XLI

ANNUAL RABI OILSEED RESEARCH WORKERS' GROUP MEETING

RAPESEED - MUSTARD,
RABI/SUMMER GROUNDNUT,
SAFFLOWER & LINSEED

AUGUST 18-21, 1992

PKV, NAGPUR

ANNUAL PROGRESS REPORT

RAPESEED - MUSTARD

1991-92

All India Co-ordinated
Research Project On Oilseeds

ICAR

DIRECTORATE OF
OILSEEDS RESEARCH
RAJENDRANAGAR
HYDERABAD-500 030

XLI ANNUAL RABI OILSEED RESEARCH WORKERS
GROUP MEETING OF RAPESEED-MUSTARD, RABI/SUMMER
GROUNDNUT, SAFFLOWER AND LINSEED

PUNJABRAO KRISHI VIDYAPEETH
NAGPUR (MAHARASHTRA)

AUGUST 18 21, 1992

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ANNUAL PROGRESS REPORT
RAPESEED-MUSTARD
1991-92

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(Indian Council of Agricultural Research)
DIRECTORATE OF OILSEEDS RESEARCH
RAJENDRANAGAR, HYDERABAD-500 030

1992

PREFACE

The Directorate of Oilseeds Research is pleased to present the Annual Progress Report of Rapeseed-Mustard for the year 1991-92 to the oilseed research workers participating in the XLI Annual Rabi Oilseed Research Wokrers' Group Meeting scheduled to be held at College of Agriculture, PKV, Nagpur from August 18-21, 1992.

The country has crossed yet another barrier imposed by uncertain monsoon conditions to achieve a significant progress in the oilseeds production this year. Despite an alround progress in all the annual oilseed crops, the major gain in the oilseeds front this year has been principally due to the increased production of rapeseed-mustard amounting to almost 6 million tonnes. Deficiencies due to decreased production of kharif groundnut were off-set to a great extent by the increased coverage as well as production of mustard crop, thereby buffering the total oilseed production in the country to a great extent. The pivotal role played by rapeseed-mustard group of crops whose production until 1986-87 hardly crossed 3 million tonnes has been remarkable in bringing about rapid strides in the Indian oilseed scenario leading to the silent yellow revolution.

While the country could be legitimately proud of this spectacular performance it should be recognised that there exists tremendous gap between the current productivity levels on one hand and the yields achievable with the already available improved technology on the other. Secondly the critical analysis of the yield potentials of available varietal complex in this group of crops reveals a picture of yield stagnation without any major breakthrough. It is therefore necessary that while trying to bridge the gap between the current yield levels and the demonstrable productivity levels in the field on one hand, efforts should also be intensified to overcome the impediments to achieve breakthrough in productivity levels on the other. The impressive array of germplasm available in the rapeseed-mustard group of crops is yet to be successfully utilised in this context. There is a case for **germplasm enhancement** which no doubt would pay rich dividends in crossing the barriers to the productivity. Another area of research which needs to be intensified is the development of '0' and '00' varieties. Considering the time lag in this context, results available are far from encouraging. It may be appreciated that while the 'canola' varieties have actually revolutionised the production and utilisation of rapeseed-mustard in several parts of the world, we are yet to make a beginning in this regard. It is not out of place to stress that our main emphasis should be to breed the varieties with low glucosinolate content so that cake left after oil extraction could find ready export market. The crucifera in general and rapeseed-mustard group of crops in particular offer enormous potentialities for the practical exploitation of heterosis and as such the country has launched in recent years a special project on the promotion of hybrid research and developmental efforts. Notwithstanding the slow progress in this line of work it is heartening to note that fertility restoration has been reported for the tourneferti cytoplasm in the background of Brassica Juncea at IARI, New Delhi. While no doubt the current efforts with diverse CMS systems are to be continued to overcome the problems of restoration and instability, the other areas of research more particularly the exploitation of sporophytic incompatibility system at deploid level should not be lost sight of.

P.T.O

This year is also characterised by a mild incidence of aphid (Lipaphis erysimi), moderate to low incidence of Alternaria blight and white rust and moderate to low occurrence of downey mildew and powdery mildew diseases. These biotic stresses pose a serious threat particularly under late sown conditions. The incidence of clubrot in West Bengal, sclerotenia-rot in Rajasthan, Western U.P. and Haryana and powdery mildew in Gujarat and Rajasthan should not be ignored and the efforts with regard to management of biotic stresses need to be further intensified. Identification of diverse sources of tolerance from among the available genetic resources of Brassica and other species of cruciferae no doubt offers very bright prospects for achieving progress towards higher levels of genetic resistance for biotic factors. It is doubtless, the current efforts in the areas have to be intensified expeditiously to consolidate the gains so far made and achieve higher levels of stability. Diversification of cultivation of rapeseed-mustard group of crops is another area which has not received the attention it deserves. The development of genotypes for harnessing the under-exploited agro-ecological situations of the Indo-Gangetic belt is another urgent need.

Dr. Parkash Kumar, Project Coordinator(R&M) and his team of scientists deserve appreciation for the excellent efforts they have put in in bringing out this report very effectively and well in time. Sincere thanks are also due to Drs. R.P. Gupta, Dhiraj Singh, Palaram, Sri S.L. Mehta, Dr. Naveen Chander, Sri M.C. Kamboj, and Sri S.R. Pundhir of the PC Unit(R&M), HAU, Hisar for their assistance in compilation and preparation of this report. The assistance rendered by the administrative and technical staff of the Directorate in bringing out this report in mimeograph form is also worthmentioning.

Hyderabad
Date: 05.08.1992

(M.V.R. PRASAD)
PROJECT DIRECTOR

RAPESEED-MUSTARD

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RAPESEED-MUSTARD

ANNUAL PROGRESS REPORT-RABI, 1991-92

SUMMARY-CUM-PROGRESS REPORT

1. Weather and its effect

The weather had been playing a hide and seek game with the mustard crop during the Rabi-1991-92. The less rains from September to November and almost total failure during the month of October, delayed the sowing of mustard crop and most of the area under mustard crop was either with pre-sowing irrigation or late sown. The temperature fluctuations during the reproductive stage in some zones, more specifically in zone-II, had adverse effect in the seed setting which later on was compensated to some extent by timely and widespread rains during winter. Hailstorm also had some damage in isolated pockets in some zones. The incidence of mustard aphid, Lipaphis erysimi on mustard crop was mild throughout the country except at Pantnagar, Rahuri and Junagadh where it appeared in mild form. The moderate to heavy infection of alternaria blight and white rust; moderate to low infection of downy mildew and powdery mildew diseases was observed in normal sown crop. However, under late sown condition the occurrence of diseases was very severe. Club rot in West Bengal, Sclerotinia rot in Rajasthan, Western U.P. and Haryana; powdery mildew in Gujarat and Rajasthan appeared on rapeseed-mustard crop. These diseases are now emerging as a threat to rapeseed-mustard cultivation in the country.

The research work on rapeseed-mustard was carried out in five zones of the country. The highlights of disciplinewise rapeseed-mustard research conducted at different centres, has been discussed in this report. However, the summary of work done at different centres in respect of different disciplines during 1991-92 have been given below:

2. PLANT BREEDING

Since the inception of MM-1, each centre has been assigned the specific mandate to tackle the problem. The summary of different projects assigned under this discipline to different cooperating centres under "Micro Mission-I On Crop Production Technology-(Rapeseed-Mustard)" are as under:

During the year under report good number of crosses have been attempted at different centres for increased seed yield. From the crosses initiated earlier, a large number of selection for high seed yield from segregating populations in different fillial generation have been made. In addition coordinated trials on mustard, toria, yellow sarson, taramira, gobhi sarson and karna sarson were conducted in different climatic conditions. The following three strains have been found to exhibit highest seed yield (Kg/ha) in different rapeseed-mustard trials conducted this year.

Number of trials and three top yielders:

SN	Crop	Three top yielders with yield and location		
1	Toria	SEJ-2 (2766 Kg/ha) Kaul	PT-9005 (2397 Kg/ha) Pantnagar	PT-303 (2218 Kg/ha) Kaul
2	Mustard	DLM-29 (3647 Kg/ha) S.K. Nagar	RJ-14 (3644 Kg/ha) Navgaon	BIO-946 (3616 Kg/ha) Navgaon
3	Yellow Sarson	YSBW-9 (1960 Kg/ha) Berhampore	SUBENOY (1656 Kg/ha) Berhampore	YSBW-881 (1196 Kg/ha) Berhampore
4	Taramira	RTM-112 (1447 Kg/ha) Jobner	RTM-314 (1362 Kg/ha) Jobner	T-27 (1283 Kg/ha) Jobner
5	Gobhi Sarson	SHIRALLEE (2846 Kg/ha) PC Unit	WW-1507 (2607 Kg/ha) Kanpur	PBGS-91 (2567 Kg/ha) PC Unit
6	Karan Sarson	DLSC-1 (3125 Kg/ha) IARI,New Delhi	HC-9001 (2812 Kg/ha) Kanpur	PPC-2 (2638 Kg/ha) **Bathinda**

The strains like RH-9006 (2145 Kg/ha), RH-9020 (1866 Kg/ha), RWAR-842 and S-3 (1249 Kg/ha) were observed to be tolerant to aphid besides being high yielding. The progenies in different fillial generations (i.e. F2, F3, F4) were sown at different centres and desirable plants showing resistant/ tolerant reaction have been selected under natural conditions. New crosses have also been developed using the identified donor parents.

Strains like RH-9030, RH-9036 and RH-9042 were reported to be tolerant to white rust and alternaria besides being high yielding. In addition, newly developed strains; PR-8925, PR-9006 and RWDR-847 for alternaria and PR-8998 and PR-9021 for white rust were identified at different centres. Efforts are being made to concentrate the genes for alternaria by crossing the tolerant/resistant lines in all possible combination at few centres. Single plants showing resistance/tolerance to various diseases have also been selected. The interspecific and intraspecific crosses have also lead to the development of lines showing resistance to alternaria and white rust. For powdry mildew, strains like; SKM-91-42, SKM-90-50 and SKM-91-49 were observed promising.

A trial with 21 strains possessing high oil content (more than 40%) were evaluated in different zones of the country. Good number of strains recorded oil content more than 40%. However, a strain RW-7/86 exhibited the highest oil content of 44.8%.

Among the mustard hybrids evaluated, PHR-2 recorded the seed yield of 1666 Kg/ha as against 1128 Kg/ha and 1425 Kg/ha of Varuna and Kranti, respectively in zone-III. The restorers for tournefortii system were identified at Ludhiana and IARI, New Delhi and being confirmed in offseason nursery. Two toria hybrids; NDTH-8 and PTH-10 were also observed promising. In yellow sarson a hybrid YSH-1 was observed to have significant positive heterosis for seed yield against better parent.

A strain, Dira-343, on the basis of four location average attained the highest seed yield of 991 Kg/ha compared to 892 Kg/ha of Kranti, the highest yielding check under salinity conditions.

A exotic strain, EC-287711 of mustard has been identified possessing high seed yield and desirable quality attributes in zone-II. The F3, F4, F5 and F6 breeding material was sown and desirable plants have been selected. The quality attributes of these plants have yet to be analysed. At Ludhiana, two plants have been selected from a cross TL-15 x Tower (F6) possessing low erucic acid (less than 2.5%). New crosses have also been attempted at different centres using the identified sources for zero erucic and glucosinolate.

147 lines, 785 lines and 2869 lines of different species of Brassica were maintained by using selfing/submating keeping in view their mating systems at Kangra, Dholi and PC Unit, respectively. At PC Unit, 2400 germplasm lines of Brassicas were evaluated for seed yield and its components. The data recorded on different quantitative traits indicated the presence of sufficient amouont of variability, for these traits. A total of 38 exotic germplasm of rapeseed-mustard from Sweden, Canada and U.K. were received through NBPGR, New Delhi. The seed of these lines will be distributed to different cooperating centres.

3. AGRONOMY:

~~The~~ contribution of different factors of production on the seed yield of rapeseed-mustard revealed that the application of fertilizer was very crucial. The recommended package of practices resulted into highest seed yield at all the stations. Minimum seed yield was recorded in the absence of fertilizer and irrigation at different locations. However, at Hisar and Dholi minimum seed yield was recorded when fertilizer and plant protection measures were missing.

Jalshakti application as seed coating @ 3% + soil application @ 6 Kg/ha with two irrigations recorded highest seed yield at Bathinda. At Navgaon, application of Jalshakti @ 4 Kg/ha + seed coating @ 3% gave highest seed yield. At Junagadh, the highest seed yields were obtained with recommended package (6 irrigations) followed by Jalshakti @ 3% seed coating + @ 6 Kg/ha with three irrigations.

Newly identified salinity tolerant mustard strain, CS-52 yielded maximum under recommended fertilizer doses at most of the centres.

The source and method of application of sulphur did not influence the seed yield of mustard at Bathinda, Navgaon, Pantnagar, Kanpur and Dholi. Application of 50 Kg sulphur/ha was observed effective to harvest highest seed yield at all the locations.

The folowing cropping sequences were reported to be most remunerative at following location:

Bathinda : Toria + Gobhi Sarson intercrop
Ludhiana : Sunflower - Toria
Morena : Toria + Gobhi Sarson
Pantnagar: Fodder (Cowpea) - Toria - Wheat
Kanpur : Maize - Toria

Tractor drawn seed drill was observed to be most efficient and effective followed by desi plough with funnel proved to be superior over prototype seed-cum-fertilizer drill.

4. ENTOMOLOGY

Incidence of mustard aphid, Lipaphis erysimi on rapeseed-mustard crop was mild throughout the country except at Pantnagar, Raipur and Junagadh where it appeared in moderate form.

New screening technique have been developed for evaluating the Brassica genotype against mustard aphid infestation at seedling stage at Ludhiana and by using single leaf of the host at vegetative stage at Hisar.

The strains; T-27, TMH-9002, TMH-9001, TMH-9003 of taramira and Nos. 848, 1131 and 1167 were found to be least susceptible to painted bug.

Mustard strains; DIRM-52, DLM-29, RK-919015 and RSM-9007 at three locations; TM-18-8, RJ-9, RJ-14, RM-9 and DIR-489 at two locations were found promising against mustard aphid in IVT under field testing.

In UPN trial, 19 genotypes namely; DLC-1, JMM-926, MTM-1, GSL-8887 and TMH-52 at five locations; DLC-2, ISN-129, RE-5, GSL-8861 and GSL-1501 at four locations and RK-8602, RW-32-2,

FM-23, FM-27, RSM-8904, GSL-8858, MTM-2, MTM-3 and HC-5 at three locations possessed moderate to high level of resistance to mustard aphid under field conditions.

The strains; T-6342 and RW-2-2 of Brassica juncea; DLC-1, DLC-2 of Brassica carinata and T-27 of Eruca sativa were adjudged resistant to aphid infestation under field and laboratory-cum-screen house testing.

Mustard aphid inflicted yield losses ranging from 2.8 to 64.9 per cent in various genotypes.

Some birds such as; Dove and Red vented Bulbul were reported damaging the flower buds and immature siliquae of Brassica napus at Navgaon and Pantnagar.

5.PLANT PATHOLOGY

Seven lines of Brassica juncea namely; RK-919015, YSRL-9, SJN-9, DIR-48, TM-18-8, PCR-4 and PR-8915 showed tolerant reaction against alternaria blight at more than one locations under artificial innoculation condition. Of the above lines, TM-18-8 of Brassica juncea was reported to be resistant to all the three major diseases such as; alternaria blight, white rust and downy mildew under artificial innoculation conditions and as well as under natural condition at more than one locations. In UPN trial, six lines of Brassica campestris i.e. PYS-841, PYS-842, YSK-8502 Span, NDYS-2, TRAWASE; 10 lines of Brassica juncea such as SSK-1, RH-8539, SSK-13, Zem-1, Zem-2, DIRA-313-6-7, Domo-4, RSK-33, BJ-1, CBYS-7b and one line of Brassica carinata, HC-2 were resistant to white rust at more than one locations.

Two strains, PB(ABRNT)-5 & 6 showed resistance/tolerance against alternaria blight at more than one locations. Lines; PB(WRRNT)-1-3-5 & 13 showed resistant reaction to white rust at more than two locations.

Iprodione (.2%) was quite effective in controlling the alternaria blight at most of the centres. Dinocap (0.05%) was best in controlling powdery mildew.

The combination of 1st spray of Ridomil followed by 2nd and 3rd spray of Iprodione at an interval of 15 days on 30th October sown crop have been reported to be most effective in maximising the yield and reducing the intensity of white rust and alternaria blight at most of the centres.

The rainfall during the last week of December favoured the developement of white rust on leaves as well as staghead formation on late planting crops. It also favoured the development of alternaria on siliquae.

Mycorrhizal innoculation pathogen restricted the spread of Sclerotinia rot in mustard crop.

6. PLANT PHYSIOLOGY

The studies on the screening of frost tolerant genotypes revealed that strains like RH-9001, RH-8814 and RH-8904 were relatively frost tolerant. The cryoprotectant NAA offered protection against frost injuries.

The studies on the salinity tolerance indicated that the genotypes of *Brassica napus* and *Brassica juncea* were found to be superior to *Brassica carinata* in terms of per cent seed germination, speed of germination and root & shoot length.

The genotype x environment studies at Kanpur revealed that variety, RH-8701 gave best performance in term of seed yield because of highest number of siliquae/plant, more number of seeds/ siliqua and bold seeds. Partitioning index and harvest index were also maximum in variety, RH-8701.

7. CHEMISTRY-BIOCHEMISTRY

A large number of strains/varieties of different *Brassica* species were evaluated for high oil content. The sufficient amount of variability was observed between different species. However, the variability within the species was not very encouraging.

Lines of *Brassica juncea*, *Brassica campestris* and *Brassica napus* have been identified possessing low erucic acid and low glucosinolate content at few selcted centres. In addition efforts are still being made to screen and develop the lines/ strains having desirable quality attributes.

The effect of agronomical and plant protection measures on oil quality of mustard indicated that the application of nitrogen @ 40, 60 and 80 Kg/ha did not show much effect on the quality parameters. The incidence of alternaria disease (more than 40%) in yellow sarson affected the oil content adversely while protein, iodine and FFK contents were increased. H?

Low temperature treatment ($-2^{o}C$ to $3.5^{o}C$) in mustard genotypes resulted in the decrease of oil content while protein and reducing sugars increased. The erucic acid content declined while oleic and linoleic acid showed increase with low temperature.

ACTION TAKEN ON VARIOUS SPECIFIC RECOMMENDATIONS AS PER THE PROCEEDINGS OF XXXXIX ANNUAL RABI OILSEED RESEARCH WORKERS' GROUP MEETING ON RAPESEED-MUSTARD HELD AT OUA&T, BHUBANESHWAR, FROM AUGUST, 18-21, 1991

	Recommendation	Action taken
1.1	The Directors of Research, GBPUA&T, Pantnagar and NDUA&T, Faizabad may take up immediate steps to provide the support of a full-fledged Bio-chemist to the IDRC-ICAR Collaborative Programmes to ensure effective implementation of the Project as per the original time frame.	Needful has been done by providing Bio-chemist only at Pantnagar centre.
1.2	Under the IDRC Project, the centres namely RAU, Dholi and GBPUA&T, Pantnagar have been specifically entrusted with the mandate in the field of Alternaria blight management. Therefore, these centres may further speed-up their ongoing efforts for identification of races in <u>Alternaria brassicae</u> and generation of complete information on racial variability. For accomplishment this task, Dholi may confine its task to Eastern parts viz., Bihar, West Bengal, Orissa, Assam and Pantnagar to various other rapeseed-mustard growing areas of the country.	Needful has been reported to be done by both these centres.
1.3	The Bio-technology Centre, IARI and TERI, New Delhi may resort to modern technology tools in collaboration with AICORPO centres for speedy transfer of resistance genes to White rust and Alternaria blight into desirable agronomic backgrounds.	The Bio-technology Centre, IARI and TERI, New Delhi were requested to develop the desired breeding material. Accordingly, Dr. Shyam Parkash from Biotechnology Centre has informed that he has been able to transfer the resistance genes of Alternaria blight from wild species to <u>B. juncea</u>.

1.4	For further augmentation of natural infestation levels of aphid on Brassica crops, the HAU and PAU were advised to formulate a suitable and need based proposal for the consideration of the Council.	Both these centres submitted the Ad hoc cess fund Management Project on mustard aphid resistance to the Council. The Projects submitted by both these centres have been sanctioned by the council.
1.5	The Project may bring out a bulletin on the management of aphid in the country at the earliest possible.	The rough draft has been submitted to Dr. A.K.Raheja ADG(EB&C) for his comments. After receiving his comments the bulletin will be revised and sent to Project Director (oilseeds), Hyderabad for its publication.
1.6	The promising sources of resistance to White rust and Alternaria blight identified from various centres may be pooled and a national disease nursery trial be constituted at selected centres of AICORPO on Rapeseed- Mustard for confirming their reaction under artificial epiphytotic conditions before they are exploited in resistant breeding programmes.	Needful has been done and the results from different centres are awaited.
1.7	The Project Coordinator (R&M) may constitute a special trial for evaluation of lines containing more than 40% oil and identification of promising sources.	A trial on strains of mustard possessing oil content either 40% or more than that has been laidout at different centres to identify the promising sources.
1.8	With a view to ensure speedy progress in the Hybrid Breeding programmes, the Workshop calls for a free exchange of different CMS systems and sharing of segregating material among various AICORPO (Rapeseed-Mustard) centres involved in the Project. The Project Coordinator (R&M) may seek the assistance of CCMB, Hyderabad to resolve the controversy	The exchange of various CMS systems among the centres involved in Hybrid programme has been done by Project Coordinating Unit (R&M). The CMS lines of different available male sterility systems which were maintained and multiplied by the Unit of the PC(R&M) and were supplied to all the centres involved in Hybrid Brassica Research Programme

	regarding the sources of cytoplasm of ANAND CMS system which is widely exploited all over the world.	and others who requested to have the seed of different CMS systems. The seed material of Anand CMS system has been sent to CCMB, Hyderabad for confirming the sources of cytoplasm and the results are awaited.
1.9	The on-going efforts for improvement of quality of oil and meal in rapeseed-mustard be stepped up to achieve break-through in this crucial front. To accomplish the speedily and effectively some of the select centres actively involved in the Quality Improvement Programme be strengthened with GLC/HPLC keeping in view the facilities available with the concerned SAUs/Organisations.	As per the recommendation GLC/HPLC have been sanctioned by the Council in to HAU, Hisar, PAU, Ludhiana, RAU, Dholi, NDUA&T, Faizabad, Pusles & Oilseed Research Station, Berhampore and CCSAUA&T, Kanpur.
1.10	Under new seed policy, the Project Coordinator (R&M) may organise during rabi season for evaluation of promising material of B.napus form different parts of the world at select locations. Besides, a multilocation trial be also initiated for assessment of the potential of various low erucic acid lines currently available in B.juncea and B.napus.	As per the recommendation one trial each on B.napus, B.campestris and B.juncea possessing low erucic acid/ glucosinolate has been laid out at select centres all over the country. The results are awaited.
1.13	To maintain the genetic purity of exotic sources being used as donor parent for transferring the O' and OO' characters, the Project Coordinator (R&M) may take the responsibility for their proper maintenance and supply to testing centres every season.	As per the recommendation, all the exotic lines being used as donor sources are being maintained keeping in view their mating system and the pure seed of these lines can be supplied to any centre on demand.

Account of experiments allotted and actually conducted

i) Plant Breeding

Centre (1)	T.A. (2)	T.C. (3)	% Trial conducted (4)
Kangra	3	1	33
Khudwani	11	Nil	Nil
Ludhiana	11	11	91
Bathinda	12	10	83
Gurdaspur	3	3	100
Hisar	9	8	90
Bawal	6	2	33
Kaul	2	2	100
Karnal	2	2	100
Sriganganagar	5	5	100
Navgaon	6	5	83
IARI,New Delhi	7	5	71
PC Unit	4	4	100
Pantnagar	10	8	80
Kanpur	9	8	90
Faizabad	8	8	100
Morena	9	9	100
Raipur	3	3	100
Gwalior	1	1	100
Varanasi	3	3	100
Kota	2	2	100
SK NAGAR	6	6	100
Amreli	2	2	100
Junagadh	3	Nil	Nil
Sumerpur	2	2	100
Phaltan	2	2	100
Jalna	2	2	100
Rahuri	2	2	100
Jodhpur	3	2	70
Jobner	2	2	100
Humangadh	2	2	100
Medak	3	3	100
Berhampore	9	7	80
ChianKi	3	3	100
Kanke	2	2	100
Dholi	3	2	70
Shillongani	4	2	50
Bhubaneswar	3	3	100

contd..

1	2	3	4
ii) Agronomy			
Hisar	2	2	100
Khudwani	2	NIl	Nil
Jobner	4	2	50
Navgaon	4	4	100
Dholi	2	1§	50
Faizabad	3	1	33
Junagadh	1	1	100
Pantnagar	4	4	100
Kanpur	4	4	100
Bhantinda	4	4	100
Diggi	1	Nil	Nil
Kangra	1	1	100
Shillongani	1	1	100
Kalyani	1	1	100
Bhubaneswar	1	1	Nil
Luhdina	3	3	100
Berhampore	1	Nil	Nil
Morena	3	3	100
iii) Entomology			
Kangra	5	5	100
Ludhiana	6	6	100
Bhantinda	8	6	75
Khudwani	2	Nil	Nil
Hisar	8	8	100
New Delhi	2	Nil	Nil
Mandore	2	Nil	Nil
Navgaon	7	6	85
Junagadh	2	2	100
Pantnagar	6	6	100
Kanpur	6	6	100
Faizabad	6	6	100
Varanasi	2	Nil	Nil
Morena	5	4	80
Dholi	3	2	66.6
Shillongani	5	Nil	Nil
Berhampore	4	3	75
Raipur	1	1	10 0

contd..

