generations were evaluated and selections with desirable characters were made :

Generation	No. of crosses	Parentage
F_1 (Single crosses)	4	YSRL 9 × RH 30, YSRL 9 × PCR 7, RLM 619 × PCR 3, Rohini × PCR 3
F_1 (Multiple crosses)	5	(Pusa Basant × PCR 3) × Shiva, (RH 819 × PCR 3) × Shiva, (RH 30 × PCR 3) Shiva, (RLM 619 × PCR 3) × Shiva, (Rohini × PCR 3) × Shiva.
F_2 (Single crosses)	17	B-85 (Glossy) × Shiva, RL 1359 × Shiva, Rl 1359 × PCR 3, Kranti × Shiva, Kranti × PCR 3, Pusa Bold × Shiva, Pusa Bold × PR 3, PCR 3 × Shiva, Pusa Basant × Shiva, Pusa Basant × PCR 3, RH 819 × Shiva, RH 819 × PCR 3, RH 30 × Shiva, RH 30 × PCR 3, RLM 619 × Shiva, YSRL 9 × RH 30, Rohini × Shiva.
F_2 (Multiple crosses)	3	(B-85 (Glossy) × PCR 3) × Shiva, (Rl 1359 × PCR 3) × Shiva, (Kranti × PCR 3) × Shiva.
F_3 (Back cross generations)	6	(Domo × Pusa Bold) × Domo, (Domo × (Pusa Bahar) Pusa Bahar, (Varuna × EC 32220939) × Varuna, (RH 8113 × Domo) × RH 8113, (Domo × RH 30) × RH 30, (PCR 3 × Shiva) × Shiva.
F_3 (Single crosses)	44	PCR20 × EC287711, PCR 7 × EC322093, PCR3 × EC322093, PCR3 × EC322092, RH30 × EC322093, EC322090 × Pusa Bahar, RH30 × EC322093, PCR3 × EC333591, PCR4 × EC333591, PCR7 × EC333591, PCR9 × EC333591, PCR9A × EC333591, PCR13 × EC333591, PCR19 × EC333591, DYS25-10 × EC333591, PCR4 × EC333589, PCR9 × EC333589, PCR9A × EC333589, PCR9 × EC333589, PCR9A × EC333589, PCR13 × EC333589, PCR14 × EC333589, PCR15 × EC333589, PCR19 × EC333589, PCR20 × EC333589, PCR4 × EC333590, PCR9A × EC333589, PCR13 × EC333590, PCR14 × EC333589, PCR9A × EC3335990, PCR20 × EC333590, PCR9 × EC333591, PCR14 × EC333591, PCR20 × EC333593, PCR3 × EC287711, PCR4 × EC287711, PCR7 × EC287711, PCR9 × EC287711, PCR9A × EC287711, PCR13 × EC287711, PCR14 × EC287711, PCR15 × EC287711, PCR19 × EC287711, PCR20 × EC287711

Director showing the typical pod setting in jatai sarson to Prof. Rempel, Univ. of Manitoba, Canada.

Dr. Chapke, Deputy General Manager, RCF Ltd., Bombay viewing the variability for pod setting in yellow sarson germplasm.

Sh. Subhash Garg, Director Agriculture, Rajasthan visiting experimental fields

Deputy Director General looking into the male sterility system in *β. juncea*

Important Gene Pool Evaluated

PCR-3	—	Long siliqua, increased seeds per siliqua and medium bold seeded.
PCR-10	—	Bold seeded, late maturing and tolerant to aphid and foliar diseases.
PCR-19 & PCR-20	—	Profusely branched.
DYS-25-9	—	High oil yield per se and bold seeded.

Hybrid Breeding

Identification of Male Sterility System

To identify the most effective male sterility system for the production of commercial hybrids in rapeseed-mustard, segregating material derived from four CMS sources, viz., *tournefortii, oxyrrhina, siifolia* and *ogura* were evaluated.

Conversion Programme

Efforts continued to transfer different CMS systems through repeated back crossing to the diverse agronomic background. The sixth, fifth, fourth and third cycle of back cross substitution were completed (Table 5)

Identification of Restorers

To identify restorers, 170 F_1 hybrids based on different CMS systems, viz., 50 *tournefortii,* 30 *oxyrrhina* and 90 *siifolia* were evaluated for fertility restoration but none of the hybrid restored fertility fully.