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1	2	3	4
iv) Plant Pathology			
Ludhiana	7	6	85
Kangra	4	4	100
Bhantinda	4	4	100
Khudwani	1	Nil	Nil
Sriganganagar	3	2	66
Hisar	6	5	83
IARI, N.Delhi	1	1	1000
Navgaon	6	6	100
Junagadh	3	2	66
Pantnagar	8	8	100
Kanpur	7	7	100
Faizabad	4	4	100
Morena	6	6	100
Dholi	7	7	100
Shillongani	2	Nil	Nil
Berhampore	3	3	100
Diggi	1	Nil	Nil
SK Nagar	2	2	100
v) Plant Physilogy			
Hisar	3	3	100
Navgaon	1	Nil	Nil
Kanpur	2	2	100
Ludhiana	1	Nil	Nil
Hisar	3	3	100
Ludhiana	2	2	100
Kanpur	2	2	100
IARI.N.Delhi	1	-	Nil
PC Unit	1	1	100
CFTRI	1	0	Nil
NIN, Hyderabad	1	0	Nil

1. WEATHER AND ITS EFFECTS:

The rapeseed-mustard research of the country is spread over the 5 zones of the country categorised on the basis of agro-climatic conditions,soils and diseases and insect-pest situation. The rapeseed and mustard experiments were laid out at different AICORPO regular and voluntary centers in these zones as per the activity milestone identified under Micro Mission-I on crop production for VIIIth Plan.

The weather had been playing a hide and seek game with the mustard crop during the rabi 1991-92. The less rains from Sept. to Nov.and almost total failure during the month of Oct. delayed the sowing of mustard crop and most of the area under mustard crop was either with pre-sowing irrigation or late sown. The temperature fluctuations during the reproductive stage in some zones,more specifically in Zone-II had adverse effect in the seed setting which later on was compensated to some extent by timely and wide spread rains during winter. Hailstorms also did had some damage in isolated pockets in some zones. The incidence of mustard aphid, Lipaphis erysimi, a rapeseed-mustard crop was mild throughout the country except at Pantnagar, Rahuri and Junagarh where it appeared in mild form. Among the diseases moderate to heavy infection of Alternaria blight and white rust moderate to low infection of downey mildew and powdery mildew diseases was observed in normal sown crops. However, under late sown conditions the occurrence of diseases was very severe. Club-rot in West Bangal,Sclerotinia rot in Rajasthan, Western UP and Haryana; powdery mildew in Gujarat and Rajasthan appeared on rapeseed-mustard crops.These diseases are now emerging as a threat to rapeseed-mustard cultivation in the country. The monthly weather data recorded at different centres in different zones of the coutry have been presented in Table 1.1, 1.2, 1.3 and 1.4

TABLE 1.1 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE II

	RAINFALL(mm)							NO OF RAINY DAYS						
MONTH	HSR	DURG	SGN	JDH	JOB	LDH	BTH	HSR	DURG	SGN	JDH	JOB	LDH	BTH
JULY	NR	NR	NR	74.7	109.5	NR	NR	NR	NR	NR	7	11	NR	NR
AUG	NR	NR	NR	96.4	114.2	NR	NR	NR	NR	NR	10	11	NR	NR
SEPT	2.7	90.7	64.0	11.0	19.2	NR	NR	2	2	2	2	1	NR	NR
OCT	NIL	NIL	NIL	NIL	NIL	NIL	4	NIL	NIL	NIL	NIL	NIL	NIL	NR
NOV	NIL	2.0	NIL	NIL	1.1	NIL	0	NIL	1	NIL	NIL	1	NIL	NR
DEC	3.2	18.0	3.6	NIL	14.4	52.9	4	2	1	3	NIL	2	3	NR
JAN	11.3	13.8	7.1	26.6	26.2	82.8	33	4	3	4	2	2	9	NR
FEB	22.9	4.0	33.1	12.8	NIL	8.7	NIL	2	1	6	1	NIL	3	NR
MAR	3.6	9.4	1.3	3.7	1.1	11.9	NIL	2	4	5	1	1	2	NR
APR	NR	NIL	NR	NR	NIL	6	NIL	NR	NIL	NIL	NR	NIL	3	NR

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(III)

TABLE 1.1 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE II

MONTH	TEMPERATURE													
	HSR		DURG		SGN		JDH		JOB		LDH		BTH	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
JULY	NR	NR	NR	NR	NR	NR	38.0	27	35.4	26.4	NR	NR	NR	NR
AUG	NR	NR	NR	NR	NR	NR	34.4	25	31.8	24.9	NR	NR	NR	NR
SEPT	35.3	22.2	33.8	20.5	36.9	25.1	35.4	21	33.2	20.5	NR	NR	NR	NR
OCT	33.2	13.9	32.0	16.0	34.4	16.3	36.5	17	33.8	12.3	31.8	15.0	37.0	15.5
NOV	28.0	9.9	27.2	11.2	29.1	11.2	30.8	15	26.8	8.5	26.0	10.1	31.0	10.8
DEC	22.6	7.6	24.0	9.8	23.4	7.8	27.7	12	24.1	6.9	20.0	7.6	23.7	7.6
JAN	20.8	6.3	19.8	7.8	20.1	7.4	25.2	11	21.7	6.3	17.7	7.4	22.1	6.8
FEB	21.1	6.6	23.4	9.3	21.9	9.0	26.0	12	23.9	7.2	19.7	7.4	23.2	8.0
MAR	27.8	10.4	27.4	13.7	28.3	13.2	31.9	17	29.8	13.2	25.3	11.8	29.4	12.1
APR	NR	NR	33.1	19.0	32.2	16.4	NR	NR	35.2	18.8	19.7	7.4	35.7	16.4

TABLE 1.1 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE II

MONTH	RELATIVE HUMIDITY(%)							SUN SHINE HOURS			
	HSR	DUR	SGN	JDH	JOB	LDH	BTH	HSR	DUR	SGN	JDH
JULY	NR	NR	NR	73	66.5	NR	NR	NR	NR	NR	7.6
AUG	NR	NR	NR	79	75.5	NR	NR	NR	NR	NR	7.3
SEPT	NR	70	64.9	76	60.0	NR	NR	NR	8.0	NR	9.4
OCT	NR	53	64.7	47	47.0	NR	NR	NR	8.7	NR	10.0
NOV	NR	65	73.3	51	54.5	NR	NR	NR	7.4	NR	8.8
DEC	NR	75	88.7	64	62.5	NR	NR	NR	7.5	NR	8.5
JAN	NR	63	87.1	60	61.0	4.6	NR	NR	5.6	NR	7.7
FEB	NR	78	79.3	69	53.5	7.7	NR	NR	8.6	NR	9.2
MAR	NR	49	65.1	48	50.5	7.4	NR	NR	6.0	NR	7.8
APR	NR	42	60.7	NR	31.5	7.7	NR	NR	8.9	NR	NR

TABLE 1.2 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE III

MONTH	RAINFALL(mm) MOR	PANT	KAN	FZB	JAG	RAP	NO OF RAINY DAYS MOR	PANT	KAN	FZB	JAG	RAP
JULY	170.7	89.2	66.6	NR	NR	191.6	9	4	6	NR	NR	12
AUG	271.8	277.6	427.0	NR	NR	348.9	16	21	21	NR	NR	19
SEPT	63.6	235.0	38.8	NR	227.5	77.6	5	13	5	NR	15	5
OCT	NR	NR	NR	NR	82.2	20.0	NR	NR	NR	NR	4	1
NOV	7.2	8.0	7.0	NR	79.1	16.4	1	2	3	NR	3	1
DEC	40.5	94	18.8	NR	3.03	3.2	2	4	3	NR	NR	NR
JAN	2.3	9.2	5.2	NR	5.8	NR	1	4	1	NR	1	NR
FEB	9.0	16.8	3.8	NR	NR	0.4	1	2	1	NR	NR	NR
MAR	NR	NR	NR	NR	NR	0.2	NR	NR	NR	NR	NR	NR
APR	NR	NR	1.0	NR	NR	18.8	NR	NR	1	NR	NR	2

contd...

TABLE 1.2 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE III

TEMPERATURE

MONTH	MORENA MAX.	MORENA MIN.	PANTNAGAR MAX.	PANTNAGAR MIN.	KANPUR MAX.	KANPUR MIN.	FAIZABAD MAX	FAIZABAD MIN	JAGDALPUR MAX	JAGDALPUR MIN.	RAIPUR MAX	RAIPUR MIN.
JULY	36.4	27.4	35.1	26.7	37.1	28.1	NR	NR	NR	NR	31.0	23.1
AUG	31.9	24.6	22.1	25.1	31.1	25.7	NR	NR	NR	NR	28.9	22.9
SEP	33.0	22.4	31.9	22.8	32.7	24.7	NR	NR	30.9	22.3	31.5	23.4
OCT	34.2	15.4	31.5	16.2	33.1	16.3	33.6	11.2	9.9	19.8	30.9	18.5
NOV	27.2	11.1	26.3	10.5	36.1	11.9	30.6	8.0	27.4	15.4	27.9	12.9
DEC	22.1	7.3	22.1	7.8	22.7	9.7	26.6	6.0	26.6	11.2	26.3	10.0
JAN	22.0	4.9	20.4	7.2	22.3	8.6	24.6	4.0	27.5	9.0	27.2	9.4
FEB	23.6	6.4	21.1	11.0	22.9	8.6	27.6	5.0	NR	NR	28.7	11.4
MAR	31.1	13.2	28.8	12.2	30.9	15.2	35.0	12.0	NR	NR	28.2	16.5
APR	36.6	20.5	NR	NR	36.2	20.2	39.6	16.0	NR	NR	39.9	22.1

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TABLE 1.2 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE III

	RELATIVE HUMIDITY(%)						SUN SHINE HOURS					
MONTH	MOR	PANT	KAN	FZB	JAG	RAP	MOR	PANT	KAN	FZB	JAG	RAP
JULY	78.5	82	63.1	NR	NR	89	NR	6.7	NR	NR	NR	1.9
AUG	84.0	91	86.1	NR	NR	94	NR	4.6	NR	NR	NR	1.4
SEP	77.5	91	58.5	NR	86.5	92	NR	6.8	NR	NR	NR	6.3
OCT	64.5	89	52.2	8.6	81.1	92	NR	8.8	NR	NR	NR	4.4
NOV	70.5	84	66.7	8.6	84.6	90	NR	7.9	NR	NR	NR	6.5
DEC	77.0	91	73.7	9.0	85.1	92	NR	6.6	NR	NR	NR	6.9
JAN	75.5	92	68.8	9.3	83.6	87	NR	6.0	NR	NR	NR	8.2
FEB	74.5	89	61.5	9.4	NR	76	NR	6.6	NR	NR	NR	8.9
MAR	69.5	82	45.2	8.6	NR	56	NR	NR	NR	NR	NR	9.1
APR	67.0	NR	40.4	6.7	NR	49	NR	NR	NR	NR	NR	9.0

TABLE 1.3 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE IV

	RAINFALL (mm)			NO OF RAINY DAYS			TEMPERATURE					
							SKNAGAR		PHALTAN		RAHURI	
MONTH	SKN	PHT	RAH	SKN	PHT	RAH	MAX	MIN	MAX	MIN	MAX.	MIN.
JULY	NR	42.7	NR	NR	15	NR	NR	NR	30.4	21.2	NR	NR
AUG	NR	15.0	NR	NR	10	NR	NR	NR	30.6	20.2	NR	NR
SEPT	NR	63.6	NR	NR	9	NR	NR	NR	32.6	19.7	NR	NR
OCT	NR	54.0	NR	NR	1	NR	36.9	16.2	33.4	15.8	32.6	16.0
NOV	1.0	5.2	NR	NR	1	NR	31.7	13.9	25.1	11.6	29.7	14.8
DEC	NR	NR	NR	NR	NR	NR	28.5	9.5	23.5	9.3	27.9	9.2
JAN	6.5	NR	NR	NR	NR	NR	26.9	8.4	30.8	8.1	29.1	9.4
FEB	NR	NR	NR	NR	NR	NR	28.0	10.3	31.9	9.6	30.5	9.4
MAR	NR	NR	NR	NR	NR	NR	33.3	16.0	37.5	15.5	NR	NR
APR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

contd....

TABLE 1.3 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE IV

	RELATIVE HUMIDITY(%)			SUN SHINE HOURS		
MONTH	SKN	PHT	RAH	SKN	PHT	RAH
JULY	NR	73	NR	NR	1.4	NR
AUG	NR	68	NR	NR	2.4	NR
SEPT	NR	58	NR	NR	4.8	NR
OCT	56	36	73	9.9	8.1	8.7
NOV	66	38	78	8.9	5.8	7.5
DEC	75	84	78	9.0	8.1	8.6
JAN	74	79	74	8.6	8.9	9.2
FEB	76	79	74	9.8	9.4	9.5
MAR	62	58	NR	9.5	8.9	NR
APR	NR	NR	NR	NR	NR	NR

TABLE 1.4 MONTHLY WEATHER DATA RECORDED AT DIFFERENT CENTRES OF ZONE V DURING 1991-92

	RAINFALL(mm)						NO OF RAINY DAYS						TEMPERATURE 0 C.				RELATIVE HUMIDITY(%)						SUN SHINE hrs.	
													CHAN		DHOL									
MONTH	CHAN	DHOL	KANK	BHV	SHL	BERH	CHAN	DHOL	KANK	BHV	SHL	BERH	MAX.	MIN.	MAX.	MIN.	CHAN	DHOL	KANK	BHV	SHL	BERH	BHV	BERH
JUL.	NR	NR	NR	NR	NR	206.6	NR	NR	NR	NR	NR	14	NR	NR	NR	NR	NR	NR	NR	NR	NR	93	NR	5.7
AUG.	689.4	NR	NR	NR	412.2	140.4	21	NR	NR	NR	22	10	31.5	25.0	NR	NR	NR	NR	NR	NR	92	88	NR	4.8
SEPT.	131.3	11.9	NR	NR	285.2	408.0	13	2	NR	NR	25	16	32.6	23.8	33.3	25.3	NR	80	NR	NR	94	94	NR	4.8
OCT.	6.5	NIL	17.8	104.7	214.6	119.0	1	NIL	3	14	13	4	31.8	18.8	32.3	18.8	NR	87	87	91	93	93	4.9	8.7
NOV.	11.0	NIL	3.0	79.0	35.4	NIL	1	NIL	1	3	2	NIL	28.9	11.6	28.2	12.9	79	99	81	89	96	91	6.4	7.7
DEC.	32.9	4.0	75.1	3.0	31.6	51.8	3	4	4	1	6	2	25.1	9.0	23.4	9.5	88	100	83	87	98	93	7.4	7.3
JAN.	NIL	1.2	2.8	20.5	10.4	2.0	NIL	1	1	2	4	1	25.0	6.7	22.4	8.0	78	100	85	91	96	95	7.7	7.1
FEB.	3.5	3.4	NR	54.9	34.8	24.5	2	2	NR	3	12	3	27.3	8.6	24.0	8.6	82	100	79	90	93	93	7.4	NR
MAR.	NIL	NIL	NR	NIL	3.2	2.2	NIL	NIL	NR	NIL	4	1	35.5	14.4	31.4	15.2	69	79	62	91	89	89	8.1	NR
APR.	NIL	NIL	NR	NR	NR	NR	NIL	NIL	NR	NR	NR	NR	39.6	18.9	38.8	20.0	74	69	NR	NR	NR	90	NR	9.0

2. BREEDING

2.1

Name of the Project : Development of high yielding varieties of Rapeseed-Mustard

Objectives : To develop and identify varietie possessing desirable maturity period, high seed yield and oil content

Locations : Zone-II : Ludhiana, Bathinda, Gurdaspur Hisar, Kaul, Karnal

Zone-III : Kanpur, Faizabad, Morena, Jagdalpur, Pantnagar, Raipur

Zone-IV : Berhampore, Ranchi, Chianki, Shillongani, Bhubaneshwar

(A) Toria(B.campestris)

Toria is an important oilseed crop and is being grown as a catch crop in most of the States. Besides pure cropping, toria is also being used as an inter crop with gobhi sarson. The breeding objective is to develop varieties of toria which can fit well in the prevalent cropping system. The attempts are being made to develop short duration varieties i.e. about 85 days for wheat based cropping system and long duration varieties i.e. about 110 days for sugarcane based cropping system.

The results obtained during the year under report at different centres have been presented below:

Progress of Work:

Ludhiana:

Large number of crosses in different fillial generations were evaluated and the desirable ones' have been selected. In addition, 54 fresh crosses were developed and 52 F_2 progenies were raised.

With a view to develop the composite population, about 200 S1 plants possessing similar morphological traits like earliness, plant height and branching pattern were selected for carrying out further cycles of selection.

Direct as well as reciprocal crosses between white flower spontaneous mutant of variety TL-15 and Yellow flowering sibs were made to study the inheritance of this character.

56 F_1's obtained from two 8x8 half diallel sets involving

open pollinated versus F_1 parents were studied to know the nature and magnitude of genes involved for the inheritance of various characters.
In IVT, highest seed yield of 1971 kg/ha was recorded by strain PBT-37 as against the highest yielding zonal check variety TL-15 (1556 kg/ha) (Table-2.1.1).

In AVT-1, none of the strains surpassed the targetted seed yield of 1300 kg/ha (Table-2.1.4).

Bathinda:

The strains namely; T-17, T-20, T-35, T-52, T-57, T-79, T-83, T-84, PBT-33-21, PBT-33-58, PBT-33-78, PBT-33-15, PBT-41 and PBT-42 matured within 85 days.

On the basis of three locations viz., Bathinda, Ludhiana and Gurdaspur, the entries; PBT-40 and PBT-29 were observed high yielders with average yield potential of 1716 and 1668 kg/ha, respectively.

In IVT, the highest seed yield of 1611 kg/ha was recorded by strain PBT-37 as against the 1546 kg/ha of highest yielding zonal check variety TL-15 (Table-2.1.1).

In AVT-1, none of the tested strain recorded higher seed yield as compared to the highest yielding zonal check variety TL-15 which recorded the seed yield of 1710 kg/ha (Table-2.1.4).

Gurdaspur:

In IVT, strain PBT-37 recorded the highest seed yield of 1924 kg/ha as against 1511 kg/ha of PT-303, the highest yielding check variety (Table-2.1.1).

In AVT, strain TW-872-2 recorded the highest seed yield of 1500 kg/ha compared to 1495 kg/ha of highest yielding check variety T-9 (Table-2.1.4).

Hisar:

With a view to develop early and high yielding varieties of toria, 48 biparental crosses developed last year from early and late hetrozygous populations were grown and allowed random mating. The plants have been harvested in bulk to form the base population for making further selections.

Very early and very late maturing plants have been selected from the material sown this year. These plant progenies will be evaluated and then used to create two seperate gene pools (i.e. very early and very late) to operate selection for plants possessing high seed yield and desirable hybrid varieties of toria. 65 inbred lines having considerable genetic variability have been given second inbreeding. These germplasm lines were back selfed to identify fertile types. Considerable degree of variation in respect of self compatibility was observed.

18 self fertile types identified last year were involved in crossing programme with B.juncea, B.napus, B.carinata and B.tournefortii.

In a crossing block with certain checks, natural hybrids like Sangam x Torch, Sangam x Chamba-4, Sangam x BSH-1 and Sangam x Span were developed in natural pollination using certain doses of gametocides. These crosses have recorded more than 100% heterosis.

In IVT, strain PBT-38 exhibited the highest seed yield of 1489 kg/ha compared to 1096 kg/ha of T-9, the highest yielding check (Table-2.1.1).

In AVT-1, TH-9002 recorded the highest seed yield of 1545 kg/ha compared to 1475 kg/ha of TH-68, the highest yielding check variety (Table-2.1.4).

Kaul:

In IVT , strains namely: PBT-38 exhibited the highest seed yield of 2148 kg/ha followed by TH-9101(1803 kg/ha) and DT-8(1753 kg/ha)as against 1555 kg/ha of PT-303, the highest yielding check variety (Table-2.1.1).

Karnal:

In IVT , strain DT-10 recorded the highest seed yield of 1382 kg/ha as against 777 kg/ha of PT-303, the highest yielding check variety (Table-2.1.1).

Zone III

Kanpur:

The following 8 populations were developed by mixing the seed of different desirable plants of different genotypes. The material was grown in isolation and the bulk seed has been harvested after removing the undesirable plants.

1. Bhawani, T-9, PT-303
2. TK-8601, Bhawani
3. NDR-8501, Bhawani
4. Lakhimpur local, T-9 and Bhawani
5. TK-89-4-04, T-9 and Bhawani
6. Bhawani, TW-28/86 and T-9
7. Bhawani, TWB-14/86 and T-9
8. T-36, early Yellow Toria

45 F_1 crosses alongwith 10 parents were grown for identifying the suitable best combining parents. The data with respect

to different traits have been recorded and the analysis is under progress.

In IVT, none of the strains under test could surpass the national check variety PT-303 (Table-2.1.2).

Faizabad:

In IVT, none of the strain recorded the higher seed yield compared to the national standard PT-303 (1481 kg/ha) (Table-2.1.2).

Morena:

As against the target seed yield of 1500 kg/ha a locally developed strain JMT-689 recorded an average seed yield of 1791 kg/ha in adopted trials in Distt. Morena which is 12.5% and 16.2% significantly higher than the check T-9 and Bhawani, respectively. This strain matured in 90 days against the target maturity period of 95 days.

In IVT, none of the strain surpassed the national check variety PT-303 (Table-2.1.2).

Jagdalpur:

In IVT, the yields of strains under test in general were very poor at this centre (Table 2.1.2).

Pantnagar:

The efforts are underway to develop early and high yielding varieties of toria using early donors such as Bhawani, D-1, D-2, D-3, TS-29, NDT-871 and M-27. Good number of fresh crosses have been attempted this year and their seed harvested. In addition, the population of different crosses in different fillial generations were grown and desirable plants from these populations have been selected. 10 F_4 populations (derived from second cycle of selection), 14 F_3 (derived from first cycle of selection) and 20 F_2 populations were derived from crosses involving early donor sources and high yielding strains/varieties were grown. The early maturing plants, possessing desirable morphological traits have been selected from each population and the composite seed of these plants will constitute population for further selection and evaluation. 12 F_1's have been advanced to F_2 for making selection of the desirable plants in the subsequent generation.

Two broad genetic based populations i.e. early dwarf (RCP 90-1) and medium dwarf (RCP 90-2) were grown in isolation.

About 200 plants in each of these populations have been selected and bud pollinated. At maturity, sibbed as well as open pollinated seeds from each plant have been harvested separately.

52 S2 progenies were sibbed to raise S3 but sibbed seed of only 23 progenies have been obtained. In addition, 19 S0 plants were sibbed to raise S1 plants.

In IVT, strain PT-9005 recorded the highest seed yield of 2397 kg/ha followed by PBT-38(2203 kg/ha) compared to 2138 kg/ha of highest yielding check Bhawani (ZC) (Table-2.1.2).

Raipur:

In IVT, strain TWB-14/86 recorded the highest seed yield of 1518 kg/ha compared to 1130 kg/ha of PT-303, the highest yielding check (Table-2.1.2).

TORIA (RAINFED)

Berhampore:

Among the test entries TWB-881 recorded highest seed yield of 766 kg/ha followed by 759 kg/ha of TWB-884 compared to 419 kg/ha of B-54, the highest yielding check.

Of the 9 strains evlauated the highest seed yield of 907 kg/ha was recorded by entry TWB-25/86 followed by 814 kg/ha of TWB-29/86 compared to 535 kg/ha and 486 kg/ha of TWC-3 and B-54 respectively. The maturity duration of the strains under test ranged from 77 to 81 days.

In IVT, highest seed yield of 796 kg/ha was recorded by strain PT-8857 followed by TK-9102 (771 kg/ha) as compared to highest yielding check variety T-9 (740 kg/ha) (Table-2.1.3).

Ranchi:

In IVT, none of the strains under test outyielded the highest yielding check variety Panchali (Table-2.1.3).

Chianki:

In IVT, none of the strain recorded the targetted seed yield of 800 kg/ha (Table-2.1.3).

Shillongani:

In IVT , the yields in general were very poor and no conclusive result could be drawn (Table-2.1.3).

Dholi:

Following fresh crosses were attempted and their seed harvested:

RAUTS 17 x Dwarf	PT-303 x Dwarf
RAUTS 17 x Yellow seeded	PT-303 x Yellow seeded

(B) INDIAN MUSTARD (B. juncea)

Locations: (IRRIGATED)	Zone II	: Ludhiana, Bathinda, Sriganganagar, Hisar, Delhi, Ghaziabad, Durgapura, Hanumangarh
	Zone III	: Morena, Kanpur, Varanasi, Pantnagar, Etah, Kota, Raipur, Faizabad/Masodha
	Zone IV	: S.K.Nagar, Amreli, Sumerpur, Jalna, Medchal, Junagarh
	Zone V	: Dholi, Bhubaneshwar, Berhampore, Chianki, Sabour

Ludhiana:

A yellow seeded strain YSRL-9 recorded the highest seed yield (2157 kg/ha) followed by RLC-1055-1 (1932 kg/ha) compared to 1686 kg/ha, 1667 kg/ha and 1532 kg/ha RL-1359, Kranti and Varuna, respectively. In addition, several other strains such as YSRL-13, RL-91-4, RL-91-16, RL-91-20, RL-91-15, RL-91-23, RL-91-27 etc. were observed to be promising and surpassed the assigned target of 2000 kg/ha.

In IVT, strain RSM-151 recorded the highest seed yield of 2039 kg/ha compared to 1836 kg/ha of Kranti, the highest yielding check (Table-2.1.5).

In AVT-1, none of the strain under test recorded significantly higher seed yield compared to highest yielding check variety Kranti (1970 kg/ha). However, a strain JGM-9056, recorded the highest seed yield of 1978 kg/ha (Table-2.1.1).

Bathinda:

On the basis of multilocation testing in the state of Punjab, entries; PBR-91 and J-10 showed stable performance. PBR-91 was in the top significant group in six trials out of 9. The per cent increase in favour of PBR-91 against Varuna and Kranti was 33.2 and 31.7, respectively.

In another multilocation trial 16 entries were evaluated at four locations viz., Bathinda, Ludhiana, Gurdaspur and Faridkot. In this trial also PBR-91 was the top yielder with average yield potential of 1835 kg/ha.

A strain PBR-91 recorded the increase of 33.2% and 31.7% in seed yield against Varuna and Kranti, respectively. In addition to this the following bredding material generated/ handled.

Fresh crosses attempted - 562, F_1's grown and advanced to

F_2-124, F_2's of 158 crosses, F_3's progenies-245, F_4's progenies-803, Yellow seeded progenies-328 and F_5's progenies-365 were grown and evaluated.

In IVT, the highest seed yield of 2117 kg/ha was recorded for strain RSM-151 compared to 1658 kg/ha of Kranti, the highest yielding check (Table-2.1.5).

In AVT-1, strain JGM-9062 recorded significantly higher yield of 1882 kg/ha compared to highest yielding check variety Kranti (1322 kg/ha) (Table-2.1.11).

Sriganganagar:

In IVT, strain JMM-90-12 attained the maximum seed yield of 2555 kg/ha compared to highest yielding check variety Kranti (1777 kg/ha) (Table-2.1.5).

In AVT-1, strain RLC-949 recorded the highest seed yield of 1661 kg/ha compared to 1554 kg/ha of Varuna, the highest yielding check variety (Table-2.1.11).

Hisar:

At this centre, the efforts are being made to develop varieties possessing bold seed and non-shattering habit. Two entries namely; RH-8812 and RH-8605 possess bold seed and were found promising. Both these entries recorded the seed yield of 2188 kg/ha and 1910 kg/ha respectively as compared to Varuna.

50 F_4 progenies were evaluated and desirable plants have been selected. The bold seeded plants have also been selected from F_2 progenies of RH-8315 x RH-30, RH-8113 x RH-30, RH-819 x RH-30 and RH-781 x RH-30.

In IVT, strain RH-8824 recorded the highest seed yield of 2510 kg/ha compared to 1974 kg/ha of Varuna the highest yielding check variety (Table-2.1.5).

In AVT-1, strain JGM-9056 recorded the highest seed yield of 2522 kg/ha as against 2125 kg/ha of RL-1359 the highest yielding check variety (Zonal) (Table-2.1.11).

IARI, New Delhi:

A total of 200 F_3 and 285 advance generation lines were planted alongwith three checks; Pusa Basant, Pusa bold and Varuna in an augmented design. Based on agronomic superiority, disease and pest reaction, 108 families were finally retained as single plant and bulk selections. 300 single plants and 8 homozygous bulk were made in this material. The following cross progenies were observed most promising :

(Pusa bold x Dira 335-1) x Dira 313....Profuse branching

(Varuna x Dira 335-2) x Dira 313*
(Pusa bold x Dira 335-1) x (Varuna x Dira 313)
(Dira 335 x Dira 326) x (PR-45 x 563)
Dira 418-51-4
Dira 344-1
(Dira 335 x Dira 313) - W 93-8...Resistant to White rust
(Dira 335 x Dira 313) -W 93-10
(Dira 335 x Dira 313) -W 93-10-1
(W132) x (Pusa bold x Dira 313) x (Pusa bold)

255 diverse mustard F_2's were evaluated against Pusa bold, Pusa basant and Pusa barani. 2400 single plant selections were made in 243 cross progenies for seed yield and major yield components. Emphasis was given to select early and medium maturity derivatives. The promising crosses observed are as follows:

Dira 326 x MCN-27................Multiple branching habit
Dira 418 x (PR-45 x 1564)........Profuse branching
Dira 418 x (Pusa bold x 1561)....-do-
(PR-45 x Dira 403) x Dira 326....Long siliquae
Dira 313 x Kranti*...............Profuse branching and segregating for white rust resistance
Dira 367 x Dira 313*.............Profused, Bold yellow seeds
Dira 313 x Dira 367*.............Non-shattering habit
Dira 313 x RH-30.................Very good plant type

*' denotes segregation for white rust resistance

114 F_1's were planted for evaluation. Another set of line x tester crosses involving 15 diverse lines and 8 testers was planted for evaluation.

167 crosses were attempted with the objective to incorporate resistant to white rust, alternaria tolerance in high yielding backgrounds. Backcross programme in cross Pusa bold x Dira 313 continued for developing high yield and white rust resistant varieties.

In IVT, the strains RH-8922 and RSM-9007 recorded the highest seed yield of 2058 kg/ha compared to 1671 kg/ha of highest yielding check variety RL-1359 (Table-2.1.5).

aziabad:

In IVT, strain PSR-6 recorded the highest seed yield of 1718 kg/ha compared to 1633 kg/ha of Kranti, the highest yielding check (Table-2.1.5).

In AVT-1, none of the tested strain recorded higher yield compared to highest yielding check variety, Kranti (1333 kg/ha) (Table-2.1.11).

Durgapura:

In IVT, SJN-191 exhibited the highest seed yield 2447 kg/ha followed by 2440 kg/ha of RSM-151 compared to 2167 kg/ha of RL-1359, the highest yielding check (Zonal) (Table-2.1.5).

In AVT-1, strain JGM-9056 recorded highest seed yield of 2717 kg/ha against highest yielding check RL-1359 (2350 kg/ha) (Table-2.1.11).

Hanumangarh:

In IVT, strain RH-8824 recorded the highest seed yield of 1530 kg/ha compared to 1297 kg/ha of highest yielding check variety Varuna (Table-2.1.5).

In AVT-1, strain JGM-9056 recorded the highest seed yield of 1417 kg/ha compared to 1262 kg/ha of highest yielding check variety, Kranti (Table-2.1.11).

Zone-III

Morena:

In IVT , strain DLM-29 recorded the highest seed yield of 2075 kg/ha compared to 1392 kg/ha of highest yielding check variety, Kranti (Table-2.1.6).

In AVT-1, among tested strains PCR-7 recorded the highest seed yield of 1958 kg /ha as against 1729 kg/ha, 1719 kg/ha and 2002 kg/ha of Varuna, Kranti and Rohini, respectively (Table-2.1.12).

Kanpur:

42 F_1 crosses alongwith their parents were grown and evaluated for quantative traits. The following segregating populations were grown and selection for desirable high seed yield and other attributes was performed.

F_2 populations : 45; F_3 populations :90; F_4 populations:71 and F_5 populations:28.

Ten parents diallel (Laha-101, Varuna, Vardan, Rohini, Vaibhav, Krishana, NDR-8501, RK-8501, Mathura Rai and B-85) excluding reciprocals was developed.

The single crosses namely; Varuna x Mathura Rai, RK-8502 x Laha-101, Laha-101 x RK-8601, Mathura Rai x Varuna, Varuna x Zem-1 , Vaibhav x Zem-1, Vardan x Zem-1, Rohini x Zem-1, Varuna x T-6342, Varuna x CSR-1017, Rohini x T-6342, Vaibhav x T-6342, Vaibhav x CSR-1017 and Vardan x CSR-1017 were attempted and their seed have been harvested.

In station trials, strains namely; RK-8701(2071 kg/ha) and RK-8502 (2244 kg/ha) recorded the highest seed yield.

In IVT , DIRM-52 recorded highest seed yield of 2622 kg/ha followaed by SKNM-90-4(2578 kg/ha) compared to 1933 kg/ha and 1911 kg/ha of Varuna and Kranti, respectively (Table-2.1.6).

In AVT-1, strains RH-8904(2475 kg/ha) and DLM-23(2415 kg/ha) recorded significantly higher seed yield against highest yielding check variety, Kranti(2015 kg/.ha) (Table-2.1.12).

Varanasi:

In IVT ,strain DLM-29 recorded the highest seed yield of 1370 kg/ha against highest yielding check variety, Varuna(960 kg/ha) (Table-2.1.6).

In AVT-1, strain RSK-64 recorded the highest seed yield of 1360 kg/ha against the highest yielding check variety, Kranti(1015 kg/ha) (Table-2.1.12).

Pantnagar:

The strains namely; PR-1108, Poorvi Raya, Seeta and RW-4-6(B/11) are being used as donor parents for incorporating earliness. 13 F_2 populations, 99 F_3 and 124 F_4 progenies derived from early maturing sources and high yielding varieties were grown and desirable plants possessing high seed yield and earliness were selected. 10 F_1 crosses were advanced to F_2 generation. 20 fresh F_1 crosses involving dwarf and early source(PPMS-1) and important strains/ varieties were attempted. These are listed below:

PPMS-1 x NDR-3801, GMCN-137 x PPMS-1, PPMS-1 x Pusa bold, IB-718 x PPMS-1, PPMS-1 x NDR-8501, PPMS-1 x Kranti, GMCN-71 x PPMS-1, Varuna x PPMS-1, Kranti x PPMS-1, GMCN-77 x PPMS-1, RW-7-86 x PPMS-1, GMCN-125 x PPMS-1, GMCN-154 x PPMS-1, GMCN-41 x PPMS-1, RW-2086 x PPMS-1, Kranti x Poorvi Raya, Kranti x PR-1108, PR-1108 x PPMS-1, GMCN-45 x PR-1108 and PR-8805 x PPMS-1.

In IVT, DIR-489 recorded highest seed yield of 1083 kg/ha against 586 kg/ha and 737 kg/ha of Varuna and Kranti, respectively (Table-2.1.6).

In AVT-1, none of the tested strain attained the targetted seed yield. The yields in general were poor. However, the highest seed yield was recorded by a strain PBR-91(722 kg/ha) against 599 kg/ha of highest yielding check variety, Kranti (Table-2.1.12).

Etah:

In IVT, strain HJ-002 recorded the highest seed yield of 2017 kg/ha against 1820 kg/ha of highest yielding check variety, Kranti (Table-2.1.6).

Kota:

In IVT , none of the strain recorded higher seed yield as compared to the Zonal check variety, Rohini(2446 kg/ha) (Table-2.1.6).

In AVT , strain PCR-7 recorded the highest seed yield 1657 kg/ha against 1380 kg/ha of highest yielding check variety, Varuna (Table-2.1.12).

Raipur:

In IVT , strain PCR-5 recorded the highest seed yield of 2083 kg/ha against the highest yielding check variety, Varuna(1694 kg/ha) (Table-2.1.6).

In AVT-1, strain RSM-8904 recorded the highest seed yield of 1893 kg/ha against highest yielding check variety, Kranti(1669 kg/ha) (Table-2.1.12).

Faizabad/Masodha:

In IVT, strain RSM-9007 recorded the highest seed yield of 1865 kg/ha against 1778 kg/ha of highest yielding check variety, Kranti (Table-2.1.6).

In AVT -1, RLC-949 recorded the highest seed yield of 1692 kg/ha compared to 1619 kg/ha of highest yielding check variety, Kranti (Table-2.1.12).

Zone-IV

S.K.Nagar:

i) The following number of crosses which were in different fillial generations were grown and the desirable plants were selected/bulked.

Fillial generation	No. of crosses	No. of progenies grown		No. of plants/ progeny bulks	
		IPS	Bulk	IPS	Bulk
F2	11	-	11	40	-
BC1 F2	5	-	7	32	-
F3	16	104	-	312	5
F4	21	89	48	339	135
F5	10	11	24	30	21
Total	63	204	90	753	161

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ii) The following fresh crosses for obtaining the segregants of high seed yield were developed:

SKM-91-32 x GM-1, SKM-91-32 x Varuna, SKM-91-32 x Pusa bold , SKM-91-32 x PM-67, SKM-91-39 x GM-1, SKM-91-39 x Varuna, SKM-91-39 x Pusa bold, SKM-91-39 x PM-67, SKM-91-40 x GM-1, SKM-91-40 x Varuna, SKM-91-40 x Pusa bold , SKM-91-40 x PM-67, Lalpur x GM-1, Lalpur x Varuna, Lalpur x Pusa bold, Lalpur x PM-67.

In IVT, strain DLM-29 recorded the highest seed yield of 3647 kg/ha followed by DIR-489 (3387 kg/ha) compared to 2487 kg/ha of highest yielding check variety, Kranti (Table-2.1.7).

In AVT , BIO-902 recorded the highest seed yield of 3517 kg/ha compared to 2930 kg/ha of highest yielding check variety, Kranti (Table-2.1.13).

Amreli:

In IVT, strain PCR-4 recorded the highest seed yield of 2323 kg/ha against 1987 kg/ha of Zonal check variety, GM-1 (Table-2.1.7).

In AVT-1, among tested strains, RSK-69 recorded the highest seed yield of yield of 2169 kg/ha against highest yielding check(ZC) variety, GM-1(2172 kg/ha) (Table-2.1.13).

Sumerpur:

In IVT, strains PSR-7 and RSM-151 recorded the highest seed yield of 1200 kg/ha against highest yielding check variety, Kranti(1050 kg/ha) (Table-2.1.7).

In AVT-1, the strains RK-9001 and BIO-902 recorded the highest seed yield of 1489 kg/ha compared to highest yielding zonal check variety, GM-1(1222 kg/ha) (Table-2.1.13).

Jalna:

In IVT, strain RSM-151 recorded the highest seed yield of 2667 kg/ha compared to highest yielding check variety, Kranti(1733 kg/ha) (Table-2.1.7).

In AVT-1, none of the tested strain could outyielded the highest yielding zonal check variety, GM-1(2194 kg/ha) (Table-2.1.13).

Medchal:

In IVT, strain DIRM-52 recorded the highest seed of 2627 kg/ha against the highest yielding check variety, Kranti(2186 kg/ha) (Table-2.1.7).

In AVT-1, highest seed yield of 2771 kg/ha was recorded for

RSK-69 compared to 2509 kg/ha of highest yielding check variety, Kranti (Table-2.1.13).

Phaltan:

In AVT-1, strain PCR-7 recorded the highest seed yield 1326 kg/ha compared to 1219 kg/ha of highest yielding zonal check variety, GM-1 (Table-2.1.13).

Junagadh:

On the basis of three years of large scale trial average entries namely; RSK-12, MI-88-45 and RSK-16 were found promising and they recorded 16.8, 7.47 and 3.55 per cent higher seed yield than the check variety Varuna respectively.

In small scale trial,15 entries were evaluated. 10 entries which were tested for two years recorded 28.65% to 8.60% higher yield than check variety Varuna. While three entries tested for only one year recorded 43.8% to 13.1% higher yield than the check variety Varuna. The promising strains are SKM-90-34, SKM-90-42 and MJ-90-127 as they recorded more than 25% higher yield compared to Varuna.

69 new entries were tested in three tests of preliminary yield trials where 4 entries viz. SKM-91-23, MI-91-149, MJ-91-146 and MJ-91-147 were found promising as they recorded significantly higher seed yield than the check varieties Varuna, GM-1 and Kranti.

Trombay:

Among the 24 Trombay Mustard (TM) cultures TM-1 to TM-24, 15 are yellow seeded and the remaining nine are black seeded. Two cultures TM-2 (black seeded mutant) and TM-4 (yellow seeded, recombinant) have been released for commercial cultivation by Assam Agricultural University for Assam state. The oil content of high oil selections (3-5% more) followed up for five years and it was concluded that oil content studies should be followed up for 4-5 years to identify high oil lines with stable oil content.

TM-18 is the earliest maturing mustard variety available in the country requiring 65-70 days for harvest at Trombay compared to 95-100 days for the national check Varuna. Such early cultures have the potential to replace toria in the multiple cropping system because they are less susceptible to pests and diseases, moisture stress and shattering.

Zone-V

Dholi:

The following F_3 progenies derived from a 8 x 8 diallel and line x tester were grown and selection for high seed yield and early maturity was done:

Progeny	Pedigree
RAURD - 92-3-1	BR-40 x Dholi 1/86
RAURD - 92-3-2	RH-30 x Dholi 1/86.
RAURD -92-3-3	Varuna x MDOC -49.

The following advance material for high seed yield in F7 generation identified:

RAURD-92-1	Pusa bold x DIRM-45-8.
RAURD-92-2	Varuna x B-85.
RAURD-92-3	DIR-45-8 x Varuna.
RAURD-92-6	DIRM-5-3 x DIR-45-8.
RAURD-92-8	DIR-5-3 x Varuna.
RAURD-92-10	RWC-6 1/11 x Varuna.
RAURD-92-11	RWC-6 1/11 x Kranti.
RAURD-92-13	Pusa bold x RWC-6 1/11.

The following advance generation mutants (M8 seeds) were also identified for high seed yield.

RAURMD-92-1	B-85 x RWC-6 1/11 (25 Kr)
RAURMD-92-2	RWC-6 1/11 x B-85(25 Kr.)
RAURMD-92-3	-do- (50 Kr.).
RAURMD-92-5	RWC-6 1/11 x DIR-45-8(50 Kr.)
RAUIRMD-92-6	B-85 x DIRM-45-8 (75 Kr).

Two plants(RAURD-92-23 and RAURD-92-67) were selectead from the population of Kranti, which were short statured and early in maturity.

In IVT, strain PSR-7 recorded the highest seed yield of 1400 kg/ha compared to highest yielding check variety, Pusa basant(767 kg/ha) (Table-2.1.8).

Bhubaneswar:

In IVT, strain SKNM-90-13 attained the highest seed yield 1354 kg/ha followed by 1333 kg/ha of DIRM-52 compared to 933 kg/ha of highest yielding check variety, Kranti (Table-2.1.8).

Berhampore:

During the year under report, 14 entries that confirmed to mature between 95-100 days were evaluated aagainst early maturing local checks B-85, TM-4 and RK-2. The entry RW-8726 recorded highest seed yield of 1219 kg/ha followed by RW-3/86 B(1250 kg/ha). The other entry which recorded significantly higher yield against check was RW-872. The maturity varied from 96-109 days.

22 selections derivatives from different crosses were evaluated. The selection S1(Cross code 8418) recorded significantly higher seed yield as compared to local check variety, Pusa bold.

In IVT, strain PCR-4 recorded the highest seed yield of 2290 kg/ha against highest yielding zonal check variety, Pusa basant(1560 kg/ha) (Table-2.1.8).

Locations: (RAINFED)	Zone II	: Navgaon, Bawal
	Zone V	: Berhampore, Shillongani

Navgaon:

In IVT, a number of strains namely; RJ-14 (3644 kg/ha), BIO-94 (3616 kg/ha), RL-90-1 (3111 kg/ha), RJ-9 (3097 kg/ha), PCR-5 (3005 kg/ha) etc. recorded significantly higher seed yield as against the highest yielding check variety Varuna (Table-2.1.9).

Bawal:

In IVT, the highest seed yield of 1367 kg/ha was recorded by a strain TM-18-8 as against 867 kg/ha of highest yielding check variety, Kranti (Table-2.1.9).

Zone-V

Berhampore:

In IVT, strain RJ-9 recorded the highest seed yield of 1445 kg/ha as against the 998 kg/ha of highest yielding check variety Kranti (Table-2.1.10).

Shillongani:

In IVT, strain PCR-5 recorded the highest seed yield of 1092 kg/ha compared to 577 kg/ha of highest yielding check variety Varuna (Table-2.1.10).

2.2

Name of the Project : Breeding for aphid tolerance in Indian mustard

Objectives : i) To develop varieties tolerant to aphid

ii) Identification/development of new sources with increase level of tolerance

Locations : Kangra, Ludhiana, Bathinda, Hisar, Pantnagar, Berhampore and Trombay

Kangra:

The following backcrosses were attempted to develop aphid tolerant mustard genotypes:

(PBM-16-12 x Varuna) x Vâruna,
(PBM-16-12 x Rohini) x Rohini and
(PBM-16-12 x Kranti) x Kranti

PBM-16-12 was used as donor parent for aphid tolerance.

Ludhiana:

During the year under report the entries namely; JMG-70, JMG-217, JMG-293, JMG-386, CSR-61 and IB-1674 were selected on the basis of low aphid index and aphid population.

Bathinda:

15 enteries viz., CSR-192, CSR-226, CSR-272, CSR-402, CSR-446, CSR-464, CSR-483, CSR-898, CSR-1006, CSR-1065, CSR-1270, CSR-1128, B-92, RC-1141 and RC-1204 remained free from aphid incidence.

Hisar:

Apart from possessing the aphid tolerance, two entries, namely; RH-9006 (2145 kg/ha) and RH-9020 (1866 kg/ha) also outyielded the highest yielding local check RH-30 (1748 kg/ha). F_4 progenies of RH-8113 x T-6342, RH-8602 x T-6342 and RH-819 x T-6342 were evaluated in replicated progeny row trial. Good recombinents have been selected from the F_2 generation of crosses between tolerant sources such as apetalous lines, white flower, glossy stem and purple plant material and agronomically superior lines. The above tolerant sources have been used this year in the crossing programme and F_1 seed have been harvested.

Pantnagar:

125 F_3 and 104 F_4 progenies were grown under natural

conditions (without insecticidal spray) with a border row of infactor row of Yellow sarson variety around each strip. The attack of aphid was not much, thus effective screening could not be done. However, desirable plants with less incidence of aphid damage have been selected for further evaluation and selection.

Berhampore:

10 strains showing tolerant reaction to aphid were evaluated. Of these, the test entries RWAR-842 (1331 kg/ha) and S-3 (1249 Kg/ha) yielded significantly higher than T-6342. Score value of aphid was based on randomly selected 20 plants at two stages i.e. full bloom stage and pod formation stage. The variation in yield could not be explained as the aphid pressure during the year under report was very low, which requires further confirmation.

IARI, New Delhi:

Over 300 progenies from the cross Pusa bold x Dira 326 were planted in F_3 generation. Based on aphid infestation on inflorescence and overall visual rating on the families and plants, 576 lines were bulked as well as 100 single plant selections were made under late planting.

Under timely planting of the above replica, 41 lines were bulked and 120 single plant selections retained from 60 families. These selections are at par in maturity to that of standard checks and also possess yellow bold seeds. It is proposed to resort to recurrent selection in most tolerant ones to upgrade the level of aphid tolerance.

2.3

Name of the Project: Disease resistance/tolerance

Objectives : i) Development of high yielding varieties possessing resistance/tolerance against major diseases

ii) Indentification of new sources of disease resistance

Locations : Ludhiana, Bathinda, Hisar, Pantnagar, Berhampore

Progress of Work

(a) Alternaria blight

Ludhiana:

At Ludhiana, 331 germplasm lines were screened in field conditions for Alternaria blight. Ten lines namely; NDR-190, PSR-5, RSK-33, JMM-904, DIR-457, RH-8904, Bio-902, RL-1359 and RW-8716 were identified with one score of Alternaria blight. These lines have further been crossed in all possible combinations to study the inheritance of blight resistance.

Bathinda:

At this centre interspecific and intra-specific crosses were made few years back to develop lines/strains resistant to alternaria and white rust. As a result of this several lines such as J-22, J-75, J-78, J-95, J-102, J-135, J-154, J-162, J-168, J-174, J-175, J-176 and J-179 have been indentified as resistant against Alternaria blight.

Hisar:

BC2 crosses were further advanced to BC3. In addition BC2 crosses were attempted in RH-781 x Domo-4, RH-819 x Domo-4, RH-781 x RC-781 and RH-819 x RH-781. Three strains namely; RH-9030 (1965 kg/ha), RH-9036 (1900 kg/ha) and RH-9042 (1868 kg/ha) recorded significantly higher seed yield compared to local and zonal checks RH-30 (1431 kg/ha) and RH-8113 (1709 kg/ha), respectively. These strains apart from being higher yielding were also observed to be resistant to alternaria and white rust. Desired plants possessing high seed yield and resistance to alternaria blight have also been selected from the progenies.

Pantnagar:

Eleven F_2 populations (8 from single crosses and 3 from double crosses) and 94 F_3 progenies involving RC-781 and PHR-1 as donor parents and Poorbi raya, Pusa bold, Kranti and Krishna as agronomic parents were grown in the field. The spores suspension was sprayed both at leaf and pod stage. All the plants were observed to be susceptible at leaf stage. However, variation in the appearnace of disease was observed at pod stage. The plants showing low score of infection were harvested. As a result 220 individual plants from F_2 and 145 plants from F_3 progenies have been selected for further selection of desirable plants in the subsequent generations. Besides, 7 F_1's (3 way and double crosses) made during previous season were grown and advanced to F_2. In order to concentrate the genes for Alternaria resistance/tolerance lines like RC-781, PHR-1, PHR-2, PR-8925 and PR-9006 were intercrossed in all combinations (excluding reciprocals). These crosses will be grown in the coming crop season. Besides 5 fresh crosses involving above donor parents and new strains were attempted and their seeds harvested. The crosses have also been attempted between Brassica juncea and Turnip, but no success was obtained. Two strains namely; PR-8925 and PR-9006 which showed disease index of 22% and 26% respectively were tested for disease reaction at different centres. The line PR-8925 (925 kg/ha) yielded higher than the checks Varuna (773 kg/ha) and Kranti (666 kg/ha).

Berhampore:

At this centre, 10 alternaria tolerant selections were evaluated against YRT-3 and RC-781 resistant checks and Kranti, the susceptible check. The results indicated that the test selection RWDR-8410 (1545 kg/ha) recorded higher seed yield than the high yielding national check, Kranti (1411 kg/ha) followed by RWDR-847 (1502 kg/ha). As far as the disease reaction is concerned all the test entries were at par with the resistant/tolerant checks, RC-781 and YRT-3, respectively.

Dholi:

F_2 and F_3 segregating population of following 15 crosses were raised and evaluated :

Varuna x Domo,	Varuna x Zem-2,	Varuna x Tower,
Varuna x Midas,	Varuna x DIR-325,	Kranti x Domo,
Kranti x Tower,	Kranti x Zem-2,	Kranti x Midas,
Kranti x DIR-325,	Pusa bold x Zem-2,	Pusa bold x Domo,
Pusa bold x Midas,	Pusa bold x DIR-325,	Pusa bold x Tower,

Seven single plant selections (F_2's) i.e., Varuna x DIR-325 (Score 1-12%, P 5%), Varuna x Midas (SPS 1) (L 20%, P 10%) Varuna x Midas (SPS 2) (L 25%, P 10%), Varuna x Tower (L 25%, P 10%), Kranti x DIR-325 (L 15%, P 5%), Pusa bold x Tower (L 20%, P 10%) and Pusa bold x Zem-2 (L 20%, P 10%) were raised and evaluated.

L' denotes "Leaf stage", P' denotes "Pod stage" and SPS' denotes "Single plant selection"

All the 15 crosses were backcrossed with their different parents.