Table 5 : Development of new CMS lines :

Backcross Generation	Varieties/Strains
tournefortii CMS	
6th	Pusa Bold, Sanjucta Asech, PCR-1, B-85 (glossy), RH-30, Pusa Basant, Varuna and Prakash
5th	Rohini, PCR-7 (Rajat), Kranti, PCR-3, PCR-4, PCR-8 and PCR-19
4th	DIR-313, PCR-6, Pusa Bold, RH-30, Kranti and Rohini
3rd	RH-7361, Pusa Basant, RLM-619, PCR-1, PCR-9 and Varuna
oxyrrhina CMS	
3rd	Pusa Bold, Kranti, RH-30, Varuna, PCR-1 and Varuna
siifolia CMS	
2nd	PCR-10, PCR-11, PCR-19, PCR-20, RH-30 and RH-819
ogura CMS	
3rd	Pusa Bold, PCR-7, RL-1359 and Kranti
2nd	PCR-3, Rohini

Improvement of Parental Lines

With the following promising lines, heterotic gene pool was developed at the PC Unit, Hisar for different desirable yield attributes. Their performance was evaluated during the period under report.

BREEDER SEED PRODUCTION

One thousand seven hundred Kg seed of Rajat was produced against the target of 50 Kg.

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3rd	RH-7361, Pusa Basant, RLM-619, PCR-1, PCR-9 and Varuna
oxyrrhina CMS	
3rd	Pusa Bold, Kranti, RH-30, Varuna, PCR-1 and Varuna
siifolia CMS	
2nd	PCR-10, PCR-11, PCR-19, PCR-20, RH-30 and RH-819
ogura CMS	
3rd	Pusa Bold, PCR-7, RL-1359 and Kranti
2nd	PCR-3, Rohini

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Rajat ready for bumper harvest in NRCRM field.

Director IARI being shown the long podded newly developed mustard genotype

Dr. D. P. Si

Dr. S. S. Rajan, Ex. Advisor, FAO
being shown the promising breeding material

Dr. D. P. Singh, ADG (OP) with Director at the experimental fields

CROP PRODUCTION

Production Factors

Two experiments, viz., contribution of different technological components and sulphur and nitrogen requirements which were conducted during 1993-94 were repeated during 1994-95.

Contribution of Technology Components

Fifteen treatments were taken in a RBD with three replications. The treatments included recommended practices and recommended practices without one or more technological components, namely, thinning, fertilizers, irrigation and plant protections. The sowing was done on November 25, 1994 taking RH 30 variety of mustard.

The recommended practices gave significantly higher yield over treatment T_3, T_4, T_7, T_9, T_{10}, T_{11} and T_{13}. The broadcast sowing (T_1) reduced the seed yield by 20 percent as compared to recommended practices (T_2). Out of the four components, the fertilizer (T_4) was the single most important component, contributing 38 per cent to seed yield. The thinning was next to fertilizer as in its absence there was upto 31 per cent of yield loss.

Among different combinations of two components, thinning and plant protection was the most important. In the treatment where these two components were missing, the seed yield was 57 per cent lower as compared to that in recommended practices. This combination was followed by that of fertilizer and irrigation.

No significant effect of different treatments was observed on oil content (Table 6).

Table 6 :

Treat-ments	
T_1	
T_2	
T_3	
T_4	
T_5	
T_6	
T_7	
T_8	
T_9	
T_{10}	
T_{11}	
T_{12}	
T_{13}	
T_{14}	
T_{15}	
CD at 5%	

T_1—Broadcast
T_3—Recommended
T_5—Recommended
protection; T_7—Reco
without thinning and
T_{10}—Recommended
fertilizer and plant pr
T_{13}—Recommended
practices without thin
thinning, fertilizer, irri

Table 6 : Yield attributes and seed yield and oil content of mustard as influenced by different component of technology under late sown condition

Treat-ments	Branches/ plant (no.)	Siliquae/ plant (no.)	Seeds/ siliqua (no.)	1000-seed weight (g)	Seed yield (kg/ha)	Oil content (%)
T_1	24.0	204.6	24.7	9.0	951	41.2
T_2	25.3	211.5	25.7	8.4	1193	37.8
T_3	24.6	250.1	24.5	8.5	827	40.9
T_4	20.8	226.1	26.3	9.5	741	29.4
T_5	19.3	179.1	25.0	9.1	948	41.4
T_6	18.4	199.6	22.3	9.0	1364	38.8
T_7	23.5	208.1	24.3	8.5	569	40.6
T_8	24.2	189.4	24.2	9.4	890	39.7
T_9	26.2	246.2	24.6	9.3	510	40.1
T_{10}	21.8	213.2	23.6	8.2	563	40.7
T_{11}	18.6	179.8	24.6	9.2	777	40.9
T_{12}	16.6	162.2	25.2	8.7	1346	38.8
T_{13}	31.9	239.0	24.6	8.8	819	40.9
T_{14}	24.2	173.9	24.8	9.2	1406	40.2
T_{15}	25.2	209.2	22.7	9.4	1016	39.7
CD at 5%	NS	NS	NS	NS	320	NS