New crosses were made involving adopted varieties with Jathai Rai having fair tolerance to Alternaria blight. These crosses are as folllows:

Varuna x Jathai Rai, Kranti x Jathai Rai, Pusa bold x Jathai Rai, BR-40 x Jathai Rai, RAURD 1001 x Jathai Rai, RAURD 1002 x Jathai Rai and Vardan x Jathai Rai

In yellow sarson two single crosses namely; 66-197-3 x Pendent type local and YST-151 x Pendent type local were made.

35 selected progeneis alongwith 9 F_1's grown for generation advancement at Lahul Spiti in offseason.

(b) White rust (Albugo candida)

Kangra:

The following crosses were attempted taking BEC series, YRT-3, RGC-9005 and NDR-871 as donor parents for white rust resistance:

BEC-112 x Varuna, BEC-128 x Varuna, BEC-143 x Varuna, BEC-129 x Varuna, BEC-112 x Kranti, BEC-128 x Kranti, BEC-129 x Kranti, BEC-143 x Kranti, Varuna x YRT-3, Krishna x YRT_3, Kranti x YRT-3, RL-1359 x YRT-3, RLM-619 x YRT-3, RCC-4 x YRT-3, RCC-15 x YRT-3, Varuna x RHC-9005, Krishna x RHC-9005, Kranti x RHC-9005, RL-1359 x RHC-9005, RLM-619 x RHC-9005, RC-4 x RHC-9005, RCC-15 x RHC-9005, Varuan x NDR-871, Krishna x NDR-871, Kranti x NDR-871, RL-1359 x NDR-871, RLM-619 x NDR-871, RCC-4 x NDR-871

Ludhiana:

Of the 331 germplasm lines screened, 11 lines namely; RL-1-3, RL-1-22, RL-1-25, RL-2-28, RL-2-30, RL-2-41, RL-3-58, RL-3-69, PB(WRRNT)-3, PB(WRRNT)-4 and PB(WRRNT)-6 had a score of zero for white rust. As such, these lines were classified as highly resistant under natural conditions, however, these will be further screened under laboratory conditions to confirm their reaction. These lines were selfed and crossed with RL-1359 in order of transfer the resistance. The BC-1 cross with RL-1359 will be attempted at Keylong during summer 1992.

Bathinda:

The strains/selections namely; J-23, J-24, J-80, J-131, J-173 and J-180 were observed to be completely free from white rust both at leaf and pod stage. The results will be confirmed by evaluating seed material under laboratory conditions.

Pantnagar:

At this centre efforts are being made to develop white rust resistant varieties of Toria and Mustard through recombinant progeny and backcrossing approaches.

In Toria, a population named as SW-83-4302, observed free from white rust under artificial epiphytotic conditions is being used as donor parent. During this season, the cross PT-303 x SW-83-402 alongwith parents was grown. The F_1 was advanced to F_2 and backcrossed with the recurrent parent.

In Mustard, Domo, Cutlas, and YRT-3 have been used as donor parent. On the basis of 2 years data (artificial inoculation in the field), strains PR-8998 and PR-9021 which showed disease index 10.35% and 10.33% respectively were identified as resistant. These two strains were evaluated for their yield performance at the centre. It was observed that the strain PR-8998 (694 kg/ha) and PR-9021 (648 kg/ha) yielded at par with the check variety Varuna (717 kg/ha) and Kranti (666 kg/ha).

Twelve lines developed recently were evaluated for white rust reaction in epiphytotic conditions in glasshous. The WR-9201 and WR-9205 were observed moderately resistant with score in the rate scale of 0-5. Six F_2 populations and 128 F_3 progenies were screened under field conditions and were artificial inoculated by spraying sporangial inoculum. The plants showing low level of white rust infection have been harvested. As a result, 140 individual plants from F_2 populations and 186 individual plants from F_3 progenies have been selected. Seven F_1's were grown and advanced to F_2. Besides 40 fresh crosses have also been attempted using the aforesaid donor parents. In glasshouse, 4 F_2 populations were screened at seedling stage under artificial inoculated conditions and the studies form 112 individual plants showing less infection have been harvested. Besides, first backcrossing cycle was also done.

IARI, New Delhi:

A total of 593 progenies of F_2, F_3 and backcrosses involving DIRA-313 as the donor for white rust resistance and promising agronomic (recurrent) parents DIRA-335, Pusa bold and others, were planted for evaluation. The incidence of white rust was satisfactory which permitted rigourous effective selection for rust resistance in field. 350 resistant and tolernat single plants coupled with agronomic superiority, were retained from amongst 70 selected progenies. Some of the more promising ones would be advanced for further screening at Wellington during the offseason.

Besides two white rust resistant selections namely; DIRA-313-6 and DIRA-313-7 have been included in national screening nursery for white rust resistant.

168 new crosses have been attempted to incorporate the resistance to white rust and alternaria blight in high yielding backgrounds. Backcross programme for Pusa bold x DIRA-313 has been pursued for white rust resistance.

Morena:

The work is being done in Toria and mustard. In Toria, the cross between T-9 and Parkland (White rust resistant Canadian variety) has entered into BC-2 stage whereas with that of Bhawani and Parkland in BC-1 stage. In mustard the material developed by crossing and released variety such as Pusa bold, Varuna, Krishana, Rohini etc. The white rust resistant donors L-4 , L-6, R-908 have entered in BC-3 stage. Fresh crosses between Pusa bold, Seeta and BIO-YSR and Zem-1 have been attempted during the year. Selections were performed in F_3 population of PB x L-6, Rohini x L-6, RK-9503 x L-6, RK-8503 x L-4 and Varuna x R-908 and desirable plants showing resistance to white rust and also possess high seed yield have been selected.

Powdery Mildew: (Peronospora brassicae)

S.K.Nagar:

The 22 lines showing tolerance to powdery mildew and white rust were evaluated alongwith local check GM-1 and national checks Varuna and Kranti. The line SKM-91-42 (3048 kg/ha), SKM-91-50 (2825 kg/ha) and SKM-91-49 (2862 kg/ha) were observed to be promising with respect to seed yield and disease tolerance. The disease index varied from score 1-2 for these three strains. Selection for tolerant/resistant plants against powdery mildew and white rust was also performed in the varying fillial generations is presented below:

Generation	No.of crosses	No.of progenies IPS	Bulk	No. of plants progeny/ bulks selected IPS	Bulk
F2	60	-	60	65	-
BC-2F2	16	-	16	33	-
BC-2F3	16	48	-	79	-
F4	4	14	8	46	8
F5	2	-	3	-	2
Total	98	62	87	223	10

New Crosses were attempted using SKM 91-42, SK -91-43, SKM-91-44, CSR-71, YRT-5 as donor parents and improved cultivars as agronomic basis.

2.4

Name of the project	:	Breeding for increased oil content
Objectives	:	To develop/identify genotypes with high oil content
Mustard	:	43% or more
Locations	:	Ludhiana, Bathinda, Hisar, Kanpur, Faizabad and Pantnagar
Toria	:	44% or more
Locations	:	Ludhiana, Bathinda, Hisar, Kanpur and Pantnagar
Yellow Sarson	:	46.5% or more
Locations	:	Pantnagar and Berhampore.
Taramira	:	38% or more
Location	:	Diggi

Progress of work:

21 strains of mustard identified for high oil content in previous years were evaluated in different zones of the country. The zone wise results have been discussed below:

Zone II

Ludhiana:

None of the strains recorded the targeted oil content of 43% (Table 2.4.1). However, the highest oil content of 40.4% was recorded by strain SRM-156 as against 36.7% by check variety Varuna. Interestingly, the strain SRM-156 recorded the highest seed yield of 2437 kg/ha as compared to 1000 kg/ha of highest yielding check variety, Varuna.

Bathinda:

None of the strains under test recorded the targeted oil content.The oil content ranged from 33.6%to 38.6%.The highest oil content 38.6% was recorded in strain RW-3186 followed by 38.1% of RW-7/86 and SRM-156 as against 36.6% of highest check variety, Varuna. The highest seed yield of 2300 kg/ha was recorded for the strain PRG-908 as against 1478 kg/ha of highest yielding check variety Kranti (Table 2.4.1).

Hisar:

The highest oil content of 44.8% was recorded in a strain RW-7/86 compared to 44.1% of check variety Kranti .The highest seed yield of 3775 kg/ha was recorded for a strain PRG-914 as against 2680 kg/ha of highest yielding check variety, Kranti (Table 2.4.1).

PC Unit, Hisar:

The highest oil content of 40.8% was recorded in a strain DYS-27-9 compared to 38.9% of highest oil content check variety, Varuna. The highest yield of 2462 kg/ha was recorded by PRG-908 as compared to 2065 kg/ha of highest yielding check variety, Kranti (Table 2.4.1).

Zone-III

Kanpur:

A strain RW-7/86 recorded highest oil content of 44.3% as compared to 38.3% of Kranti. Whereas, RK-8604 recorded the highest seed yield of 2326 kg/ha compared to 1689 kg/ha of Kranti (Table 2.4.2).

Pantnagar:

The highest seed yield of 1149 kg/ha followed by 1113 kg/ha was recorded by NDYR-8 and RC-891, respectively as compared to 700 kg/ha of Kranti (Table 2.4.2).

Faizabad:

A strain NDYR-8 recorded the highest seed yield of 1481 kg/ha compared to highest yielding check variety, Varuna(1234 kg/ha) (Table 2.4.2).

Zone-V:

Berhampore:

A strain RK-8605 recorded the highest seed yield of 1226 kg/ha as against 1066 kg/ha of highest yielding check variety, Kranti(Table 2.23).

F_1 crosses developed last year were grown and advanced to F_2 generation. New crosses have been attempted using the identified high oil content lines as donor parents and agronomically superior lines as the recurrent parents.

2.5

Name of the Project : Development of hybrids.

Objectives : Development and identification of promising hybrids in Rapeseed-Mustard

Locations :

Toria : Ludhiana, Hisar, Faizabad, Pantnagar

Mustard : Ludhiana, IARI, New Delhi, Navgaon, PC Unit, Biotechnology Centre

Progress of work:

The detailed report with respect to the development of hybrid in rapeseed-mustard has been brought out separately. However, the summary of the progress made during the year under different Sub-Projects of Hybrid Programme has been presented below:

Evaluation of two mustard hybrids namely; PHR-2 and PHR-7 revealed that the hybrid PHR-2 recorded numerically higher average seed yield of 1998(Kg/ha) compared to 1689(Kg/ha), 1840(kg/ha) and 1866(Kg/ha) of Varuna, Kranti and RL-1359, respectively in Zone-II. On the basis of pooled mean, in Zone-III PHR-2 recorded the seed yield of 1666(Kg/ha) against 1128, 1425 and 1377(Kg/ha) of Varuna, Kranti and Rohini, respectively. The data have been presented in Table 2.5.1, 2.5.2.

The available CMS systems namely; carinata, tournefortii, Ogura, Polima and oxyrrhina are being exploited for the development of hybrids. Presently, carinata CMS is being used for developing hybrids by Punjab Agril. University, Ludhiana. In tournefortii CMS system, partial restoration was observed with EJ-2, RE-15, RE-35, YST, CE-3, CCJ, RT-57, MHC-1-3 and RJ-10. In Ogura CMS, fertility restorer gene(s) being introgressed from R.sativa and promising source for fertility restoration identified in B.napus. In Polima CMS stable sterile plants have been identified and diversification of restorer line Italy is being done. A good number of crosses have been evaluated with oxyrrhina cytoplasm but none of them could restore fertility.

In all, about 3000 new crosses were attempted at different centres with available CMS systems to identify restorer genotypes.

The identified source/lines for white rust resistance and aphid tolerance are being converted into CMS through backcross substitution.

Backcross substitution programme is being continued for transferring B.juncea genome in the cytoplasmic backgrounds

of E.sativa, B.oxyrrhina, B.tournefortii, B.fruiticulosa, D.muralis, Moricanda arvensis, D.catholica and Trachystoma balli.
Few new crosses involving the D.erucoides, Sinapis allioni, B.alboglabra, B.tournefortii, B.alba and B.fruticulosa were attempted.

The derivatives of crosses namely; B.juncea x B.napus and B.juncea x B.carinata possess high degree of resistance to white rust and downy mildew diseases and are being used to develop male sterile lines in resistant/tolerant backgrounds.

Good combining parents and high heterotic responsive crosses identified. The fresh crosses involving new breeding strains in different mating designs attempted to identify good combining parents and high heterotic responsive crosses.

Parental lines are being further improved through selection and recombination. Stable resistant and breeding material developed through intervarietal crosses being converted in different CMS background.

Various field plot technique were evaluated for the production of hybrid seed. Highest seed set was recorded when the male rows were sown in higher frequency i.e. 1:2 1:3 1:4. Gross hybrid seed yields were higher (207 to 333 kg/ha) in seed production plots having 1M:3F sowing design. The cost of producing hybrid seed ranged from Rs. 54/- per kg to Rs. 84/- per kg.

Cytological studies indicated that tournefortii CMS is associated with impaired fertility. This system possess meiotic abnormalities whereas, carinata CMS is cytologically normal. Oxyrrhina CMS has stable expression of sterility, no meiotic abnormalities and good female fertility.

Desirable S_1 plants of toria were bud pollinataed to produce S_2 seeds. The conversion of toria lines in the background of available CMS is being continued. The toria experimental hybrids developed through genic male sterility evaluated. NDTH-8 recorded heterosis for seed yield of 57.11%. In addition, 11 double cross and S-allele homozygote x variety hybrids evaluated. PTH-10 recorded 2843 kg/ha compared to 1453 kg/ha of PT-303.

Three new S-alleles were added to the existing S-allele tester set comprising 17 different S' alleles. In total 55 self compatible lines of toria identified to develop hybrids.

B.tournefortii, Polima and Ogura CMS have been extensively exploited to perfectize three line system for exploiting heterotic vigour in B.napus. The identified restorer sources and its diversification in different agronomically superior background is continued. The desirable heterotic responsive cross combinations and superior genotypes for Alternaria and shattering resistance being developed.

Three yellow sarson hybrids developed through genic male sterility were evaluated. The hybrid YSH-1 recorded significant positive heterosis for seed yiaeld against better parent.

2.6

Name of the Project : Identification of salt tolerant strains

Objectives : To identify the salt tolerant strains

Locations : Karnal, Jodhpur, Faizabad and Kanpur.

Progress of work:

With a view to identify salt tolerant lines, a trial was laid-out at Karnal, Jodhpur, Kanpur and Faizabad. The results obtained at these centres have been given below:

Karnal:

Salinity/alkalinity varietal trial was sown in Semi-Arid Saline Soil at Sampla. Soil salinity(ECe ds/m) at harvest was determined from each variety/line in all replications. The seed yield was subjected to analysis of co-variance using salinity as co-variate. The soil salinity(ECe ds/m) seed yield and adjusted seed yield at standard salinity levels have been presented in Table 2.6.1. Varietal differences were not significant. The highest seed yield was recorded for DIRA-343(1024 kg/ha) as against 631 kg/ha of Kranti, the highest yielding check variety.

Table : 2.6.1 Showing the results of salinity/alkalinity trial conducted at Sampla during 1991-92.

Code	Strain	*'	**'	Code	Strain	*'	**'
SCN-1	NDR-190	9.4	368	SCN-11	CS-438	11.2	802
SCN-2	NDRE-4	8.2	773	SCN-12	CS-209	11.9	546
SCN-3	PST-1	7.3	368	SCN-13	CS-395	9.3	511
SCN-4	PST-2	7.1	468	SCN-14	CS-383	9.6	871
SCN-5	PST-3	6.1	520	SCN-15	PCR-906-2	8.7	548
SCN-6	WRR-3-1	8.3	255	SCN-16	RK-8902	8.8	882
SCN-7	CS-12	9.1	497	SCN-17	DIRA-343	8.9	1024
SCN-8	CS-15	8.3	882	SCN-18	Varuna(NC)	6.6	517
SCN-9	CS-42	8.7	795	SCN-19	Kranti(NC)	8.6	631
SCN-10	CS-50	8.1	793	SCN-20	NDR-8501(ZC)	9.2	402
	CD at 5%		NS				NS

*' denotes Soil salinity (ECe ds/m)

**' denotes Mean seed yield after adjustment of all salinity levels to standard salinity of ECe 8.6 ds/m

A trial comprising of 27 entries which were earlier screened in saline soil alongwith checks Kranti, Krishana and Pusabold were sown on 10 October in RBD and replicated thrice. The soil salinity (ECe) at harvest ranged from 4.2 to 11.9 dS/m. Seed yield was, therefore, subjected to analysis of co-variance using salinity data from each variety as co-variate. Adjusted seed yield was highest for DLM-2(928 kg/ha) followed by RJ-11 (858 kg/ha) and CS-265 (854 kg/ha) (Table 2.6.2). Varietal differences were, however, not significant.

Table:2.6.2 Showing the results of a trial conducted under saline soil at Karnal during 1991-92.

Variety/ lines	Mean seed yield adjusted at standard salinity level of ECe-7.6 ds/m (Seed yield kg/ha)	Variety/ lines	Mean seed yield adjusted at standard salinity level of ECe-7.6 ds/m (Seed yield kg/ha)
1. RK890	547	16. 312	281
2. RK8920	499	17. CS401	495
3. RK8958	384	18. KRISHNNA	658
4. RB8911	347	19. CS419	629
5. KRANTI	425	20. CS424	588
6. RJ8	688	21. CS427	614
7. RJ11	858	22. CS428	536
8. DLM2	928	23. CS430	721
9. CS15	555	24. CS437	466
10.NDR189	688	25. CS439	592
11.RSK8	791	26. CS450	425
12.RM54	692	27. CS454	422
13.CS50	588	28. CS464	584
14.CS132	584	29. PUSABOLD	562
15.CS265	854	30. DLM6	806
CD 5%	NS	CD 5%	NS

CAZRI, Jodhpur:

In a coordinated varietal trial on 27(20 +7) varieties of Indian mustard, were evaluated for salt tolerance at two soil salinity levels (ECe- 9.5 and 12.3 and control 2.3 ds/m) in a split-plot design with three replications. Root zone salinity significantly influenced the seed yield causing depression in it by 32.1 and 55% at the EC levels of 9.5 and 12.3 ds/m, respectively over control. Days taken to flower and maturity were advanced by 5 and 2 days at the respective salinity levels when compared to control. Varieties depicted a considerable response to salinity showing range in mean seed yield across the salinity levels from 81.1 g (SCN-2) to 160 g (CZR-1). Similarly, seed yield at the later salinity level decreased as minimum as CZR-2 followed by SCN-11, SCN-2, RLC-1357, SCN-15, SCN-13 showing less than 50% yield decline, were rated better salt tolerant than other varieties under the existing conditions. The data have been presented in Table 2.6.3.

Table:2.6.3 Seed yield (3.5 m long rows) of Indian mustard under saline condition at Jodhpur during Rabi 1991-92.

Varieties	Strain	Control	ECe 9.5 (ds/m)	ECe 12.3 (ds/m)	Mean across salinity level
SCN-1	176.6	100.0	73.3	116.6	58.4
SCN-2	110.0	80.0	53.3	81.1	42.4
SCN-3	153.3	80.5	63.3	98.8	58.7
SCN-4	110.0	96.6	46.6	84.4	57.6
SCN-5	146.6	120.0	70.0	112.2	52.2
SCN-6	113.3	86.6	46.6	82.2	58.8
SCN-7	160.0	116.6	80.0	118.8	50.0
SCN-8	216.0	110.0	43.3	123.3	79.9
SCN-9	136.6	100.0	60.0	98.8	56.0
SCN-10	223.3	113.3	56.6	131.1	49.2
SCN-11	163.3	123.3	93.3	126.6	42.8
SCN-12	116.6	101.6	61.6	93.3	47.1
SCN-13	166.6	123.3	93.3	126.6	43.9
SCN-14	170.0	103.3	70.0	114.4	58.8
SCN-15	153.3	130.0	85.0	122.7	44.6
SCN-16	153.3	100.0	76.6	110.0	50.0
SCN-17	176.6	126.6	91.6	131.6	48.1
SCN-18	240.0	126.6	63.3	143.3	73.6
SCN-19	160.0	120.0	58.3	126.1	63.5
SCN-20	153.3	93.3	60.0	102.2	60.8
CZR-1	230.0	153.3	96.6	160.0	58.0
CZR-2	143.3	116.6	93.3	117.7	34.9
CZR-3	226.6	140.0	100.0	153.8	55.8
CZR-4	166.6	123.3	85.0	125.0	48.9
RLC-1357	153.3	100.0	86.6	113.3	43.5
PB	156.6	116.6	80.0	117.7	48.9
CS-50	230.0	85.0	68.3	84.4	70.3

Experimental details:

Location	Jodhpur
Year	1991-92 Rabi
Design	Split-Plot
Replication	3
Plot size	6.5 x 3.5 m(Net plot 3.5 m long single row)
Sowing date	5.11.1991
Harvesting date	12.3.1992
NPK application	Nil
No.of irrigation	4 including pre sowing
No.of varieties	20
Soil type	Loamy sand
Date of thinning	27.11.1991

Kanpur:

The yield were very poor,the highest being recorded for a strain CS-209 as against 293 kg/ha of Varuna,the highest yielding check.

Faizabad:

A strain DIRA-343 attained the maximum seed yield of 1420 kg/ha compared to 1533 kg/ha of Kranti, the highest yielding check.

On the basis of four locations i.e., Karnal, Jodhpur, Kanpur and Faizabad Dira-343 possessed the highest seed yield of 991 kg/ha compared to 892 kg/ha of Kranti, the highest yielding check variety.The data have been presented in Table 2.6.4.

2.7

Name of the Project : Breeding for low erucic and glucosinolate content varieties of rapeseed-mustard

Objectives : To develop varieties possessing low erucic acid and glucosinolate content

Pantnagar:

Rapeseed-mustard varieties cultivated in India, generally contain a high amount of erucic acid in oil and glucosinolate in seed meal. Therefore, research efforts are underway to evolve rapeseed-mustard varieties with low erucic acid and/or low glucosinolates in seed meal.

In toria, Canadian cultivars Tobin and Parkland are being used as donor parents. During current crop season these donors were crossed with T-9, PT-303 and PT-30. Besides, 8 F_1's were advanced to F_2. A F_2 population of cross PT-303 x Tobin was grown and desirable plants were selected. During current crop season 5 fresh crosses were made.

In mustard, Zem-1 and Zem-2 are being used as donor parents. During current season 14 fresh crosses were made. Five F_1's were grown and advanced to F_2 and seed of individual plants have been collected separately. Five F_2 population, 58 F_3 progenies and 28 F_4 progenies were grown and desirable plants were selected. Consequently, individual plant seeds of 94, 124, 285 and 139 of generations F_2, F_3, F_4 and F_5 respectively are available for quality analysis for final selection in the laboratory.

One thousand lines of rapeseed-mustard were analysed for glucosinolate using test tape method and the lines showing low glucosinolates are listed below:

Crop	**Genotypes**
Toria	TCN-1, TCN-7, TCN-11, PTC-8, PTC-18
Mustard	MLS-2, MLS-11, MLS-14, MLS-19, MCN-10, PR-9001, PR-9024, MECN-17, MECN-6, MECN-11, MECN-1, MECN-2, MECN-7, MECN-4, MECN-8, MECN-12, PR-8928.

Hisar:

The donors like Zem-1 and Zem-2 for low erucic acid and EC-626743 for high oil content and yellow seed coat colour have been involved in crossing programme with advanced promising strains. Besides, single plants have also been selected from the material of exotic origin especially the chinese material. Analysis in respect of quality traits is in progress.

Gurdaspur:

Fifteen strains of B.napus were evaluated against Kranti, Varuna and GSL-1. The strains GSL-004 recorded the highest seed yield of 1393 kg/ha compared to 1130 kg/ha of highest yielding check variety, Varuna (Table 2.7.4).

Ludhiana:

The selected progenies of yellow seeded and brown seeded B.juncea were evaluated for low erucic acid and oleic and linoleic acids. The contents of erucic acid in yellow seeded types varied from 11.18 to 38.02%. Six lines namely; S-5-P17-P7-P4, S-5-P7(E), S-45-P4-P4-P4, S-45-P1-P1-P1-P2(E), S-S-P15-P7-P4 and S-5-P2(E) had erucic acid from 11.18% to 13%. In brown seeded erucic acid content varied from 10.08% to 43.80%.

In toria, TL-15 was crossed with double low variety Tower (B.napus). Now the material is in F_6 generation and one plant (bud pollinated) had 5.4% erucic acid, 0.5% glucosinolates, 49.2% oleic acid and 25.9% linoleic acid. The oil content was 39%.

36 genotypes of B.juncea, B.napus and B.carinata were evaluated for fatty acid profile. Six lines of B.juncea (OM 13, OM 14, OM 15, OM 39, OM 43 and OM 47) have erucic acid below 2.5%. These lines had high level of oleic and linoleic acid. Similarly in B.napus, six lines (i.e. GSL-6001, 6007, 6009, 6032, 6047 and 6063) had low erucic acid (i.e. less than 2.5%). In B.carinata, CE 8 possessed less erucic acid compared to standard varieties.

During the year under report 7 strains of mustard were evaluated for seed yield and quality attributes at Ludhaiana, Hisar, Navgaon and PC(RSM) [illegible]

[illegible]ana:

Amongst tested B.napus strains, a strain WW-1507 recorded significantly higher seed yield compared to highest yielding check variety, Kranti(1540 kg/ha) (Table 2.7.4).

Hisar:

At Hisar, in strains of *B.juncea* the highest seed yield was recorded by a strain NGPY-1 (2664 kg/ha), but the strain NGPY-1 did not had zero erucic acid. The strain EC-287711 possessed 2437 kg/ha seed yield compared to 1738 & 1706 kg/ha of Varuna and Kranti, respectively and possessed low erucic acid content (Table 2.7.1).
None of the tested *B.napus* strain could surpass the check variety, Kranti(2752 kg/ha) (Table 2.7.4).

Navgaon:

In *B.juncea*, the highest seed yield 2383 kg/ha was recorded for a strain NGPY-1 compared to 2266 kg/ha of highest yielding check variety, Kranti (Table 2.7.1).

None of the tested strain of *B.napus* recorded higher seed yield then the check varity, Kranti (Table-2.7.4).

IARI, New Delhi:

None of the tested *B.napus* strains could surpass the check varieties of Indian mustard. However, a strain ISN-602 recorded significantly higher yield compared to the check variety, GSL-1 (722 kg/ha) (Table 2.7.4).

Sriganganagar:

The highest seed yield of 2342 kg/ha was recorded for a strain ISN-733 of *B.napus* compared to 2000 kg/ha of highest yielding check variety, Kranti (Table 2.7.4).

PC(R&M):

Besides maintenance and multiplication of quality breeding material, the fresh crosses between recommended/released varieties and the exotic donor parents viz; EC-322093, EC-322090, EC-322091 and EC-322092 were made to incorporate the low erucic acid content .

In *B.juncea*, none of the tested entry of low erucic acid could surpass the highest yielding check variety, Varuna(2119 kg/ha). However, the strains namely, RW-28-11-2, RW-21-59-2 and EC-287711 were observed at par as compared to the check varieties. It is interesting to note that the exotic strain EC-28711 possessed zero erucic acid and comparatively low glucosinolate content (Table 2.7.1).

The highest seed yield of 2846 kg/ha was recorded for a strain Shirale *B.napus* as compared to the highest yielding check variety, Kranti(2545 kg/ha) (Table 2.7.4).

Zone-III

Morena:

A strain PR-8958 of B.juncea recorded the highest seed yield of 1828 kg/ha compared to 1722 kg/ha, the highest yielding check variety, Kranti. Amongst low/zero erucic acid strains, the highest seed yield was recorded for a strain EC-287711 (1650 kg/ha) (Table 2.7.2).

None of the B.napus strains surpassed significantly the highest yielding check variety, Kranti. However, culture-1 recorded the highest yield of 2320 kg/ha compared to 1974 kg/ha of Kranti, the highest yielding check (Table 2.7.5).

Kanpur:

None of the strain of B.juncea under test recorded the higher yield as compared to the check variety, Kranti(1271 kg/ha). However, the zero erucic acid strain EC-287711 possessed the seed yield of 1129 kg/ha at par of Kranti and significantly higher compared to check variety, Varuna (816 kg/ha) (Table 2.7.2).

The check variety, Kranti recorded the highest seed yield of 2652 kg/ha in B.napus trial (Table 2.7.5).

Faizabad:

None of the strain of B.juncea tested, could surpass the check variety, Kranti. However, the zero erucic acid strain EC-287711 (1123 kg/ha) was observed at par in seed yield as compared to the check variety, Varuna(1020 kg/ha) (Table 2.7.2).

All the B.napus strains were poor yielders compared to the check varieties, Kranti (1153 kg/ha) and Varuna (889 kg/ha), respectively (Table 2.7.5).

Pantnagar:

None of the B.juncea entry surpassed the highest yielding check variety, Kranti(1094 kg/ha). In general, the yields were poor, no conclusive results could be drawan (Table 2.7.2).

None of the entries, of B.napus outyielded the national check varieties Kranti and Varuna recording the yields of 1368 kg/ha and 1089 kg/ha, respectively (Table 2.7.5).

S.K.Nagar:

A strain, NGPY-1 of B.juncea recorded the highest seed yield of 2764 kg/ha as compared to 2084 kg/ha of highest yielding check variety, Varuna. This entry also possessed low erucic acid content (Table 2.7.3).

The strandard varieties; Kranti and Varuna yielded 1488 kg/ha and 1495 kg/ha, respectively and maintained their superiority over the strains of *B.napus* under test (Table 2.7.5).

Berhampore:

Among the low erucic acid strains of *B.juncea*; EC-287711 (1090 kg/ha) recorded highest seed yield (Table 2.7.3).

All the *B.napus* entries had poor yield compared to national check varieties; Varuna and Kranti (Table 2.7.5).

2.8

Name of the Project : Development and identification of late sown varieties

Objectives : Identification of varieties suitable for late sown condition

Zone II : Hisar, Sriganganar, IARI, New Delhi

Zone III : Morena, Faizabad, Varanasi, Pantnagar, Kanpur, Etah

Zone IV : Jalna, Rohri, Medchal

Zone V : Chianki, Dholi, Ranchi, Berhampore, Bhubaneshwar

Progress of work :

The results have been presented in Table; 2.8.1, 2.8.2, 2.8.3 and 2.8.4.

Hisar:

Highest seed yield of 1244 kg/ha was recorded for a strain TM-17-8. This strain recorded significantly higher yield as compared to the identified late sown check variety, RH-7859 (942 kg/ha).

Sriganganagar:

A strain, RN-100 recorded the highest seed yield of 689 kg/ha as compared to the highest yielding check variety, RH-7859 (467 kg/ha).

Morena:

The strains, TM-21 and RW-873 recorded significantly higher seed yield of 830 kg/ha as against the highest yielding check variety, Vardan (655 kg/ha).

Faizabad:

A strain, RK-9046 recorded significantly higher seed yield of 1708 kg/ha as compared to 1450 kg/ha of highest yielding check variety, Kranti (1450 kg/ha).

Varanasi:

A strain, RN-100 recorded significantly higher seed yield of 1450 kg/ha as against the highest yielding check variety, Vardan 1240 kg/ha .

Pantnagar:

None of the strain under test could surpass the highest yielding check variety, Vardan, which recorded the highest seed yield of 1234 kg/ha .

Kanpur:

A strain, PCR-3 recorded the highest seed yield of 3518 kg/ha as compared to 1666, 2296 and 1999 kg/ha of Varuna, Kranti and Vardan, respectively.

Etah:

A strain, NDR-389 recorded the highest seed yield of 2474 kg/ha compared to 1825, 2334 and 1028 kg/ha of Varuna, Kranti and Vardan, respectively.

Jalna:

A strain, PCR-3 recorded the significantly higher seed yield of 2357 kg/ha as compared to the highest yielding check variety, Kranti (1867 kg/ha).

Rahuri:

A strain, Pusa bahar recorded the highest seed yield of 1524 kg/ha as compared to 676, 1176 and 1069 kg/ha of Varuna, Kranti and Seeta, respectively

Medchal:

A strain, RK-911256 recorded the highest seed yield of 3440 kg/ha followed by 3413 kg/ha of RLC-962 as compared to 1920, 2747 and 2747 kg/ha of Varuna, Kranti and Seeta, respectively.

Chianki:

The strains, RK-9046 and PCR-3 recorded the significantly higher seed yield of 1170 kg/ha and 1143 kg/ha as compared to 862, 809 and 764 kg/ha of Varuna, Kranti and Sarma, respectively.

Dholi:

A strain, NDR-8602 recorded the highest seed yield of 874 kg/ha followed by RK-911256 (856 kg/ha) as compared to 726, 630 and 593 of Varuna, Kranti and Sarma, respectively.

Ranchi:

A strain, NDR-8602 recorded the highest seed yield of 522 kg/ha as compared to 329, 387 and 429 kg/ha of Varuna, Kranti and Sarma, respectively.

Berhampore:

A strain, RK-918502 recorded significantly higher seed yield of 1045 kg/ha as compared to 521, 719 and 521 kg/ha of Varuna, Kranti and Sarma, respectively.

Bhubaneshwar:

The yield levels were very poor, therefore, no conclusive result could be drawn.

2.9

Name of the Project : Germplasm Management

Objectives : Collection, maintenance, distribution and evaluation and cataloguing of rapeseed-mustard germplasm accession

Locations : PC Unit (R&M), Hisar and AICORPO (R&M), Research Centre

Progress of work :

During the year under report, 136 lines identified as promising in previous years were evaluated at Ludhiana, Pantnagar, Navgaon, S.K.Nagar and Berhampore. The data recorded on quantitative trials have indicated the presence good amount of variability and are being pooled for further analysis.

Kangra:

At Kangra, the following germplasm lines were maintained by bag selfing/sibmating;

Mustard 147, Brown Sarson 55, Toria 26, Yellow Sarson 34, Karan Sarson 11, G.Sarson 24.

Dholi:

During the year under report, 785 germplasm lines of different Brassicas were maintained by selfing/sibmating keeping in view the mating systems of each spp.

PC Unit:

During 1991-92, a total of 2869 germplasm lines of rapeseed-mustard were maintained by either sibmating/selfing keeping in view their mating system. Apart from these 5 exotic lines received from China were also maintained to enable for distribution to different centres.

Of the above lines mentioned, 2400 lines of rapeseed-mustard were evaluated for seed yield, and its component traits. In addition these lines were evaluated for oil content and disease & insect-pest intensity. The data recorded on above traits indicated the sufficient amount of variability within and between species. On the basis of data recorded, the promising lines will be identified for evaluation at different centres during the year 1992-93.

The detailed data with respect to all the traits has been given seperately in the germplasm catalogue.

A total of 38 exotic germplasm of rapeseed-mustard from Sweden, Canada and U.K. were received through NBPGR, New Delhi. The details of these exotic germplasm have been given in the catalogue prepared by the unit.

C. YELLOW SARSON (BRASSICA CAMPESTRIS)

2.10

Name of the Project : Development of varieties which matures in 90 days

Objectives : Evaluation of single plant selection for yield

Locations : Berhampore

Progress of work :

During 1988-89, 8 single plant progenies were selected which matured around 90 days. Subsequently, these progenies were further evaluated during 1989-90, 1990-91 and 1991-92. This year these progenies confirm their earliness over check variety B-9 and matured 2-4 days earlier. The earliest maturing selection, YSBW-872 matured in 91 days but had poor yield. Two selections namely; YSBW-878 and 881 outyielded the check, recording the yield of 1517 kg/ha and 1591 kg/ha, respectively. These selections matured in 95 days.

2.11

Name of the Project : Development of high yielding varieties of Yellow Sarson

Objectives : To identify varieties of Yellow Sarson possessing high seed yield

Locations : Berhampore, Chianki

Progress of work :

Berhampore:

The F_4 progenies of selected single plants derived from cross between NC-1 x B-9 were grown in progeny rows. Selection was practised and desirable single plants have been selected.

The F_2 progenies of 4 crosses namely; B-9 x Tori-7, B-9 x TC-328, B-9 x Candle and B-9 x Exotic campestris pollen mass were grown in progenies blocks. Few plants were selected on the basis of yield and maturity.

In AVT, 9 strains were evaluated against YST-151. A strain, YSBW-9 recorded the highest seed yield of 1960 kg/ha compared to 720 kg/ha of YST-151 (Table-2.11.1).

Chianki:

A strain, SSK-6 attained the maximum seed yield of 1161 kg/ha compared to 764 kg/ha of national standard YST-151 (Table-2.11.1).

D. TARAMIRA (ERUCA SATIVA) .

2.12

Name of the Project : Development of high yielding varieties of Taramira

Objectives : To identify varieties possessing high seed yield

Locations : Morena, Bathinda and Jobner

Progress of work :

Morena:

None of the strain under test surpassed significantly the standard variety, T-27 in IVT (Table 2.12.1).

In AVT-1, the strains under test did not recorded significantly higher seed yield compared to standard T-27 (Table 2.12.2).

In AVT-2, RTM-314 recorded significantly superior seed yield of 958 kg/ha compared to 821 kg/ha of check variety T-27 (Table 2.12.3).

Bathinda:

In IVT, a strain, PBTM-1 recorded significantly superior seed yield of 1153 kg/ha compared to 884 kg/ha of check variety T-27 (Table 2.12.1).

In AVT-1, RTM-312 recorded significanlty superior seed yield of 935 kg/ha compared to 844 kg/ha of T-27 (Table 2.12.2).

In AVT-2, a strain RTM-314 attained significant higher seed yield of 992 kg/ha compared to 745 kg/ha of T-27 (Table 2.12.2).

Jobner:

In AVT-1, none of the strain under test recorded superior seed yield compared to check variety T-27 (Table 2.12.2).

In AVT-2, the highest seed yield of 1447 kg/ha was recorded for a strain RTM-112 compared to 1283 kg/ha of T-27. However, the results were non-significant (Table 2.12.3).

Sriganganagar:

In IVT, the standard T-27 attained the highest seed yield of 1022 kg/ha (Table 2.12.1).

E. KARAN RAI (BRASSICA CARINATA)

2.13

Name of the Project : Evaluation of Karan rai strains under rainfed conditions

Objectives : To identify high yielding strain of Karan rai

Locations : Kangra, Delhi, Ludhiana, Bathinda, Bawal

Progress of work :

The data have been presented in Table 2.13.1.

Kangra:

A strain, HC-9001 attained the maximum seed yield of 1324 kg/ha compared 889 kg/ha of Kranti, the highest yielding check.

IARI, New Delhi:

The highest seed yield of 3125 kg/ha was recorded for a strain, DLSC-1 compared to 1944 kg/ha of Varuna, the check variety.

Ludhiana:

At this location also, strain HC-9001 maintained its superiority and recorded highest seed of 2400 kg/ha comapred to 1924 kg/ha of Varuna, the highest yielding check variety.

Bathinda:

Of the strains under test, NPC-2 exhibited the highest seed yield of 2170 kg/ha as against 1583 kg/ha of Kranti, the highest yielding check variety.

Bawal:

A strain, PCC-2 recorded highest seed yield of 1852 kg/ha compared to 1407 kg/ha of highest yielding check variety Kranti.

2.14
BREEDER SEED PRODUCTION

BREEDER SEED PRODUCTION OF RAPESEED-MUSTARD CROPS DURING 1991-92

SN	CENTRE	VARIETY	CROP	QUANTITY INDENTED (QTLS)	QUANTITY PRODUCED (QTLS)
1	PANTNAGAR	KRANTI	MUSTARD	1.00	7.00
		KRISHNA	-do-	0.15	3.00
		PT-303	TORIA	0.50	36.00
2	KANPUR	T-9	TORIA	0.90	2.75
		VARUNA	MUSTARD	8.49	12.00
		BHAWANI	TORIA	0.20	0.70
		ROHINI	MUSTARD	0.60	9.00
		VARDAN	-do-	0.25	3.75
		VAIBHAV	-do-	0.20	3.00
3	LUDHIANA	RL-1359	MUSTARD	0.21	0.80
		RLM-619	-do-	0.20	6.00
		TL-15	TORIA	0.45	18.00
4	BERHAMPORE	B-9	Y.SARSON	0.38	3.00
5	SHILLONGANI	M-27	TORIA	2.30	3.00
6	HISAR	RH-30	MUSTARD	0.70	16.00
		SANGAM	TORIA	0.15	0.20
		RH-8113	MUSTARD	0.10	0.20
7	IARI	PUSA BOLD	MUSTARD	2.73	2.48
		PUSA BAHAR	-do-	0.20	0.27
		PUSA BASANT	-do-	0.20	NOT RECEIVED
8	FAIZABAD	NDR 8501	MUSTARD	0.06	-do-
	TOTAL			19.97	127.15

T-

TABLE 2.1.1 SHOWING THE RESULTS OF TORIA STRAINS TESTED UNDER IVT IRRIGATED IN ZONE II DURING 1991-92

			SEED YIELD (Kg/ha)							DAYS TO MATURITY							OIL CONTENT(%)					****SEED WEIGT(g)		
SN	CODE	STRAIN	LDH	BTH	GUD	HSR	KAUL	KNL	MEAN	LDH	BTH	GUD	HSR	KAUL	KNL	MEAN	LDH	BTH	GUD	HSR	MEAN	HSR	GUD	MEAN
1	TCN-1	PT-303(NC)	1407	972	1511	972	1555	777	1199	91	90	90	78	97	116	94	39.7	39.6	42.7	44.	41.6	3.2	3.5	3.4
2	TCN-2	T-9(NC)	1037	1009	1231	1096	1382	654	1068	90	91	94	85	96	116	95	40.9	42.1	41.7	44.	42.2	3.1	2.6	2.9
3	TCN-3	TK-9101	1630	1593	1231	1022	1234	520	1205	91	90	87	78	98	115	93	40.1	39.9	42.1	40.	40.5	3.3	3.1	3.2
4	TCN-4	TK-9102	1444	1509	969	1196	1359	962	1239	91	89	91	79	96	118	94	39.7	40.1	43.2	43.	41.7	3.2	3.5	3.4
5	TCN-5	TH-9101	1770	1231	911	1184	1803	943	1307	91	88	96	78	96	118	95	40.3	42.5	42.6	45.	42.7	3.3	3.7	3.5
6	TCN-6	TH-9102	1348	1028	1062	1150	1433	778	1133	90	89	92	71	90	115	91	40.7	41.5	40.7	44.	41.9	3.1	3.8	3.5
7	TCN-7	TWB-876-1	1096	833	1191	1069	1259	476	987	89	88	91	70	88	116	90	40.2	42.1	40.9	45.	42.2	3.5	3.6	3.6
8	TCN-8	TWB-876-2	1170	1046	1111	1100	1308	454	1031	89	88	87	69	89	115	90	40.9	40.9	44.3	45.	42.8	3.1	3.5	3.3
9	TCN-9	TWB-14/86	1111	851	1369	1111	1396	847	1115	92	90	93	77	96	115	94	39.9	41.7	41.8	46.	42.1	3.2	3.7	3.5
10	TCN-10	PT-8857	1541	1009	1098	1273	1333	475	1121	91	89	88	77	95	116	93	39.6	42.5	43.3	45.	42.8	3.1	3.2	3.2
11	TCN-11	PT-9005	1149	1519	1110	1208	1729	835	1258	92	90	90	81	97	115	94	39.9	41.4	42.8	46.	42.6	3.1	3.3	3.2
12	TCN-12	PBT-38	1296	1472	898	1489	2148	514	1302	92	91	86	82	93	115	93	40.4	40.7	41.4	45.	42.1	3.1	3.3	3.2
13	TCN-13	JMT-6901	1244	1241	1467	1165	1555	349	1170	91	92	91	70	94	116	92	41.5	41.3	39.8	46.	42.3	3.4	3.4	3.4
14	TCN-14	JMT-688-14	1837	1107	1178	1111	1507	898	1283	91	93	90	79	97	115	94	42.1	40.1	43.3	46.	43.0	3.4	3.4	3.4
15	TCN-15	DT-8	1222	890	1067	1262	1753	793	1162	91	92	85	79	95	116	93	40.7	40.1	41.6	45.	41.8	3.5	3.5	3.5
16	TCN-16	DT-10	1052	1361	1267	1130	1729	1382	1320	90	91	105	78	96	123	97	39.1	39.5	41.7	45.	41.5	3.1	2.9	3.1
17	TCN-17	SEJ-2	1259	1685	947	1620	2766	524	1466	91	90	111	88	98	116	99	38.2	42.2	40.8	42.	40.9	2.9	3.5	3.2
18	TCN-18	PPMS	1481	1556	1344	1235	1308	539	1243	90	87	106	88	103	119	99	38.8	42.1	39.1	42.	40.6	2.6	3.6	3.1
19	TCN-19	PBT-37	1971	1611	1924	1169	1679	682	1506	91	88	91	77	98	118	94	43.2	39.5	42.3	46.	42.9	3.2	3.4	3.3
20	TCN-20	TL-15/TH-68	1556	1546	1329	1088	1085	866	1245	91	85	91	70	90	118	91	41.7	40.2	42.7	46.	42.8	3.3	3.3	3.3
GM			1381	1256	1210	1182	1566	713	1218	90	89	92	77	95	116	93	40.3	41.1	41.9	45.	42.0	3.2	3.4	3.3
SEM			189	47.7	163	63.8	-	47.8																
CD AT 5%			542	136	467	182	370	136																
CV%			23.8	6.6	23.4	9.4	14.5	11.7																

TABLE 2.1.2 SHOWING THE RESULTS OF TORIA STRAINS TESTED UNDER IVT IRRIGATED IN ZONE III DURING 1991-92

SN	CODE	STRAIN	SEED YIELD (Kg/ha)							DAYS TO MATURITY							OIL CONTENT(%)			1000 SEED WEIGHT(g)						
			KAN	FZB	MOR	JAG	PANT	RAP	MEAN	KAN	FZB	MOR	JAG	PANT	RAP	MEAN	KAN	FZB	MEAN	KAN	FZB	MOR	JAG	PANT	RAP	MEAN
1	TCN-1	PT-303(NC)	2218	1481	1960	277	1916	1130	1497	105	101	95	87	89	86	94	45.2	46.2	45.7	2.9	3.2	3.9	2.6	3.6	2.5	3.1
2	TCN-2	T-9(NC)	1747	1407	1677	343	2018	1018	1368	103	98	96	86	93	87	94	42.8	46.5	44.6	2.5	2.9	3.1	2.1	3.5	2.6	2.8
3	TCN-3	TK-9101	2053	1070	1900	229	1999	1241	1415	101	103	97	86	91	86	94	43.4	46.6	45.1	2.5	2.9	3.2	2.9	3.5	2.7	2.9
4	TCN-4	TK-9102	1920	1267	1567	327	1888	1028	1332	107	101	95	85	91	81	93	44.4	46.3	45.3	2.8	3.1	3.6	2.3	3.5	3.1	3.1
5	TCN-5	TH-9101	1387	1095	1633	260	2055	1259	1281	100	101	90	83	89	84	91	44.2	46.4	45.3	2.5	3.1	3.5	1.9	3.5	2.9	2.9
6	TCN-6	TH-9102	1262	1177	1433	245	1629	1074	1136	98	97	90	80	87	81	89	43.8	44.8	44.3	2.2	3.1	3.2	2.2	3.3	2.9	2.8
7	TCN-7	TWB-876-1	1467	1159	1243	419	1833	1370	1250	102	92	88	81	90	82	89	47.1	47.5	47.3	2.7	3.2	3.4	3.1	3.6	3.1	3.2
8	TCN-8	TWB-876-2	1029	1152	1200	414	1666	1148	1101	99	-	87	78	88	81	87	47.5	47.1	47.3	3.1	-	3.6	2.4	3.5	3.1	3.1
9	TCN-9	TWB-14/86	1520	1161	1460	370	1592	1518	1270	100	98	90	85	90	84	91	43.1	45.8	44.4	3.2	3.2	3.8	2.2	3.4	2.9	3.1
10	TCN-10	PT-8857	1667	1309	1627	323	1944	1269	1356	103	103	91	86	92	85	93	46.4	46.1	46.2	2.3	2.9	3.6	2.5	3.3	3.1	2.9
11	TCN-11	PT-9005	1787	1267	1617	325	2397	1093	1414	101	99	95	87	89	86	93	46.6	46.9	46.7	3.1	2.9	3.2	2.4	3.5	2.7	2.9
12	TCN-12	PBT-38	2098	1235	1610	211	2203	1093	1408	107	101	92	87	94	85	94	47.4	46.8	47.1	2.8	2.6	3.9	2.1	3.4	3.1	2.9
13	TCN-13	JMT-6901	1458	1473	1777	373	1759	898	1289	101	98	95	87	90	82	92	45.4	44.2	44.8	2.8	3.2	3.6	2.8	3.7	2.8	3.2
14	TCN-14	JMT-688-14	1595	1251	1817	232	1962	1148	1334	104	101	95	86	92	86	94	45.3	46.3	45.8	3.1	2.9	3.7	2.3	3.4	2.9	2.7
15	TCN-15	DT-8	1742	1161	1643	299	2055	1306	1367	111	101	96	92	94	86	97	47.5	46.1	46.8	2.8	3.1	3.9	2.2	3.4	3.7	3.2
16	TCN-16	DT-10	1524	1202	1405	263	1962	1306	1277	110	104	96	90	94	89	97	46.3	45.4	45.8	2.8	2.7	3.4	2.2	3.1	3.2	2.9
17	TCN-17	SEJ-2	1819	1144	-	334	2138	1074	1301	119	101	-	96	96	85	99	40.2	38.9	39.5	2.8	2.1	-	1.9	3.2	2.7	2.5
18	TCN-18	PPMS	1560	1309	-	255	2018	-	1285	116	99	-	91	94	89	98	39.6	39.8	39.7	2.4	2.3	-	2.1	3.4	2.4	2.5
19	TCN-19	PBT-37	1804	1350	1922	314	2036	-	1485	105	100	92	86	93	83	93	43.5	46.2	44.8	1.9	3.1	3.3	1.2	3.3	2.9	2.6
20	TCN-20	BHAWANI(ZC)	-	1111	1088	385	2138	-	1180	-	98	98	83	90	80	90	-	45.4	22.7	-	2.7	3.5	2.3	3.5	2.7	2.9
GM			1666	1239	1587	309	1960	1174	1317	104	99	93	86	91	84	93	44.7	45.4	43.9	2.7	2.9	3.5	2.2	3.4	2.9	2.9
SEM			256		113	39.5	91.5	64.6																		
CD AT 5%			NS		316	109	261	186																		
CV%			26.6	11.1	12.4	21.1	8.1	9.5																		