T_1—Broadcast sowing with recommended practices; T_2—Recommended practices; T_3—Recommended practices without thinning; T_4—Recommended practices without fertilizer; T_5—Recommended practices without irrigation; T_6—Recommended practices without plant protection; T_7—Recommended practices without thinning and fertilizer; T_8—Recommended practices without thinning and irrigation; T_9—Recommended practices without thinning and plant protection; T_{10}—Recommended practices without fertilizer and irrigation; T_{11}—Recommended practices without fertilizer and plant protection; T_{12}—Recommended practices without irrigation and plant protection; T_{13}—Recommended practices without thinning, fertilizer and plant protection; T_{14}—Recommended practices without thinning, irrigation and plant protection and T_{15}—Recommended practices without thinning, fertilizer, irrigation and plant protection.

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Sulphur and Nitrogen Fertilization

The experiment taking five levels of sulphur (0, 15, 30, 45 and 60 Kg/ha) and three levels of nitrogen (60, 90 and 120 Kg/ha) was laid out in a factorial RBD with three replications. The sowing was done on 22nd of November, 1994 with RH 30 variety of mustard.

As is evident from Table 7, the maximum seed yield was obtained at 30 Kg/ha 'S' level, the higher rates of sulphur could not increase the seed yield as in the 1993-94. Increase in the seed yield was mainly due to increase in the number of siliqua per plant and number of seed per siliqua. The response for nitrogen was also the highest at the rate 60 Kg/ha, which gave maximum seed yield (1700 Kg/ha).

The levels of nitrogen and sulphur could not affect the oil content significantly. However, there was 2 per cent increase in oil content over control when 30 Kg/ha sulphur was applied.

Table 7 : Influence of different levels of sulphur and nitrogen on yield attributes, seed yield and oil content of mustard under late sown condition

Treat-ment	Branches/ plant (no.)	Siliquae/ plant (no.)	Seeds/ siliqua (no.)	1000-seed weight (g)	Seed yield (kg/ha)	Oil content (%)
Sulphur (Kg/ha)						
0	20.4	298.0	22.1	8.8	1677.8	37.8
15	14.8	297.0	20.8	8.7	1333.3	39.7
30	19.5	358.7	22.1	8.7	1833.3	39.5
45	16.4	287.9	20.9	8.9	944.4	39.2
60	19.4	448.6	21.7	8.8	1000.0	39.2
CD at 5%	NS	115.8	NS	NS		NS
Nitrogen (Kg/ha)						
60	16.8	302.2	21.4	8.8	1700.0	39.8
90	15.8	357.3	21.8	8.7	1253.3	39.8
120	21.5	355.2	21.4	8.8	1120.0	37.7
CD at 5%	NS	NS	NS	NS	NS	NS

BIOCHEMISTRY

Two thousand two hundred eighty two Germplasm lines of Indian mustard, brown sarson, yellow sarson and gobhi sarson were analysed for oil content by NMR. The five promising germplasm lines identified for high oil content, alongwith the number of samples analysed in each group and the range of oil content are presented below :

Indian Mustard (*B. juncea*)

Number of samples analysed : 1840

Range of oil content (%) : 36.0 – 43.7

High oil content genotypes : CSR-880 (42.6)
JMG-117 (42.6)
JMG-111 (42.8)
JMG-425 (43.0)
CSR-3 (43.7)

Gobhi Sarson (*B. napus*)

Number of samples analysed : 72

Range of oil content (%) : 38.7 – 40.4

High oil content genotypes : ISN-602 (39.9)
BN-41 (40.2)
Cult. 1 (40.2)
BN-50 (40.2)
GLS-8814 (40.4)

Brown Sarson (*B. campestris* var. Brown Sarson)

Number of samples analysed : 215

Range of oil content : 38.0 – 42.9

High oil content genotypes : BSC-137 (41.3)
BSC-171 (41.8)
BSC-82 (42.4)
BSC-45 (42.7)
BSC-186 (42.9)