TABLE 2.1.3 SHOWING THE RESULTS OF TORIA STRAINS TESTED UNDER IVT RAINFED IN ZONE V DURING 1991-92

			SEED YIELD (Kg/ha)						DAYS TO MATURITY						1000 SEED WEIGHT(g)				
SN	CODE	STRAIN	BERH	RAN	CHAN	SHL	BHV	MEAN	BERH	RAN	CHAN	SHL	BHV	MEAN	BERH	RAN	CHAN	SHL	MEAN
1	TCN-1	PT-303(NC)	673	355	333	307	1166	566	93	84	88	95	85	89	3.6	2.9	3.1	3.6	3.3
2	TCN-2	T-9(NC)	740	566	440	137	1194	615	92	84	86	97	86	89	3.3	3.5	3.2	2.7	3.2
3	TCN-3	TK-9101	554	307	317	185	1099	492	95	82	90	93	85	89	3.3	3.1	3.2	3.1	3.2
4	TCN-4	TK-9102	774	391	411	303	1208	617	92	86	87	92	83	88	3.3	3.7	3.2	3.4	3.4
5	TCN-5	TH-9101	554	318	516	235	1083	541	92	81	86	95	85	88	3.9	2.9	3.2	2.7	3.2
6	TCN-6	TH-9102	560	535	360	133	1011	519	85	83	87	97	85	88	3.6	2.9	2.9	2.8	3.1
7	TCN-7	TWB-876-1	493	535	397	185	890	500	88	79	89	95	83	87	3.4	3.4	3.1	3.4	3.3
8	TCN-8	TWB-876-2	591	343	442	170	833	475	83	80	91	94	81	86	3.5	3.1	3.1	3.4	3.[illegible]
9	TCN-9	TWB-14/86	749	511	497	185	1222	632	95	80	85	93	84	87	3.3	3.1	2.9	2.6	2.9
10	TCN-10	PT-885	796	360	319	240	1110	565	97	82	88	93	86	89	3.5	3.1	3.1	3.5	3.3
11	TCN-11	PT-9005	673	451	431	159	1094	561	95	84	89	98	86	90	3.5	3.4	3.4	3.1	3.4
12	TCN-12	PBT-38	661	471	506	115	944	539	96	82	83	97	85	90	3.8	3.1	3.8	2.7	3.4
13	TCN-13	JMT-6901	495	295	388	89	1055	464	92	79	85	96	84	87	3.6	3.4	3.1	3.1	3.3
14	TCN-14	JMT-688-14	620	424	573	141	1027	557	95	85	89	95	85	90	3.8	3.9	3.4	3.1	3.6
15	TCN-15	DT-8	628	553	531	204	1093	601	97	86	95	96	86	92	3.5	2.9	3.5	3.1	3.3
16	TCN-16	DT-10	763	493	400	122	766	508	97	87	99	100	87	94	3.5	3.4	3.7	2.6	3.3
17	TCN-17	SEJ-2	635	800	621	281	1055	678	97	92	90	116	90	97	3.6	3.9	4.9	2.5	3.7
18	TCN-18	PPMS	607	711	457	144	1041	592	97	92	89	100	88	93	3.7	2.9	6.6	1.9	3.8
19	TCN-19	PBT-37	628	550	540	167	1200	617	95	87	86	97	85	90	3.6	3.7	3.1	2.8	3.3
20	TCN-20	PANCHALI(ZC)	591	582	333	-	1058	854	90	79	-	89	84	86	3.5	3.1	3.1	3.2	3.2
GM			639	477	440	184	1057	574	93	83	88	96	85	89	3.6	3.2	3.5	2.9	3.3
SEM			41	61.1	33	47.8	74												
CD AT 5%			115	175	92.5	137	212												
CV%			10.9	22.2	12.9	39.7	12.1												

TABLE 2.1.4 SHOWING THE RESULTS OF TORIA STRAINS TESTED UNDER AVT IRRIGATED IN ZONE II DURING 1991-92

			SEED YIELD (Kg/ha)						DAYS TO MATURITY						OIL CONTENT(%)					1000 SEED WEIGHT(g)		
SN	CODE	STRAIN	LDH	BTH	HSR	GUD	KAUL	MEAN	LDH	BTH	HSR	GUD	KAUL	MEAN	LDH	BTH	HSR	GUD	MEAN	HSR	GUD	MEAN
1	TCN-21	TH-9002(NC)	1260	1169	1540	1163	1091	1244	91	93	75	90	92	88	39.	38.7	45.1	41.9	41.3	3.1	3.6	3.4
2	TCN-22	T-9(NC)	1700	1558	1022	1495	1141	1383	91	94	78	96	98	91	39.	39.4	44.8	43.5	41.7	2.9	3.1	3.1
3	TCN-23	PT-303(IC)	1467	1466	1082	1465	975	1291	91	91	70	90	97	88	38.	39.1	44.3	41.3	40.8	3.2	3.6	3.4
4	TCN-24	TL-15/TH-68(	1878	1710	1475	1390	941	1478	91	90	68	92	95	87	41.	39.9	45.8	42.5	42.3	2.7	3.1	2.9
5	TCN-25	TW-872-2	1122	1069	1218	1500	841	1150	89	85	69	91	91	85	38.	38.9	45.2	41.5	40.9	3.1	3.1	3.1
GM			1485	1394	1267	1402	997	1309	91	91	72	91	95	88	39.	39.2	45.0	42.1	41.4	3.1	3.3	3.2
SEM			83.5	32.4	99.6	76.3	71															
CD AT 5%			247	96	204	225	205															
CV%			14.2	5.7	12.2	13.3	11.4															

ABLE 2.1.5 SHOWING THE PESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE II DURING 1991-92

			SEED YIELD (Kg/ha)									DAYS TO MATURITY								OIL CONTENT(%)				1000 SEED WEIGHT(g)					
SN	CODE	STRAIN	LDH	BTH	SGN	HSR	DLH	GZB	DURG	HUN	MEAN	LDH	BTH	SGN	HSR	DLH	GZB	DURG	MEAN	LDH	BTH	HSR	MEAN	LDH	SGN	HSR	DLH	DURG	MEAN
1	MCN-1	SJN-191	1396	1442	2155	2008	1633	1640	2447	1097	1727	140	142	144	143	152	140	143	143	36.6	34.1	43.8	38.1	4.9	5.1	5 5	4.9	4.8	5.1
2	MCN-2	DIRM-52	1183	1533	1688	1754	1912	1471	1920	1297	1594	149	142	144	145	152	144	147	146	34.3	36.1	44.4	38.2	4.9	5.2	5.6	5.3	4.3	5.1
3	MCN-3	DIR-489	1345	1717	1911	2130	1554	1261	1653	665	1529	148	148	148	146	155	142	147	147	36.1	35.2	40.8	37.3	4.5	5.4	5.3	5.6	4.9	5.1
4	MCN-4	PCR-4	1077	1583	1888	1350	1771	1387	2180	898	1516	144	140	144	168	151	143	151	148	37.3	33.6	41.3	37.4	4.6	2.6	5.5	5.5	3.9	4.4
5	MCN-5	DLM-29	1431	1908	2188	1803	1795	1568	2140	964	1724	150	148	144	145	150	147	133	145	33.4	38.5	45.3	39.0	3.8	5.2	4.6	4.1	4.1	4.4
6	MCN-6	TM-18-8	464	1125	1337	1038	762	889	1520	865	1000	141	150	142	166	134	136	141	144	34.7	34.7	42.4	37.2	2.1	4.1	2.4	2.6	4.8	3.2
7	MCN-7	BIO-246	964	1475	2222	1779	2000	1375	1493	898	1525	147	144	148	141	153	144	142	145	38.9	35.3	42.3	38.8	5.5	4.8	5.5	6.2	4.4	5.3
8	MCN-8	BIO-94	1100	1450	2133	1496	1750	1363	2267	632	1523	145	150	144	143	151	139	146	145	34.7	36.5	44.2	38.4	5.1	4.8	5.5	6.1	4.6	5.2
9	MCN-9	RL-90-1	1397	983	2133	1779	1875	1381	2133	1297	1622	145	151	148	143	155	146	152	148	36.6	37.1	43.1	38.9	3.1	4.2	5.2	4.8	5.1	4.5
10	MCN-10	RM-9	1640	1350	2000	2037	1825	1526	1527	1131	1629	149	141	148	145	155	147	145	147	37.4	35.8	42.2	38.4	4.9	5.6	4.6	4.8	4.2	4.8
11	MCN-11	SKNM-90-13	1839	1125	2055	2435	2042	1111	2187	1097	1736	148	142	148	143	148	142	135	143	36.9	36.5	45.4	39.6	3.2	3.4	3.7	3.6	5.1	3.8
12	MCN-12	SKNM-90-4	1363	1958	2177	1803	1867	1501	2233	964	1733	148	143	148	136	148	141	147	144	37.1	36.3	43.1	38.8	3.6	5.6	3.7	3.4	5.3	4.3
13	MCN-13	PR-8915	1922	1175	2133	2276	1762	1231	1713	964	1647	148	144	151	144	155	147	145	147	36.6	35.1	42.9	38.2	3.7	5.3	5.5	4.5	5.1	4.8
14	MCN-14	PR-8943	1500	1375	1833	1974	1646	1435	1687	964	1551	150	148	151	141	152	146	145	147	36.1	36.3	41.7	38.0	2.9	5.1	4.1	3.6	5.3	4.2
15	MCN-15	PSR-7	1775	1958	2222	2047	1937	1327	1853	964	1760	147	152	148	138	153	144	147	147	36.1	37.5	45.4	39.6	4.6	3.4	5.6	4.6	5.1	4.7
16	MCN-16	PSR-6	1706	1375	2000	2095	1875	1718	1313	1131	1651	141	142	144	142	153	145	146	144	35.5	35.8	44.4	38.5	4.7	2.6	5.6	4.8	4.4	4.4
17	MCN-17	RSM-151	2039	2117	2166	1608	1812	1483	2440	1330	1874	150	150	153	143	154	147	144	148	38.4	36.5	43.2	39.3	3.8	3.8	2.7	2.9	4.9	3.6
18	MCN-18	RW-873	919	767	1533	1243	1354	1201	1753	532	1162	141	146	142	167	140	138	141	145	37.3	35.6	42.1	38.3	3.1	5.1	2.9	2.7	3.2	3.4
19	MCN-19	RW-872	1289	733	1611	1365	1621	1219	1500	931	1283	141	149	142	166	138	136	141	144	36.8	36.3	39.1	37.4	2.8	4.1	2.4	2.8	4.7	3.4
20	MCN-20	RK-919015	1647	1217	2000	1462	1625	1459	2073	1097	1572	151	148	148	142	157	146	145	148	37.8	35.1	43.9	38.9	3.1	4.1	4.8	4.4	4.9	4.3

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TABLE 2.1.5 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE II DURING 1991-92

T-6

			SEED YIELD (Kg/ha)									DAYS TO MATURITY								OIL CONTENT(%)				1000 SEED WEIGHT(g)					
SN	CODE	STRAIN	LDH	BTH	SGN	HSR	DLH	GZB	DURG	HUN	MEAN	LDH	BTH	SGN	HSR	DLH	GZB	DURG	MEAN	LDH	BTH	HSR	MEAN	LDH	SGN	HSR	DLH	DURG	MEAN
21	MCN-21	RK-919003	1872	1450	2388	1803	1812	1357	2173	1230	1760	150	142	148	145	157	147	152	148	36.1	36.4	41.2	37.9	3.9	2.4	4.5	3.9	3.9	3.7
22	MCN-22	RH-8824	1367	1442	1611	2510	1583	1531	1633	1530	1650	150	148	148	146	157	147	151	149	35.2	36.1	41.9	37.7	3.9	4.8	5.5	4.6	4.9	4.7
23	MCN-23	RH-8922	1687	1125	2055	1998	2058	1297	1493	1131	1605	152	150	153	144	156	146	147	149	36.5	36.7	43.1	38.7	4.3	4.2	5.5	3.7	4.8	4.5
24	MCN-24	RJ-9	1269	1050	1833	1730	1925	1400	1207	1197	1451	149	150	148	142	159	143	145	148	36.3	36.5	41.1	37.9	4.7	4.8	5.5	4.1	4.1	4.6
25	MCN-25	RJ-14	1216	1425	1933	1389	1391	1291	1813	931	1423	149	144	148	141	153	142	143	145	36.2	35.9	42.3	38.1	5.4	5.2	4.7	4.8	5.1	5.1
26	MCN-26	KBJ-24	1793	1567	1555	1974	1737	1213	1853	1264	1619	152	151	148	141	159	148	147	149	36.2	35.8	43.5	38.5	2.8	3.1	3.7	2.9	4.1	3.3
27	MCN-27	KBJ-28	1440	1358	1933	1399	1600	1423	2353	1363	1608	149	144	148	142	157	147	147	147	36.2	36.7	41.9	38.2	4.1	4.6	3.3	3.2	4.3	3.9
28	MCN-28	JMM-90-12	1468	1842	2555	1715	2029	1231	1813	599	1656	147	148	153	168	157	144	145	151	35.9	34.8	43.1	37.9	4.1	3.8	4.5	3.7	4.8	4.2
29	MCN-29	JMM-90-3	1400	1617	1811	1988	1900	1321	1473	1164	1584	144	152	144	142	159	145	147	147	37.1	35.9	42.8	38.6	5.1	3.1	5.4	5.6	4.1	4.7
30	MCN-30	RSM-9001	1748	1258	2033	1993	1791	1688	1720	732	1620	149	144	148	141	156	146	146	147	35.7	35.2	43.4	38.1	3.8	3.8	3.9	3.5	5.1	4.1
31	MCN-31	RSM-9007	1151	1675	2166	1730	2058	1580	2127	1397	1735	145	148	144	142	154	143	145	145	35.9	36.7	40.7	37.7	3.5	4.4	3.9	4.1	5.1	4.2
32	MCN-32	HJ-002	1434	1308	2133	1364	1583	1177	2233	964	1524	150	147	144	141	156	141	147	146	40.1	36.2	42.3	39.5	3.5	4.2	4.4	4.8	4.8	4.3
33	MCN-33	PCR-5	1386	1392	1500	1559	1479	1261	1933	1131	1455	149	149	148	141	157	142	150	148	36.2	37.2	45.9	39.7	4.6	3.4	5.5	4.7	2.8	4.2
34	MCN-34	VARUNA(NC)	972	825	1433	1974	1625	1153	927	1297	1275	149	150	148	166	155	145	145	151	36.5	36.5	43.9	38.9	4.8	4.8	4.9	4.8	3.1	4.5
35	MCN-35	KRANTI(NC)	1836	1658	1777	1827	1546	1633	1587	1031	1611	149	150	148	142	158	145	150	148	36.3	36.7	45.6	39.5	3.2	4.6	3.9	3.4	4.1	3.8
36	MCN-36	RL-1359(ZC)	1324	1060	1355	1511	1671	1383	2167	964	1428	149	149	148	144	159	146	146	148	37.4	39.5	46.1	41.1	4.4	4.2	5.6	5.6	4.3	4.8
	GM		1426	1400	1929	1776	1727	1374	1848	1045	1566	147	146	147	146	153	143	145	146	36.4	36.1	43.0	38.1	4.0	4.3	4.5	4.2	4.5	4.3
	SEM		221	54.9	192	118	146	127	267	92																			
	CD AT 5%5%		633	158	551	339	406	366	776	264																			
	CV %		21.9	5.55	14.1	9.4	11.6	13.1	19.4	12.4																			

ABLE 2.1.6 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE III DURING 1991-92

			SEED YIELD (Kg/ha)									DAYS TO MATURITY								OIL CONTENT(%)			1000 SEED WEIGHT(g)						
SN.	CODE	STRAINS	MOR	KAN	VAR	PANT	ETH	KOT	RAP	MAS	MEAN	MOR	KAN	VAR	PANT	ETH	KOT	RAP	MEAN	KAN	MAS	MEAN	MOR	KAN	VAR	PANT	KOT	MAS	MEAN
1	MCN-1	SJN-191	1183	2267	1060	717	1668	1529	1667	1482	1446	123	120	110	136	130	117	116	121	41.7	40.1	40.9	5.4	5.8	3.5	4.5	5.2	4.7	4.8
2	MCN-2	DIRM-52	1000	2622	1120	607	1111	1663	1417	1296	1355	121	121	111	144	132	124	121	124	43.4	44.2	43.8	4.3	6.1	3.6	4.3	6.1	6.1	5.0
3	MCN-3	DIR-489	1925	2044	1130	1083	1116	1529	2014	1556	1549	124	129	110	144	131	124	119	125	43.6	43.5	43.5	6.5	5.3	3.1	5.3	6.4	6.1	5.4
4	MCN-4	PCR-4	1150	2044	1210	439	1149	1473	1806	1444	1339	129	121	106	136	131	117	117	122	42.9	40.2	41.5	5.9	4.6	2.8	3.7	6.6	5.5	4.8
5	MCN-5	DLM-29	2075	2111	1370	579	823	1807	1736	1618	1514	125	128	112	144	132	124	120	126	45.7	45.1	45.4	4.9	4.1	2.9	4.7	4.1	4.1	4.1
6	MCN-6	TM-18-8	1058	1089	1080	257	621	1139	903	1758	988	120	117	110	139	127	112	110	119	38.9	37.2	38.0	3.2	3.9	3.1	3.4	3.1	4.1	3.4
7	MCN-7	BIO-246	1058	2289	970	609	1227	1640	2056	1642	1436	126	122	114	144	131	120	115	124	41.6	40.7	41.1	6.9	5.9	3.1	5.1	6.4	6.1	5.5
8	MCN-8	BIO-94	892	2422	1240	634	1320	1418	1972	1309	1400	128	121	109	145	130	124	121	125	42.6	43.1	42.8	6.4	5.7	3.1	4.8	6.1	5.9	5.3
9	MCN-9	RL-90-1	1142	2133	1320	692	1189	1390	1903	1630	1424	127	123	110	144	132	125	120	125	42.2	43.9	43.0	5.1	4.6	3.2	4.8	4.8	4.1	4.4
10	MCN-10	RW-9	1626	2400	890	969	1386	1418	861	1395	1368	122	130	103	144	133	126	122	125	42.6	42.7	42.6	4.7	4.2	2.8	5.1	4.1	3.7	4.1
11	MCN-11	SKNM-90-13	1200	2444	940	856	1171	1529	1319	1494	1375	121	121	107	139	130	117	116	121	40.2	42.8	41.5	3.3	3.4	2.8	4.2	3.7	2.9	3.3
12	MCN-12	SKNM-90-4	1383	2578	1240	670	1349	1835	916	1494	1433	122	121	112	138	130	118	115	122	42.1	41.7	41.9	3.8	2.9	3.8	3.3	3.7	3.5	3.5
13	MCN-13	PR-8915	842	2356	1320	857	1446	1724	1417	1346	1412	126	131	105	144	132	125	120	126	40.9	43.4	42.1	4.6	4.8	3.1	4.4	4.8	4.2	4.3
14	MCN-14	PR-8943	1433	1756	1150	858	1533	1334	1014	1593	1333	123	130	109	144	133	125	120	126	38.8	43.7	41.2	3.9	4.1	3.2	4.4	4.1	3.3	3.8
15	MCN-15	PSR-7	1183	2289	1240	559	1365	1751	1833	1716	1492	125	121	106	144	131	124	121	124	42.7	43.9	43.3	4.4	4.9	3.3	4.9	5.3	5.4	4.7
16	MCN-16	PSR-6	1200	2267	1360	685	1264	1890	1597	1679	1492	125	124	107	145	130	123	123	125	41.8	43.1	42.4	4.8	4.6	4.1	4.6	4.7	5.2	4.6
17	MCN-17	RSM-151	1383	2267	1280	966	1507	1918	1167	1605	1511	120	128	109	143	130	124	122	125	40.5	43.4	41.9	3.3	3.1	3.9	3.6	3.1	3.1	3.3
18	MCN-18	RW-873	1233	2467	1280	664	1011	2085	1347	1482	1446	121	114	114	147	124	114	111	120	39.1	37.9	38.5	3.3	3.2	3.4	4.7	3.1	2.9	3.4
19	MCN-19	RW-872	1208	1978	1300	673	1098	1585	1458	1284	1323	123	114	113	126	120	113	110	117	40.4	38.4	39.4	3.3	3.1	3.5	4.2	2.3	3.1	3.2
20	MCN-20	RK-919015	1292	2044	1200	712	1201	1418	1389	1605	1357	126	130	108	145	132	121	121	126	39.5	44.1	41.8	4.2	4.1	3.7	4.5	4.1	3.7	4.0

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TABLE 2.1.6 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE III DURING 1991-92

SN.	CODE	STRAINS	SEED YIELD (Kg/ha)									DAYS TO MATURITY								OIL CONTENT(%)			1000 SEED WEIGHT(g)						
			MOR	KAN	VAR	PANT	ETH	KOT	RAP	MAS	MEAN	MOR	KAN	VAR	PANT	ETH	KOT	RAP	MEAN	KAN	MAS	MEAN	MOR	KAN	VAR	PANT	KOT	MAS	MEAN
21	MCN-21	RK-919003	1200	2133	1160	628	1389	1362	1597	1247	1339	123	129	106	144	131	118	125	125	40.4	43.2	41.8	4.2	3.4	3.1	4.5	4.1	4.2	3.9
22	MCN-22	RH-8824	1217	1867	1260	597	1272	1115	1958	1618	1363	128	128	111	144	132	126	128	128	41.1	43.9	42.5	4.7	4.5	3.9	4.5	4.3	3.7	4.2
23	MCN-23	RH-8922	1759	2444	1080	894	1285	1724	1389	1617	1523	130	129	112	144	132	125	119	127	39.7	44.6	42.1	4.1	4.1	3.6	4.2	4.1	4.9	4.1
24	MCN-24	RJ-9	1367	2156	940	592	1212	1724	1444	1272	1338	124	129	116	143	131	120	116	125	40.3	37.2	38.7	4.9	3.9	3.7	4.1	5.5	3.7	4.3
25	MCN-25	RJ-14	1425	1933	890	574	801	1751	1597	1232	1275	124	119	115	140	131	116	114	122	41.4	39.7	40.5	4.9	4.5	3.2	4.7	4.5	5.2	4.5
26	MCN-26	KBJ-24	1133	2156	920	895	1752	1585	1306	1321	1383	129	131	112	144	133	125	118	127	37.5	44.1	40.8	3.3	2.6	3.4	4.4	3.1	3.2	3.3
27	MCN-27	KBJ-28	1460	1822	920	903	1493	1668	986	1272	1316	133	123	108	142	133	123	119	125	41.9	44.5	43.2	3.6	2.9	2.9	4.1	2.6	3.3	3.2
28	MCN-28	JMM-90-12	1408	2444	760	633	1163	1640	1736	1334	1389	126	129	104	142	132	120	113	123	38.3	43.4	40.8	4.1	4.1	2.9	4.5	4.4	4.1	4.0
29	MCN-29	JMM-90-3	1175	2422	1140	807	1360	2335	1278	1642	1519	128	122	109	143	132	120	119	124	41.9	41.3	41.6	6.5	5.1	3.1	4.8	6.3	6.7	5.4
30	MCN-30	RSN-9001	1592	2556	1290	745	1718	1640	1264	1235	1505	131	130	112	143	131	124	119	127	39.5	41.5	40.5	3.9	3.9	3.1	4.1	3.3	3.6	3.6
31	MCN-31	RSM-9007	1250	1556	1080	847	1427	1751	1569	1865	1418	125	122	110	134	129	117	118	122	39.8	41.3	40.5	4.2	3.4	3.2	3.9	4.8	4.1	3.9
32	MCN-32	HJ-002	1158	2044	1240	620	2017	1446	1903	1358	1473	126	128	113	144	131	124	121	126	41.1	42.2	41.6	5.3	4.2	3.1	4.4	4.6	4.4	4.3
33	MCN-33	PCR-5	1150	1844	1120	640	1326	1894	2083	1667	1465	123	130	114	144	131	125	120	126	43.1	44.7	43.9	4.5	4.1	3.1	4.7	5.5	4.2	4.3
34	MCN-34	VARUNA(NC)	575	1933	960	586	989	1501	1694	1235	1184	123	122	110	144	133	123	122	125	41.8	41.8	41.8	5.9	5.1	2.9	5.1	4.6	4.8	4.7
35	MCN-35	KRANTI(NC)	1392	1911	890	737	1820	2113	1653	1778	1536	121	127	112	144	131	122	120	125	41.7	44.2	42.9	5.1	3.7	2.8	4.6	3.1	3.8	3.8
36	MCN-36	ROHINI(ZC)	1150	1289	930	328	1297	2446	1181	1284	1238	127	127	114	145	131	120	122	126	41.3	42.3	41.8	6.5	3.8	2.8	4.1	3.8	4.3	4.2
GM			1275	2121	1118	697	1302	1660	1512	1483	1396	124	124	110	142	130	121	118	124	41.1	42.3	41.7	4.7	4.2	3.2	4.4	4.4	4.3	4.2
SEM			136	106	112	101	127	88.8	161	67.4																			
CD AT 5%			378	306	285	290	365	207	462	194																			
CV%			15.1	7.1	10.2	20.6	13.8	14.8	15.1	6.5																			

TABLE 2.1.7 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE IV DURING 1991-92

			SEED YIELD (Kg/ha)						DAYS TO MATURITY						OIL CONTENT (%)	1000 SEED WEIGHT(g)			
SN.	CODE	STRAINS	SKN	AMRL	SUM	JAL	MED	MEAN	SKN	AMRL	SUM	JAL	MED	MEAN	JAL	SKN	AMRL	JAL	MEAN
1	MCN-1	SJN-191	1887	1793	1100	1667	2613	1812	120	98	105	136	99	109	37.	3.9	3.6	6.5	4.7
2	MCN-2	DIRM-52	3257	2093	1000	1500	2627	2097	121	98	102	121	100	105	37.	4.7	3.6	7.2	5.2
3	MCN-3	DIR-489	3387	1900	733	1167	2240	1885	121	97	102	130	98	106	36.	4.8	4.1	5.9	4.9
4	MCN-4	PCR-4	2973	2323	867	2433	1920	2103	123	97	105	131	100	108	37.	4.3	3.9	5.9	4.7
5	MCN-5	DLM-29	3647	2020	1033	1767	1893	2072	121	98	102	131	100	107	39.	4.7	2.9	7.4	5.1
6	MCN-6	TM-18-8	1773	1393	667	1110	853	1159	118	97	100	119	90	101	38.	2.9	1.9	7.1	3.9
7	MCN-7	BIO-246	2080	1493	967	1467	1040	1409	122	97	105	127	98	106	38.	4.1	4.6	6.4	5.1
8	MCN-8	BIO-94	2387	1953	1133	1567	1120	1632	123	97	102	121	100	105	36.	6.7	3.6	7.7	6.1
9	MCN-9	RL-90-1	2580	1610	900	2067	907	1612	122	98	102	130	99	107	40.	4.6	2.9	8.4	5.3
10	MCN-10	RM-9	2847	1076	900	1333	933	1417	125	98	103	135	105	110	38.	3.9	2.4	5.9	4.1
11	MCN-11	SKNM-90-13	2333	1513	1100	2200	1560	1741	119	93	104	130	100	106	38.	3.1	2.3	3.9	3.1
12	MCN-12	SKNM-90-4	3004	1987	1033	2533	1840	2079	122	98	104	121	102	106	43.	3.9	2.4	4.8	3.7
13	MCN-13	PR-8915	2160	1387	833	1567	973	1384	121	93	106	135	102	109	37.	4.5	2.1	6.2	4.3
14	MCN-14	PR-8943	2440	1370	650	1900	1253	1522	124	99	101	134	101	108	35.	3.9	2.2	5.5	3.9
15	MCN-15	PSR-7	2520	1760	1200	2100	1107	1817	120	99	102	131	101	108	39.	4.8	3.9	8.5	5.7
16	MCN-16	PSR-6	2913	2017	1150	1733	1027	1768	124	97	105	125	101	107	37.	4.7	3.6	8.1	5.5
17	MCN-17	RSM-151	2407	1230	1200	2667	1027	1718	123	97	103	135	108	110	41.	3.1	2.1	4.5	3.2
18	MCN-18	RW-873	2237	1953	650	1833	800	1500	122	97	102	123	99	105	39.	3.1	1.9	5.8	3.6
19	MCN-19	RW-872	1747	2087	700	1633	880	1409	115	94	101	122	98	103	39.	3.6	2.2	4.8	3.5
20	MCN-20	RK-919015	2347	1573	900	1700	1200	1544	120	96	103	138	101	109	38.	3.9	2.3	3.3	3.2

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TABLE 2.1.7 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE IV DURING 1991-92

SN.	CODE	STRAINS	SEED YIELD (Kg/ha) SKN	AMRL	SUM	JAL	MED	MEAN	DAYS TO MATURITY SKN	AMRL	SUM	JAL	MED	MEAN	OIL CONTENT (%) JAL	1000 SEED WEIGHT(g) SKN	AMRL	JAL	MEAN
21	MCN-21	RK-919003	2280	1043	933	1533	960	1349	124	96	103	135	105	109	36.	3.8	2.3	6.5	4.2
22	MCN-22	RH-8824	1907	1550	1100	1600	933	1618	125	97	104	136	105	110	38.	4.2	2.6	7.2	4.7
23	MCN-23	RH-8922	2287	1580	1100	1567	1013	1509	124	97	107	131	102	109	38.	4.4	2.2	6.6	4.4
24	MCN-24	RJ-9	2727	1893	1116	1967	773	1695	125	97	103	123	104	106	40.	4.7	3.5	6.1	4.7
25	MCN-25	RJ-14	2213	1200	1083	2000	1520	1603	121	93	103	121	98	103	40.	4.2	2.7	6.1	4.3
26	MCN-26	KBJ-24	2273	1477	967	2167	1707	1718	124	94	102	131	102	107	38.	2.9	1.6	5.1	3.2
27	MCN-27	KBJ-28	2307	1270	933	1367	1653	1506	125	97	105	131	102	108	38.	3.2	1.8	6.1	3.7
28	MCN-28	JMM-90-12	2413	1860	783	1667	1120	1568	126	97	104	131	110	110	38.	3.3	1.2	7.8	4.1
29	MCN-29	JMM-90-3	2587	2203	1133	1933	1853	1941	124	97	103	121	98	104	40.	5.1	3.4	5.9	4.8
30	MCN-30	RSM-9001	2827	1637	1067	1800	1693	1804	126	97	104	124	102	106	38.	3.6	2.7	6.6	4.3
31	MCN-31	RSM-9007	3093	1773	983	1800	1600	1849	121	93	102	126	102	105	39.	4.1	2.6	5.7	4.1
32	MCN-32	HJ-002	2533	1530	917	1700	1653	1572	121	96	102	129	102	107	38.	3.9	2.8	7.8	4.8
33	MCN-33	PCR-5	2193	1307	1150	1967	2107	1744	123	96	106	131	102	108	39.	3.8	2.8	8.2	4.9
34	MCN-34	VARUNA(NC)	2207	1713	800	1400	1200	1464	120	95	103	131	100	107	39.	5.1	2.7	7.2	5.1
35	MCN-35	KRANTI(NC)	2487	1493	1050	1733	2186	1789	122	97	104	121	101	105	38.	3.6	2.2	5.6	3.8
36	MCN-36	GM-1(ZC)	2327	1987	1000	1667	2160	1828	117	95	103	125	102	106	40.	4.5	2.7	4.6	3.9
GM			2530	1668	967	1772	1442	1676	122	96	103	128	101	106	38.	4.1	2.7	6.3	4.3
SEM			137	116	52	219	156												
CD AT 5%			387	329	144	447	449												
CV%			7.64	9.87	9.36	12	15.3												

TABLE 2.1.8 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE V DURING 1991-92

			SEED YIELD (Kg/ha)				DAYS TO MATURITY				1000 SEED WEIGHT		
SN.	CODE	STRAINS	DHOL	BHV	BERH	MEAN	DHOL	BHV	BERH	MEAN	DHOL	BERH	MEAN
1	MCN-1	SJN-191	767	1370	1520	1219	117	103	118	112	4.4	3.9	4.1
2	MCN-2	DIRM-52	-	1333	1840	1586	-	101	120	110	-	3.3	3.3
3	MCN-3	DIR-489	720	666	1879	1088	120	101	123	114	4.8	4.1	4.5
4	MCN-4	PCR-4	1000	908	2290	1399	112	103	120	111	4.2	4.3	4.3
5	MCN-5	DLM-29	753	729	1893	1125	111	100	129	113	4.2	3.5	3.8
6	MCN-6	TM-18-8	767	475	1506	916	106	94	103	101	4.7	3.4	4.1
7	MCN-7	BIO-245	833	941	1559	1111	106	97	118	107	4.7	4.1	4.4
8	MCN-8	BIO-94	813	1104	1930	1282	106	98	119	107	4.7	4.1	4.4
9	MCN-9	RL-90-1	1033	1308	1754	1365	119	100	120	113	4.5	3.7	4.1
10	MCN-10	RM-9	833	775	2111	1239	111	99	123	111	4.2	4.1	4.2
11	MCN-11	SKNM-90-13	797	1354	1986	1379	120	96	110	108	4.5	3.1	3.8
12	MCN-12	SKNM-90-4	1333	1124	1731	1396	122	99	110	110	4.5	3.5	4.1
13	MCN-13	PR-8915	600	850	1411	953	118	101	116	111	4.5	3.4	3.9
14	MCN-14	PR-8943	630	775	1509	971	121	104	122	115	4.1	3.2	3.6
15	MCN-15	PSR-7	1400	1224	1996	1540	118	103	122	114	4.5	3.1	3.8
16	MCN-16	PSR-6	667	1266	1995	1309	116	104	124	114	4.7	4.5	4.6
17	MCN-17	RSM-151	1053	1124	1506	1227	116	104	124	114	4.5	3.8	4.2
18	MCN-18	RW-873	687	658	1553	966	107	94	99	100	3.8	3.8	3.8
19	MCN-19	RW-872	910	683	1895	1162	109	95	110	104	3.7	3.6	3.7
20	MCN-20	RK-919015	753	766	1433	984	115	104	122	113	4.1	3.6	3.8
21	MCN-21	RK-919003	1013	583	1332	976	115	103	123	113	4.1	3.2	3.5
22	MCN-22	RH-8824	833	625	1399	952	116	104	123	114	4.1	4.7	4.4
23	MCN-23	RH-8922	567	916	1393	958	113	101	125	113	4.6	4.4	4.5
24	MCN-24	RJ-9	607	766	1517	963	106	99	119	108	4.5	4.7	4.6
25	MCN-25	RJ-14	773	1062	1955	1263	11	101	118	112	4.[illegible]	4.2	4.4
26	MCN-26	KBJ-24	867	1291	1479	1212	106	103	123	110	4.5	3.5	4.1
27	MCN-27	KBJ-28	867	1166	1479	1170	118	102	121	113	4.5	3.6	4.1
28	MCN-28	JMM-90-12	660	1166	1739	1188	115	102	124	113	3.9	4.7	4.3
29	MCN-29	JMM-90-3	690	907	1445	1014	119	98	121	112	4.5	4.6	4.6
30	MCN-30	RSM-9001	760	866	1320	982	115	97	121	111	3.9	3.6	3.7
31	MCN-31	RSM-9007	697	774	1895	1122	111	98	120	109	4.5	3.9	4.2
32	MCN-32	HJ-002	833	1232	1291	1118	111	100	122	111	4.9	3.4	4.2
33	MCN-33	PCR-5	-	895	1291	1093	-	100	126	113	-	4.1	4.1
34	MCN-34	VARUNA(NC)	733	879	1506	1039	111	100	123	111	4.8	3.6	4.2
35	MCN-35	KRANTI(NC)	600	933	1501	1011	113	100	123	112	4.4	2.9	3.7
36	MCN-36	PUSA BASANT	767	600	1560	975	115	94	117	108	4.6	3.5	4.1
GM			789	947	1649		107	100	119	108.	4.1	3.8	
SEM			64.7	129	41								
CD AT 5%			183	371	115								
CV%			11.1	19.3	4.3								

TABLE 2.1.9 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER IVT RAINFED DURING 1991-92

			SEED YIELD (KG/ha)			DAYS TO MATURITY			1000 SEED WEIGHT(g)
SN.	CODE	STRAINS	NAV	BWL	MEAN	NAV	BWL	MEAN	NAV
1	MCN-1	SJN-191	2380	600	1490	122	128	125	5.5
2	MCN-2	DIRM-52	1116	1300	1208	122	136	129	5.6
3	MCN-3	DIR-489	2450	933	1691	130	135	132	7.3
4	MCN-4	PCR-4	2658	1200	1929	121	135	128	6.1
5	MCN-5	DLM-29	1394	1200	1297	128	135	131	5.9
6	MCN-6	TM-18-8	1888	1367	1627	118	136	127	3.4
7	MCN-7	BIO-246	2111	1300	1705	122	129	125	6.6
8	MCN-8	BIO-94	3616	933	2274	122	131	126	7.3
9	MCN-9	RL-90-1	3111	700	1905	131	134	132	5.8
10	MCN-10	RM-9	2166	1100	1633	122	135	128	5.3
11	MCN-11	SKNM-90-13	1513	900	1206	118	130	124	4.4
12	MCN-12	SKNM-90-4	1958	933	1445	120	130	125	4.2
13	MCN-13	PR-8915	1500	667	1083	120	129	124	5.8
14	MCN-14	PR-8943	2513	633	1573	133	133	133	4.7
15	MCN-15	PSR-7	1611	667	1139	124	131	127	6.8
16	MCN-16	PSR-6	1333	287	810	118	130	124	6.6
17	MCN-17	RSM-151	1866	633	1249	127	135	131	4.2
18	MCN-18	RW-873	2944	733	1838	118	132	125	3.2
19	MCN-19	RW-872	1958	580	1269	114	133	123	3.7
20	MCN-20	RK-919015	2005	683	1344	129	134	131	5.2
21	MCN-21	RK-919003	2033	633	1333	129	135	132	5.1
22	MCN-22	RH-8824	1241	733	987	121	133	127	6.1
23	MCN-23	RH-8922	2138	767	1452	122	133	127	5.7
24	MCN-24	RJ-9	3097	950	2023	129	129	129	5.6
25	MCN-25	RJ-14	3644	867	2255	122	132	127	6.5
26	MCN-26	KBJ-24	2333	500	1416	129	131	130	4.1
27	MCN-27	KBJ-28	2277	900	1588	124	130	127	3.7
28	MCN-28	JMM-90-12	2936	780	1858	129	133	131	4.5
29	MCN-29	JMM-90-3	1991	1160	1575	124	133	128	6.9
30	MCN-30	RSM-9001	2075	833	1454	122	130	126	4.2
31	MCN-31	RSM-9007	2152	1133	1642	121	133	127	4.9
32	MCN-32	HJ-002	2013	900	1456	126	132	129	5.9
33	MCN-33	PCR-5	3005	533	1769	129	134	131	5.9
34	MCN-34	VARUNA(NC)	2625	633	1629	123	133	128	6.6
35	MCN-35	KRANTI(NC)	2269	867	1568	129	129	129	4.6
36	MCN-36	RH-819(ZC)	2222	767	1494	130	130	130	4.9
GM			2226	842	1533	124	132	128	5.4
SEM			228	74					
CD AT 5%			NS	213					
CV%			14.5	12.4					

TABLE 2.1.10 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER I
RAINFED ZONE V DURING 199 -92

SN.	CODE	STRAINS	BERH	SHL	MEAN	SHL	BERH	MEAN	SHL
1	MCN-1	SJN-191	953	683	818	119	110	114	4.8
2	MCN-2	DIRM-52	975	611	793	122	114	118	4.9
3	MCN-3	DIR-489	1077	527	802	120	115	117	4.5
4	MCN-4	PCR-4	1179	461	820	121	115	118	5.2
5	MCN-5	DLM-29	959	511	735	123	122	122	3.3
6	MCN-6	TM-18-8	897	128	512	117	95	106	2.3
7	MCN-7	BIO-246	1097	516	806	120	110	115	5.9
8	MCN-8	BIO-94	945	505	725	120	112	116	5.4
9	MCN-9	RL-90-1	824	722	773	120	113	116	3.9
10	MCN-10	RM-9	1445	278	861	118	116	117	3.1
11	MCN-11	SKNM-90-13	1055	483	769	118	104	111	2.9
12	MCN-12	SKNM-90-4	890	494	692	118	104	111	2.8
13	MCN-13	PR-8915	919	355	637	123	107	115	3.1
14	MCN-14	PR-8943	901	255	578	118	115	116	3.7
15	MCN-15	PSR-7	1055	644	849	118	115	116	4.9
16	MCN-16	PSR-6	1112	688	900	118	117	117	4.9
17	MCN-17	RSM-151	1146	411	778	116	118	117	2.8
18	MCN-18	RW-873	1004	444	724	115	92	103	2.8
19	MCN-19	RW-872	1016	133	574	115	103	109	2.5
20	MCN-20	RK-919015	942	266	604	118	116	117	3.2
21	MCN-21	RK-919003	1024	361	692	117	116	116	3.7
22	MCN-22	RH-8824	907	488	697	117	117	117	3.5
23	MCN-23	RH-8922	1061	588	824	120	118	119	3.7
24	MCN-24	RJ-9	933	649	791	118	112	115	3.9
25	MCN-25	RJ-14	1208	533	870	118	112	115	4.2
26	MCN-26	KBJ-24	1061	594	827	119	116	117	2.4
27	MCN-27	KBJ-28	936	488	712	117	115	116	2.8
28	MCN-28	JMM-90-12	1061	466	763	116	118	117	3.9
29	MCN-29	JMM-90-3	903	566	734	118	115	116	5.6
30	MCN-30	RSM-9001	852	416	634	118	115	116	3.1
31	MCN-31	RSM-9007	1232	366	799	117	112	114	3.1
32	MCN-32	HJ-002	869	577	723	117	115	116	3.9
33	MCN-33	PCR-5	819	1092	955	117	120	118	3.6
34	MCN-34	VARUNA(NC)	909	577	743	116	116	116	4.3
35	MCN-35	KRANTI(NC)	998	405	701	116	111	113	2.9
36	MCN-36	PUSA BASANT(ZC)	914	494	704	120	117	118	5.9
GM			990	493	741.	118		118	3.8
SEM			59	103	81				
CD AT 5%			165	295	230				
CV%			10	30.2	20.1				

TABLE 2.1.11 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER AVT-1 IRRIGATED IN DURING 1991-92

		SEED YIELD (Kg/ha)								DAYS TO MATURITY							OIL CONT(%)				1000 SEED WEIGHT(g)				
SN CODE	STRAINS	LDH	BTH	HSR	SGN	GZB	DURG	HUN	MEAN	LDH	BTH	HSR	SGN	GZB	DURG	MEAN	LDH	BTH	HSR	MEAN	LDH	HSR	SGN	DURG	MEAN
1 MCN-37	JGM-9062	1514	1882	1587	1447	1195	2300	1405	1618	146	148	136	144	138	147	143	35.5	36.9	42.6	38.3	3.2	2.9	3.1	4.1	3.3
2 MCN-38	JGM-9056	1978	1632	2522	1507	1273	2717	1417	1863	149	150	147	151	141	147	147	37.1	38.7	42.4	39.4	4.1	3.3	3.8	4.2	3.9
3 MCN-39	RLC-949	1906	1368	2249	1661	1141	2117	1226	1666	147	151	141	144	141	152	146	35.8	37.3	43.9	39.1	4.4	5.1	4.3	4.8	4.7
4 MCN-40	VARUNA(NC)	1388	1012	1622	1554	1129	2117	857	1382	146	148	144	151	139	147	145	35.3	37.7	44.6	39.2	5.6	4.7	5.2	3.8	4.8
5 MCN-41	KRANTI(NC)	1970	1322	2009	1528	1333	2117	1262	1648	149	150	143	148	141	145	146	35.9	37.6	43.5	39.1	3.7	3.9	3.4	5.1	4.2
6 MCN-42	RL-1359(ZC)	1850	1088	2125	1535	-	2350	1190	1448	149	151	147	148	-	141	147	37.7	37.9	41.1	38.9	5.2	5.2	4.7	4.7	4.9
GM		1767	1384	2019	1538	1214	2286.333	1226	1604	147	149	143	147	140	146	145	36.2	37.6	43.0	39.0	4.3	4.2	4.1	4.5	4.3
SEM		72	32.2	102	85	77	191	67																	
CD AT 5%		210	99	308	NS	NS	NS	205																	
CV%		8.1	4.7	8.8	11.1	8.9	19.3	10.8																	

TABLE 2.1.12 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER AVT-1 IRRIGATED IN DURING 1991-92

SN CODE	STRAIN	SEED YIELD (Kg/ha)								DAYS TO MATURITY							OIL CONT(%)									1000 SEED WEIGHT(g)		
		MOR	PANT	FZB	VAR	KOT	KAN	RAP	MEAN	MOR	PANT	VAR	KOT	KAN	RAP	MEAN	KAN	MOR	PANT	FZB	VAR	KOT	KAN	RAP	MEAN	FZB	RAP	MEAN
1 MCN-43	PCR-3	1803	573	1429	1240	1458	2148	1833	1497	127	141	110	122	121	121	123	42.3	5.9	4.6	41.9	4.1	4.6	4.6	6.2	14.2	4.2	6.2	5.2
2 MCN-44	PCR-7	1958	558	1323	1330	1557	2148	1801	1539	127	142	108	122	121	122	123	40.8	6.4	4.5	41.8	3.5	4.7	4.9	6.3	14.1	5.5	6.3	5.9
3 MCN-4[illegible]	RSM-8904	1579	516	1513	1120	1303	-	1893	1320	127	[illegible]	112	120	-	123	125	-	4.6	3.6	42.8	3.1	3.4	-	4.1	10.2	4.6	4.1	4.4
4 MCN-46	RSM-58	1794	448	1598	975	-	-	1804	1323	127	144	104	-	-	122	124	-	4.2	4.1	41.9	3.1	-	-	4.3	9.6	3.6	4.3	3.9
5 MCN-47	PR-8902	1794	550	1577	1040	1428	2296	1500	1455	129	139	109	121	128	123	124	41.1	4.2	4.1	42.6	3.5	3.3	3.6	4.6	13.3	4.1	4.6	4.3
6 MCN-48	RH-8701	1833	599	1376	960	1487	2163	1661	1454	131	142	110	121	131	123	126	38.7	5.1	4.5	43.4	2.8	4.4	3.9	4.9	13.4	4.2	4.9	4.5
7 MCN-49	RH-8904	1609	694	1386	890	1458	2475	1798	1472	133	142	107	122	130	122	126	41.9	5.1	4.3	43.1	3.1	3.2	4.5	5.4	13.8	4.9	5.4	5.1
8 MCN-50	PBR-91	1602	722	1555	1050	1291	-	1446	1277	130	141	103	120	-	120	122	-	4.8	4.2	43.1	3.1	3.2	-	4.3	10.4	4.2	4.3	4.2
9 MCN-51	DIRA-457	1815	702	1534	1240	1303	1955	1673	1460	131	143	109	122	123	123	125	43.2	5.9	4.9	44.4	4.1	5.1	5.9	5.9	14.9	5.1	5.9	5.5
10 MCN-52	DLM-23	1729	442	1312	1340	1380	2415	1866	1497	128	143	110	123	122	123	124	42.2	6.8	5.1	41.8	3.5	6.2	5.4	7.3	14.7	6.2	7.3	6.7
11 MCN-53	RLC-949	1470	595	1692	1200	1589	2207	1488	1463	129	142	107	119	130	123	125	40.5	5.6	4.5	42.9	3.5	4.2	4.2	5.3	13.8	4.7	5.3	5.1
12 MCN-5[illegible]	YSRL-9	1050	816	1280	1050	-	1985	1541	1287	132	14[illegible]	-	120	131	124	130	41.1	4.1	4.2	43.3	2.8	-	3.8	3.8	14.7	3.9	3.8	3.8
13 MCN-55	RSK-33	1782	597	1429	1240	1398	2044	1577	1438	123	138	106	119	122	120	121	37.8	5.5	4.3	42.1	3.1	4.2	4.2	5.1	13.2	4.7	5.1	4.6
14 MCN-56	RSK-64	1606	436	1460	1360	1642	1911	1637	1436	125	138	113	120	129	120	124	39.1	4.1	4.5	43.3	3.4	3.9	3.1	4.7	13.2	3.8	4.7	4.2
15 MCN-57	VARUNA(NC)	172[illegible]	564	1302	940	1380	1674	1556	1306	123	139	109	122	122	121	122	38.8	5.7	4.3	39.8	2.9	4.9	4.7	6.6	13.4	4.6	6.6	5.6
16 MCN-58	KRANTI(NC)	1719	599	1619	1050	1374	2015	1669	1435	127	142	111	120	122	122	124	39.9	4.3	3.7	44.1	3.1	3.5	3.1	4.4	13.2	3.1	4.4	3.7
17 MCN-59	ROHINI(ZC)	2002	380	1228	860	1366	1807	1482	1303	126	143	115	120	131	120	125	40.7	5.6	4.2	41.7	2.8	4.1	3.3	4.7	13.3	4.7	4.7	4.7
GM		1698	581	1447	1110	1434	2088.785	1660	1409	127	141	108	120	125.	121	124	40.5	5.2	4.3	42.5	3.2	4.1	4.2	5.1	13.1	4.4	5.2	
SEM		112	23.7	47.2	35.2	129	82.2	81.2																				
CD AT 5%		310	65.7	131	103	NS	238	225																				
CV%		13.4	6.2	6.6	10.4	17.7	6.8	9.8																				

TABLE 2.1.13 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER AVT-1 IRRIGATED IN DURING 1991-92

SN	CODE	STRAIN	SEED YIELD (Kg/ha)							DAYS TO MATURITY							OIL CONT(%)			1000 SEED WEIGHT(g)			
			MEDH	SUM	AMR	SKN	JAL	PHL	MEAN	MEDH	SUM	AMR	SKN	JAL	PHL	MEAN	JAL	MEDH	AMR	SKN	JAL	PHL	MEAN
1	MCN-60	PCR-7	2537	1466	2039	3115	2083	1326	2094	131	104	98	122	133	112	116	37.4	6.5	3.6	5.8	6.6	7.2	5.9
2	MCN-61	RJ-10	2305	1333	1837	2798	1907	1056	1872	130	104	101	121	121	101	113	38.2	5.1	3.2	4.9	6.3	5.3	4.9
3	MCN-62	RJ-15	2338	1466	2005	2474	1861	800	1824	128	104	95	120	125	120	115	36.4	4.9	2.5	3.9	7.2	6.1	4.9
4	MCN-63	RK-9001	2551	1489	1752	3020	2080	704	1932	130	101	98	122	126	105	113	36.2	4.2	3.5	5.7	6.1	6.3	5.1
5	MCN-64	RLL-949	2550	1222	1548	3004	1972	759	1845	133	105	93	122	134	120	118	36.7	4.2	2.2	4.8	6.7	6.3	4.8
6	MCN-65	BIO-902	2287	1489	2121	3517	2116	584	2019	133	105	95	124	121	111	114	37.4	4.6	4.5	6.8	6.1	7.2	5.8
7	MCN-66	JMM-904	2440	1266	1783	2884	1880	606	1809	130	105	95	122	129	100	113	37.6	6.8	2.3	3.9	5.9	5.3	4.8
8	MCN-67	RSK-69	2771	1377	2169	3193	2089	878	2079	129	104	94	121	129	103	113	39.7	6.2	3.3	4.4	6.3	4.9	5.0
9	MCN-68	VARUNA(NC)	2393	1089	1518	2913	1769	567	1708	132	105	99	121	128	107	115	36.2	3.5	2.3	5.2	6.2	7.3	4.9
10	MCN-69	KRANTI(NC)	2509	1110	1541	2930	1898	948	1822	132	105	98	122	131	108	116	36.9	5.1	2.4	3.9	6.9	4.9	4.6
11	MCN-70	GM-1	2084	1222	2172	2924	2194	1219	1969	134	104	94	120	130	118	116	37.9	5.2	2.9	4.3	6.3	4.3	4.6
GM			2434	1320	1862	2979	1986	859	1907	131	104	97	121	127	110	114	37.3	5.1	2.9	4.9	6.4	5.9	5.0
SEM			75.6	46.5	80.6	89.2	92	133															
CD AT 5%			218	137	233	257	187	400															
CV%			6.2	6.1	8.7	6.1	5.1	11.3															