Yellow Sarson (*B. campestris* var. Yellow Sarson)

Number of samples analysed : 155
Range of oil content (%) : 42.9 – 45.3
High oil content genotypes : YSC-147 (44.0)
YSC-3 (44.3)
YSCN-3 (44.7)
NDYS-921 (45.3)
YSC-39 (45.3)

SARSON VIGYAN MELA

Second Sarson Vigyan Mela was inagurated by Dr. R. B. Singh, Director, Indian Agricultural Research Institute, New Delhi on March 14, 1995. Sh. G. C. Tiwari, Ex. Speaker of Vidhan Sabha, Rajasthan was the guest of honour. Farmers from Rajasthan and neighbouring states of Madhya Pradesh and Uttar Pradesh and scientists from Jammu and Kashmir, Uttar Pradesh and Madhya Pradesh participated in the mela. A technical bulletin entitled, "SARSON" was also released.

PUBLICATIONS

Invited Papers

1. Kumar, P. R. and Dhiraj Singh (1994). Breeding for Disease Resistance in Oil-seed *Brassicas*, Group Meeting of Rapeseed-Mustard Pathologists and Breeders held at the Punjab Agricultural University, Ludhiana, May 11-12, p. 15.
2. Kumar, P. R. (1994). Rapeseed-Mustard Breeding Paper presented at the Summer Institute on the "Recent Advances in Plant Breeding" at the Rajendra Agricultural University, Pusa, June 1994, p. 22.
3. Kumar P. R. (1994). Studies on the Development of "0" and "00" Varieties of Rapeseed-Mustard, First Annual Group Meeting of Rapeseed-Mustard Research Workers held at the College of Agriculture, JNKVV, Gwalior, August 20-22, p. 20.
4. Kumar P. R. (1995). Development of "0" and "00" Cultivars and Strategies for Researches on quality traits in Rapeseed-Mustard : Paper presented in the Review Meeting on Development of Single and Double Zero Varieties of Rapeseed-Mustard organised by NOVOD Board, Gurgaon, Feb. 20.

Technical Reports/Papers

1. First Annual Report (1994). All India Co-ordinated Research Project on Rapeseed-Mustard, National Research Centre on Rapeseed-Mustard, Bharatpur, p. 304.
2. Director's Report (1994). First All India Co-ordinated Research Project on Rapeseed-Mustard, Bharatpur, p. 21.
3. Proceedings (1994). First All India Co-ordinated Research Project on Rapeseed-Mustard, Group Meeting held at the College of Agriculture, Gwalior, p. 49.

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1. Kumar, P. R. and Dhiraj Singh (1994). Breeding for Disease Resistance in Oil-seed *Brassicas*. Group Meeting of Rapeseed-Mustard Pathologists and Breeders held at the Punjab Agricultural University, Ludhiana, May 11-12, p. 15.
2. Kumar, P. R. (1994). Rapeseed-Mustard Breeding Paper presented at the Summer Institute on the "Recent Advances in Plant Breeding" at the Rajendra Agricultural University, Pusa, June 1994, p. 22.
3. Kumar P. R. (1994). Studies on the Development of "0" and "00" Varieties of Rapeseed-Mustard, First Annual Group Meeting of Rapeseed-Mustard Research Workers held at the College of Agriculture, JNKVV, Gwalior, August 20-22, p. 20.
4. Kumar P. R. (1995). Development of "0" and "00" Cultivars and Strategies for Researches on quality traits in Rapeseed-Mustard : Paper presented in the Review Meeting on Development of Single and Double Zero Varieties of Rapeseed-Mustard organised by NOVOD Board, Gurgaon, Feb. 20.

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2. Director's Report (1994). First All India Co-ordinated Research Project on Rapeseed-Mustard, Bharatpur, p. 21.
3. Proceedings (1994). First All India Co-ordinated Research Project on Rapeseed-Mustard, Group Meeting held at the College of Agriculture, Gwalior, p. 49.

4. Major achievements, 1984-94. All India Co-ordinated Reserach Project on Rapeseed-Mustard, National Research Centre on Rapeseed-Mustard, Bharatpur, 1994 p. 10.

5. Annual Report (1994). Annual Seed Review Meeting, IARI, New Delhi, p. 5.

6. Technology Mission on Oilseed-Micro Mission I (1995). Crop Production Technology : Activity-wise Progress Report upto June 1994-Rapeseed-Mustard for the Review Meeting of the TMOP, Indian Institute of the Pulses Research, Kanpur, January 4-6, 1995. p. 24.

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Technical Bulletins

Sarson (1995). Technical Bulletin No. 2, National Research Centre on Rapeseed-Mustard, Bharatpur, p. 6.

DISTINGUISHED VISITORS

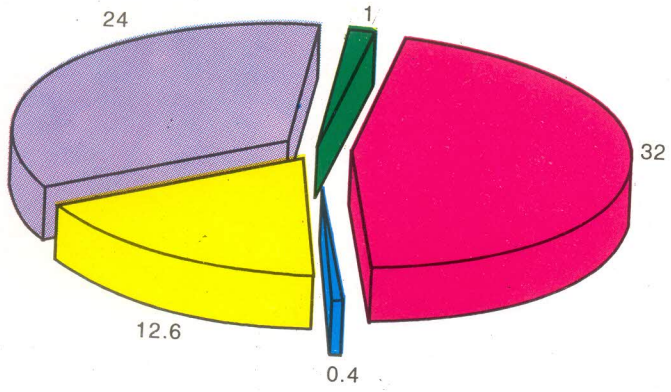
Dec. 4, 1994	Sh. Issac M. Kibotherand
Dec. 4, 1994	Dr. Julius O. Nyabundi, Ministry of Agriculture, Nairobi, Kenya
Dec. 15, 1994	Sh. Pankaj N. Mehta, Research Manager, Pioneer Hibrid, Canada
Dec. 29, 1994	Sh. Subhash Garg, IAS, Director Agriculture, Jaipur
Feb. 18, 1995	Dr. E. A. Siddiq, Deputy Director General (Crop Sciences), ICAR, New Delhi
Feb. 24, 1995	Sh. R. P. Sharma, MLA, Bharatpur
Feb. 25, 1995	Prof. Henry Rempel, University of Manitoba, Winnipeg, Canada
Feb. 27, 1995	Dr. R. Smith, Senior Agriculture Reserach Advisor, ODA, London
March 3, 1995	Dr. V. G. Chapke, Deputy General Manager, RCF Ltd., Mumbai
March 14, 1995	Prof. R. B. Singh, Director, IARI, New Delhi
March 14, 1995	Dr. B. Rai, Prof. of Genetics & Plant Breeding, BHU, Varanasi
March 27, 1995	Dr. S. S. Rajan, Ex-Advisor (Oilseeds), FAO, Bangalore

STAFF POSITION

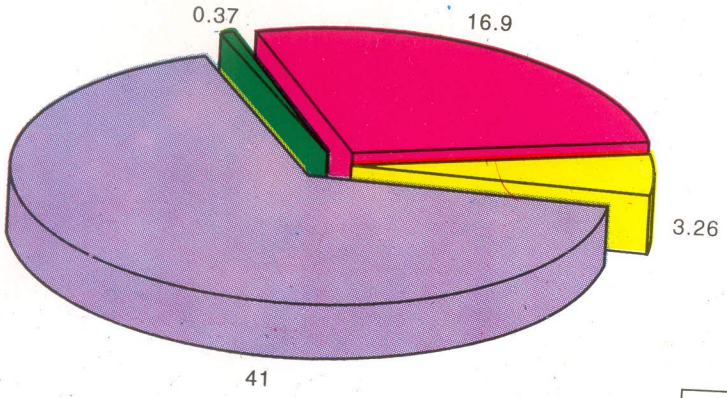
Research Management	Date of joining
Director	
Dr. P. R. Kumar	20-10-1993
Scientific	
Dr. Bhoori Singh. Sr. Scientist (Agronomy)	01-02-1995
Technical	
Sh. Sanjay Kumar T-1	16-12-1994
Sh. R. C. Meena T-1	19-12-1994
Administration & Auxilary	
Sh. Mohan Singh, Superintendent	25-01-1994
Sh. L. K. Sharma, Assistant	06-06-1994
Sh. O. P. Verma, Assistant	10-02-1995
Sh. J. L. Sharma, Stenographer	14-02-1995

Staff	Sanctioned Positions	Filled
Director	1	1
Scientific	17	1
Technical	14	2
Administrative	10	4
Supporting	3	—

BUDGETORY DETAILS FOR 1994-95 (Rs. in Lakhs)



Budget Sanctioned



Budget Expenditure

- Works
- Other Items
- Establishment
- Other Charges
- T.A.