TABLE 2.4.1 SHOWING THE RESULTS OF HIGH OIL CONTENT MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE II

			SEED YIELD(Kg/ha)					DAYS TO MATURITY					OIL CONTENT(%)					1000 SEED WEIGHT(g)			
SN	CODE	STRAIN	LDH	BTH	HSR	PCU	MEAN	LDH	BTH	HSR	PCU	MEAN	LDH	BTH	HSR	PCU	MEAN	LDH	HSR	PCU	MEAN
1	HOCN-1	RW-7/86	650	1261	1706	1291	1227	146	144	138	145	143	38.4	38.1	44.8	35.7	39.2	3.2	3.6	3.4	3.4
2	HOCN-2	RW-3186	870	1550	2723	1728	1717	148	145	138	147	144	39.1	38.6	43.6	38.8	40.0	3.6	3.6	3.7	3.6
3	HOCN-3	RW-9469B	780	1394	1819	1332	1331	146	143	137	145	142	38.1	36.9	42.3	37.1	38.6	3.6	3.5	3.5	3.5
4	HOCN-4	RK-8605	1220	1917	2794	1633	1891	149	148	144	148	147	39.1	36.1	41.4	37.1	38.4	5.9	5.2	5.4	5.5
5	HOCN-5	RK-8604	720	1606	2518	2085	1732	149	147	145	150	147	36.4	33.6	40.1	37.1	36.8	5.8	6.6	5.7	6.1
6	HOCN-6	NDYR-8	673	1907	3369	1917	1966	152	150	149	153	151	36.9	35.8	41.5	39.4	38.4	4.4	4.4	4.2	4.3
7	HOCN-7	RC-891	717	667	1943	1412	1184	156	156	148	157	154	38.8	36.1	44.4	36.6	38.9	3.6	3.1	3.3	3.3
8	HOCN-8	CSR-1110	1477	1350	2511	1517	1713	158	157	149	158	155	36.8	37.6	40.7	40.4	38.8	3.4	3.2	3.2	3.2
9	HOCN-9	RC-915	977	1806	2778	1228	1697	154	156	151	155	154	38.9	37.9	44.5	35.9	39.3	3.1	3.7	3.4	3.4
10	HOCN-10	PRG-908	803	2300	3070	2462	2158	149	155	149	154	151	38.6	37.4	44.4	40.3	40.1	3.9	3.8	3.8	3.8
11	HOCN-11	DYS-27-9	813	1711	2697	1669	1722	154	160	149	152	153	38.9	37.6	43.1	40.8	40.1	3.7	4.3	3.9	3.9
12	HOCN-12	PRG-909	1120	2155	3687	1557	2129	152	160	144	156	153	37.1	37.4	40.2	38.1	38.2	3.7	3.6	3.5	3.6
13	HOCN-13	PRG-914	1450	2039	3775	1660	2231	150	158	144	155	151	37.8	35.8	43.3	39.1	39.1	3.7	4.4	4.1	4.1
14	HOCN-14	PRG-925	-	983	2251	1283	1505	-	156	151	152	153	-	37.1	44.1	38.2	39.8	-	4.5	4.2	4.3
15	HOCN-15	SRM-45	873	1961	3467	1681	1995	151	160	161	158	157	36.1	36.9	43.1	38.6	38.6	3.1	2.9	3.2	3.1
16	HOCN-17	SRM-148	1157	1622	2940	1161	1720	153	162	145	152	153	37.2	35.8	43.9	39.1	39	3.3	3.5	3.7	3.5
17	HOCN-18	SRM-156	2437	1994	2268	1364	2015	154	164	164	158	160	40.4	38.1	41.5	38.5	39.6	3.1	2.5	3.2	2.9
18	HOCN-19	JGM-38	1123	1994	2502	1580	1799	156	160	141	142	149	38.2	37.3	42.1	38.5	39.0	4.1	4.4	4.4	4.3
19	HOCN-20	JGM-28	647	1944	2495	1721	1701	150	155	144	144	148	35.6	36.7	40.8	39.3	38.1	4.1	3.4	4.2	3.9
20	HOCN-21	JGM-21	1137	1722	2797	1898	1888	152	154	144	143	148	35.9	36.9	35.7	38.8	36.8	4.2	3.1	3.8	3.7
21	HOCN-22	JGM-881	1362	1900	1972	1780	1753	152	153	144	144	148	37.3	35.9	41.8	38.9	38.4	3.8	3.3	3.2	3.4
22	HOCN-23	KRANTI(NC)	972	1478	2680	2065	1798	152	152	144	142	147	36.1	36.1	44.1	37.6	38.4	3.8	3.4	3.4	3.5
23	HOCN-24	VARUNA(NC)	1000	1100	2495	1588	1545	150	151	144	138	145	36.7	36.6	41.5	38.9	38.4	4.1	4.8	4.4	4.4
24	HOCN-25	NDYR-10	1303	1444	1592	1957	1574	152	150	144	152	149	36.7	36.8	44.2	38.6	39.0	4.5	5.1	4.6	4.7
GM			1055.595[illegible]	1658.5416	2618.7083	1648	1750	151	154	146	150	148	37.6	36.7	42.3	38.3	38.8	3.9	3.91	3.89	3.89
SEM			108	60	120	120															
CD AT 5%			299	166	331	333															
CV%			17	6.2	7.9	12.6															

TABLE 2.4.2 SHOWING THE RESULTS OF HIGH OIL CONTENT MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE III

			SEED YIELD(Kg/ha)				DAYS TO MATURITY				OIL CONTENT(%)	1000 SEED WEIGHT(g)			
SN	CODE	STRAIN	KAN	PANT	FZB	MEAN	KAN	PANT	FZB	MEAN	KAN	KAN	PANT	FZB	MEAN
1	HOCN-1	RW-7/86	1659	420	1135	1071	122	143	122	129	44.3	3.2	3.2	3.1	3.2
2	HOCN-2	RW-3186	1511	742	1296	1183	121	144	126	130	42.1	3.1	3.8	3.3	3.4
3	HOCN-3	RW-9469B	1437	492	1382	1103	120	140	124	128	43.6	2.5	4.5	3.1	3.4
4	HOCN-4	RK-8605	2104	490	1271	1288	122	147	126	132	38.1	4.6	4.4	5.1	4.7
5	HOCN-5	RK-8604	2326	552	1074	1317	125	143	131	133	39.4	6.1	5.4	5.6	5.7
6	HOCN-6	NDYR-8	1881	1149	1481	1503	125	143	126	131	36.5	3.8	4.6	4.2	4.2
7	HOCN-7	RC-891	904	1113	419	812	141	146	129	139	41.6	2.5	3.9	3.2	3.2
8	HOCN-8	CSR-1110	2059	880	1135	1358	133	146	129	136	38.5	2.9	3.9	3.4	3.4
9	HOCN-9	RC-915	1778	656	1098	1177	134	149	131	138	40.9	3.4	3.4	2.9	3.2
10	HOCN-10	PRG-908	1956	790	1382	1376	129	143	131	134	40.2	3.1	3.7	3.6	3.5
11	HOCN-11	DYS-27-9	1867	774	1209	1283	133	147	130	137	40.6	3.3	3.6	3.3	3.4
12	HOCN-12	PRG-909	2059	1048	1234	1447	123	145	127	132	40.4	3.1	3.8	3.6	3.5
13	HOCN-13	PRG-914	1970	915	1222	1369	122	144	127	131	40.6	3.2	3.5	3.2	3.3
14	HOCN-14	PRG-925	918	-	308	613	129	-	124	127	39.4	3.9	-	4.5	4.2
15	HOCN-15	SRM-45	1585	850	1358	1264	131	149	127	136	39.4	2.3	2.9	2.8	2.7
16	HOCN-17	SRM-148	1555	841	999	1131	129	145	131	135	39.2	2.8	3.4	3.1	3.1
17	HOCN-18	SRM-156	1748	520	1185	1151	165	149	130	148	42.9	2.3	3.4	2.6	2.8
18	HOCN-19	JGM-38	1644	520	1024	1062	129	145	133	136	38.9	3.3	4.2	4.1	3.9
19	HOCN-20	JGM-28	1622	682	1148	1217	123	145	127	132	40.2	2.7	3.8	3.6	3.4
20	HOCN-21	JGM-21	1955	634	1456	1348	130	145	129	135	39.1	3.3	3.3	3.4	3.3
21	HOCN-22	JGM-881	1985	918	1222	1375	129	142	130	134	40.6	2.6	3.4	3.3	3.1
22	HOCN-23	KRANTI(NC)	1689	700	1197	1195	123	144	127	131	38.3	4.3	3.4	5.2	4.3
23	HOCN-24	VARUNA(NC)	-	456	1234	845	-	143	124	133	-	-	4.7	5.1	4.9
24	HOCN-25	NDYR-10	1555	447	1395	1132	122	148	128	133	43.3	3.8	4.4	4.3	4.2
GM			1737.6956	721	1161	1192	128	145	127	133	40.3	3.3	3.8	3.7	3.6
SEM			94.4	77.9	70.7										
CD AT 5%			262	216	196										
CV%			9.4	18.5	10.6										

TABLE 2.4.3 SHOWING THE RESULTS OF HIGH OIL CONTENT MUSTARD STRAINS TESTED UNDER IVT IRRIGATED IN ZONE V

			SEED YIELD (Kg/ha)	DAYS TO MATURITY	1000 SEED WEIGHT(g)
SN	CODE	STRAIN	BERH	BERH	BERH
1	HOCN-1	RW-7/86	1146	115	3.1
2	HOCN-2	RW-3186	979	114	3.1
3	HOCN-3	RW-9469B	972	114	3.2
4	HOCN-4	RK-8605	1226	120	5.2
5	HOCN-5	RK-8604	1066	119	5.5
6	HOCN-6	NDYR-8	858	120	3.6
7	HOCN-7	RC-891	264	126	2.7
8	HOCN-8	CSR-1110	757	127	2.7
9	HOCN-9	RC-915	740	128	2.5
10	HOCN-10	PRG-908	962	119	3.1
11	HOCN-11	DYS-27-9	757	127	3.1
12	HOCN-12	PRG-909	757	117	2.9
13	HOCN-13	PRG-914	1163	117	3.2
14	HOCN-14	PRG-925	441	118	3.1
15	HOCN-15	SRM-45	938	127	2.9
16	HOCN-17	SRM-148	809	128	2.8
17	HOCN-18	SRM-156	236	134	2.3
18	HOCN-19	JGM-38	997	120	3.5
22	HOCN-23	KRANTI(NC)	1066	119	3.6
23	HOCN-24	VARUNA(NC)	736	119	4.5
24	HOCN-25	NDYR-10	1014	119	4.1
GM			745	106	2.9
SEM			52	0.4	0.08
CD AT 5%			153	1.1	0.24
CV%			10.8	0.5	4.4

TABLE 2.6.4 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER SALINE AND ALKALINE SOILS DURING 1991-92

			SEED YIELD (Kg/ha)					DAYS MAT.	OIL CONTENT(%)		1000 SEED WEIGHT(g)	
SN	CODE	STRAIN	KNL	JODH	KAN	FZB	MEAN	FZB	KAN	KAN	FZB	MEAN
1	SCN-1	NDR-190	368	1110	344	1087	727	120	37.8	5.1	6.8	5.9
2	SCN-2	NDRE-4	773	772	358	1253	790	110	37.9	2.4	2.9	2.6
3	SCN-3	PST-1	368	941	267	687	565	127	42.4	2.8	3.1	2.9
4	SCN-4	PST-2	468	804	258	822	588	135	38.8	2.3	2.5	2.4
5	SCN-5	PST-3	520	1069	255	1200	761	135	40.8	2.3	2.9	2.6
6	SCN-6	WRR-3-1	255	783	116	687	460	135	38.6	1.9	2.6	2.3
7	SCN-7	CS-12	497	1131	323	707	664	128	39.7	2.7	3.6	3.1
8	SCN-8	CS-15	882	1174	341	1400	949	132	38.9	2.8	3.2	3.1
9	SCN-9	CS-42	795	941	258	840	708	126	40.4	2.4	3.1	2.8
10	SCN-10	CS-50	793	1249	335	933	827	127	39.3	2.4	2.9	3.1
11	SCN-11	CS-438	802	1203	329	1133	866	132	39.6	2.8	4.1	3.5
12	SCN-12	CS-209	546	888	436	820	872	128	39.8	3.5	3.5	3.5
13	SCN-13	CS-395	511	1203	255	840	702	135	40.1	2.4	2.5	2.5
14	SCN-14	CS-383	871	1089	311	733	751	132	39.1	2.9	3.1	3.1
15	SCN-15	PCR-906-2	548	1169	172	800	672	131	42.1	3.6	3.5	3.6
16	SCN-16	RK-8902	882	1049	222	400	638	135	39.1	2.7	2.2	2.4
17	SCN-17	DIRA-343	1024	1253	267	1420	991	127	40.9	3.1	3.4	3.3
18	SCN-18	VARUNA(NC	517	1365	293	1287	865	126	39.1	4.1	4.2	4.1
19	SCN-19	KRANTI(NC	631	1201	204	1533	892	136	36.9	2.7	3.4	3.1
20	SCN-20	NDR-8501(	402	973	222	933	632	131	37.8	4.4	4.5	4.5
GM			623	1068.35	278	975	735	129	39.4	3.01	3.395	3.2
SEM			-	-	52	100						
CD AT 5%			NS	-	148	278						
CV%			-	-	32.2	17.8						

TABLE 2.7.1 SHOWING THF RESULTS OF LOW ERUCIC ACID AND LOW GLUCOSINOLATE MUSTARD STRAINS TESTED IN IVT IRRIGATED IN ZONE II

		SEED YIELD (Kg/ha)					DAYS TO MATURITY					OIL CONTENT(%)				1000 SEED WEIGT (g				ERUCIC ACID
SN CODE	STRAIN	LDH	HSR	NAV	PCU	MEAN	LDH	HSR	NAV	PCU	MEAN	LDH	HSR	PCU	MEAN	LDH	HSR	PCU	MEAN	(%)
1 MOCN-1	RW-28-11-1	1349	1137	2127	894	1376	161	139	127	155	145	33.1	37.9	35.9	35.6	2.2	2.1	2.3	2.2	9.3
2 MOCN-2	RW-28-11-2	171[illegible]	1900	2016	2003	1908	156	139	129	148	143	33.1	40.8	36.7	36.8	2.4	2.1	2.5	2.3	15.3
3 MOCN-3	RW-21-59-2	171[illegible]	1803	2341	2060	1979	155	136	126	146	140	35.1	42.4	38.6	38.7	2.1	2.1	2.4	2.2	48.9
4 MOCN-4	EC-287711	221[illegible]	2437	2113	1974	2185	160	150	137	156	150	33.8	38.4	37.2	36.4	2.2	2.3	2.2	2.2	1.0
5 MOCN-5	SHIVA-1	1077	991	2008	1477	1388	156	152	136	152	149	35.1	37.3	37.8	36.7	2.8	2.8	3.1	2.9	TRACES
6 MOCN-6	NGP-Y1	1011	2664	2383	1528	1896	157	141	130	152	145	36.5	42.7	39.2	39.4	4.1	3.6	4.1	3.9	48.1
7 MOCN-9	PR-8958	2036	1810	1758	1617	1805	160	136	135	142	143	35.8	43.9	40.1	39.9	3.8	3.4	3.2	3.5	42.2
8 MOCN-7	VARUNA(NC)	1197	1738	1861	2119	1728	157	137	129	141	141	37.7	43.8	38.7	40.0	4.9	4.9	4.8	4.9	53.4
9 MOCN-8	KRANTI(NC)	1644	1706	2266	2105	1930	161	138	128	143	142	37.1	44.9	38.6	40.2	3.8	3.5	3.4	3.6	50.1
	GM	1551.1	1798.4	2097	1753	1799	158	140	130	148	144	35.2	41.3	38.0	38.2	3.14	2.97	3.1	3.0	
	SEM	23[illegible]	101	192	108															
	CD AT 5%	722	304	NS	321															
	CV %	20.5	9.8	15.8	10.6															

TABLE 2.7.2 SHOWING THE RESULTS OF LOW ERUCIC ACID AND LOW GLUCOSINOLATE MUSTARD STRAINS TESTED IN IVT IRRIGATED IN ZONE III

			SEED YIELD (Kg/ha)					DAYS TO MATURITY				OIL CONTENT(%)			1000 SEED WEIGHT(g)				
SN	CODE	STRAIN	MOR	KAN	FZB	PANT	MEAN	MOR	KAN	PANT	MEAN	KAN	FZB	MEAN	MOR	KAN	PANT	FZB	MEAN
1	MOCN-1	RW-28-11-1	1428	847	1032	711	1004	126	141	133	133	36.2	36.4	36.3	1.4	2.2	3.1	2.2	2.2
2	MOCN-2	RW-28-11-2	1433	729	662	760	896	132	143	136	137	35.3	39.9	37.6	3.1	2.4	3.3	2.4	2.8
3	MOCN-3	RW-21-59-2	1428	729	1143	655	988	125	138	132	131	35.2	38.9	37.0	2.8	2.2	3.2	2.2	2.6
4	MOCN-4	EC-287711	1650	1129	1123	664	1141	132	151	142	141	37.7	40.9	39.3	2.7	1.8	3.2	1.8	2.3
5	MOCN-5	SHIVA-1	1322	918	839	383	865	134	152	140	142	38.3	38.7	38.5	3.2	2.4	3.6	3.1	3.0
6	MOCN-6	NGP-Y1	1467	722	993	439	905	126	137	138	133	36.9	40.7	38.8	4.9	3.5	3.5	4.1	4.1
7	MOCN-9	PR-8958	1828	1239	1272	933	1318	132	145	143	140	42.3	41.6	41.9	3.3	4.2	3.7	3.9	3.7
8	MOCN-7	VARUNA(NC)	1011	816	1020	714	890	125	140	139	134	38.9	40.8	39.8	4.9	4.9	4.9	4.3	4.7
9	MOCN-8	KRANTI(NC)	1722	1271	1285	1094	1343	134	143	139	138	38.7	42.7	40.7	4.1	3.1	3.4	4.3	3.7
GM			1476.5	933	1041	705	1039	129.55	143	138	136	37.7	40.0	38.8	3.4	2.9	3.5	3.1	3.2
SEM			113	68	36	56													
CD AT 5%			338	204	110	168													
CV%			13.4	12.6	6.1	13.6													

TABLE 2.7.3 SHOWING THE RESULTS OF LOW ERUCIC ACID AND LOW GLUCOSINOLA MUSTARD STRAINS TESTED IN IVT IRRIGATED IN ZONE III

			SEED YIELD (Kg/ha)		DAYS TO MATURITY		1000 SEED WEIGHT(g)	
SN	CODE	STRAIN	SKN	BERH	SKN	BERH	SKN	BERH
1	MOCN-1	RW-28-11-1	1924	1451	120	120	2.4	2.1
2	MOCN-2	RW-28-11-2	1324	1340	119	120	2.4	2.7
3	MOCN-3	RW-21-59-2	2249	1596	118	115	2.7	3.1
4	MOCN-4	EC-287711	1142	1090	124	128	2.1	2.6
5	MOCN-5	SHIVA-1	2160	1004	120	126	2.8	2.8
6	MOCN-6	NGP-Y1	2764	1249	118	121	3.9	3.4
7	MOCN-9	PR-8958	2133	2229	123	125	3.8	3.3
8	MOCN-7	VARUNA(NC)	2084	1292	124	119	5.1	4.2
9	MOCN-8	KRANTI(NC)	1893	2093	123	120	3.3	5.2
GM			1964	1483	121	122	3.2	3.3
SEM			145	159				
CD AT 5%			436	491				
CV%			12.8	22.1				

TABLE 2.7.4 RESULTS OF B.NAPUS STRAINS TESTED UNDER NEW SEED POLICY IN IVT IRRIGATED IN ZONE II DURING 1991-92

		SEED YIELD (Kg/ha)									DAYS TO MATURITY								
SCODE	STRAINS	GUD	LDH	BTH	HSR	PCU	DLH	SGN	NAV	MEAN	GUD	LDH	BTH	HSR	PCU	DLH	SGN	NAV	MEAN
1	NECN-1ISN-733	1000	1136	1807	1436	1615	764	2342	1750	1481	158	162	148	135	137	150	162	145	149
2	NECN-2ISN-602	1035	1128	1633	1234	2196	1204	1742	1362	1441	156	159	147	135	136	149	160	144	148
3	NECN-3ISN-114	667	1119	1496	1211	2062	949	1822	1770	1387	162	158	149	137	139	151	162	145	150
4	NECN-4SEMU-249/2	881	461	-	90	1092	83	1088	-	615	167	178	158	139	160	155	173	161	161
5	NECN-5SEMU-86/22	393	1465	-	113	2207	185	1088	187	805	170	178	157	130	162	162	173	151	160
6	NECN-6GSL-8914	1095	1103	-	880	2442	370	1044	533	1066	169	169	158	141	163	155	162	150	158
7	NECN-7CULTURE-1	940	1416	1844	964	2170	556	1800	670	1295	162	157	150	141	156	148	162	150	153
8	NECN-8WW-1507	1059	1506	2100	721	1855	514	1066	266	1135	167	176	147	127	147	159	160	152	154
9	NECN-9GSL-1	375	1959	1400	1065	2320	722	777	1135	1219	162	159	155	141	161	149	169	136	154
10	NECN-1KRANTI(NC)	214	823	1540	2752	2545	1782	1800	1933	1673	159	147	148	136	142	139	148	136	144
11	NECN-1VARUNA(NC)	1130	667	1127	1829	1987	1505	2000	1516	1470	157	148	146	135	139	140	148	155	146
12	NECN-1GSL-334	1130	1391	987	569	2165	653	1222	633	1093	166	175	156	128	161	156	173	155	158
13	NECN-1GSL-8851	923	1597	1449	708	2075	486	1244	492	1121	168	169	157	128	159	160	173	152	158
14	NECN-1GSL-04	1393	1449	1089	689	2222	602	1111	777	1166	168	163	155	141	162	166	169	-	160
15	NECN-1WESTOR	1310	1160	1227	-	2169	579	1488	-	1322	164	156	154	-	159	148	164	-	157
16	NECN-1SHIRALE	941	1399	-	-	2846	509	955	-	1108	167	157	157	-	162	150	164	-	159
17	NECN-1PBGS-91	1274	1235	1227	-	2567	347	1844	-	1415	162	152	150	-	165	148	164	-	156
	GM	927	1236	1455	1018	2149	695	1437	1001	1224	163	162	152	135	153	152	163	148	154
	SEM	70.6	52.6	42.6	63.9	102	49.2	115											
	CD AT 5%	196	152	122	186	295	142	330											
	CV%	14.9	7.22	5.80	10.8	8.3	12.6	13.7											

TABLE 2.7.5 SHOWING THE RESULTS OF B.NAPUS STRAINS TESTED IN IVT UNDER NEW SEED POLICY IN ZONE III ,IV AND V DURING (1991-92)

			SEED YIELD (Kg/ha)							DAYS TO MATURITY						
			ZONE II					ZONE	ZONE	ZONE II					ZONE IV	ZONE
SN	CODE	STRAIN	KAN	MOR	PANT	FZB	MEAN	SKN	BERH	KAN	MOR	PANT	FZB	MEAN	SKN	BERH
1	NECN-1	ISN-733	1378	1926	729	543	1144	1148	1149	130	147	148	130	141	139	128
2	NECN-2	ISN-602	1393	1987	730	309	1104	963	785	134	141	142	159	144	137	125
3	NECN-3	ISN-114	1526	1993	637	452	1152	1188	975	135	144	142	167	147	139	127
4	NECN-4	SEMU-249/24	1410	363	646	-	806	20	171	143	160	162	-	155	155	134
5	NECN-5	SEMU-86/223	1970	431	477	351	807	10	14	173	159	164	158	163	154	137
6	NECN-6	GSL-8914	1393	1320	572	289	893	119	632	166	147	159	150	155	151	134
7	NECN-7	CULTURE-1	2341	2320	783	395	1459	527	958	149	147	149	168	152	142	132
8	NECN-8	WW-1507	2607	1283	834	296	1255	260	364	163	154	159	140	154	151	136
9	NECN-9	GSL-1	2207	1659	900	301	1266	433	739	160	149	153	155	154	152	137
10	NECN-10	KRANTI(NC)	2652	1974	1368	1153	1786	1488	1218	122	131	136	174	140	153	118
11	NECN-11	VARUNA(NC)	2607	852	1089	889	1359	1495	1222	125	131	140	168	141	151	117
12	NECN-12	GSL-334	2065	963	831	227	1021	100	301	166	150	163	141	155	152	138
13	NECN-13	GSL-8851	1763	622	1061	296	935	126	72	172	154	181	185	183	152	139
14	NECN-14	GSL-04	1898	974	999	247	1029	101	344	168	151	182	161	160	152	137
15	NECN-15	WESTOR	-	2037	808	-	1422	110	652	-	147	155	-	151	142	135
16	NECN-16	SHIRALE	-	1426	820	-	1123	138	650	-	147	157	-	152	141	136
17	NECN-17	PBGS-91	-	1561	1087	-	1324	164	646	-	147	148	-	147	147	134
GM			1943	1393	845	442	1169	493	640	150	147	152	158	151	147	131
SEM			152	135	58.3	31.8		49.6	79							
CD AT 5%			444	374	188	93.2		138	228							
CV%			13.6	16.4	11.9	12.5		20.1	21.3							

TABLE 2.7.4 SHOWING THE RESULTS OF B.NAPUS STRAINS TESTED UNDER NEW SEED POLICY IN IVT IRRIGATED DURING 1991-92

SN	CODE	STRAINS	OIL CONTENT (%)					1000 SEED WEIGHt(g)					E. A. (%)
			BTH	LDH	HSR	PCU	MEAN	LDH	HSR	PCU	SGN	MEAN	
1	NECN-1	ISN-733	38.3	41.2	43.3	39.7	40.6	3.7	3.1	3.4	3.1	3.3	41.6
2	NECN-2	ISN-602	38.3	42.1	45.9	38.7	41.2	4.4	2.6	3.1	2.7	3.2	34.7
3	NECN-3	ISN-114	37.1	37.5	43.5	38.7	39.2	3.3	3.1	3.1	3.4	3.2	42.5
4	NECN-4	SEMU-249/24	37.7	43.9	37.1	37.8	39.1	4.9	1.6	3.4	1.9	3.1	0.43
5	NECN-5	SEMU-86/223	39.1	43.7	41.1	40.3	41.0	2.9	1.6	3.1	1.5	2.2	TRACES
6	NECN-6	GSL-8914	40.1	41.7	44.6	39.8	41.5	3.1	2.2	2.8	2.1	2.5	51.54
7	NECN-7	CULTURE-1	38.9	38.9	42.7	42.2	40.6	3.6	3.3	3.5	3.2	3.4	1.19
8	NECN-8	WW-1507	41.1	42.6	44.1	40.4	42.0	3.1	3.3	3.2	2.8	3.1	0.37
9	NECN-9	GSL-1	38.6	40.9	44.8	40.7	41.2	2.4	1.8	2.6	2.1	2.2	36.6
10	NECN-10	KRANTI(NC)	36.6	39.8	44.1	36.8	39.3	4.5	3.1	4.4	3.8	3.9	40.4
11	NECN-11	VARUNA(NC)	35.3	41.3	46.3	36.2	39.7	4.4	4.8	4.2	4.1	4.3	38.9
12	NECN-12	GSL-334	40.1	42.7	45.9	39.3	42.1	3.1	2.1	2.2	2.2	2.4	13.9
13	NECN-13	GSL-8851	47.9	43.5	45.2	38.4	43.7	2.8	1.8	2.2	2.2	2.2	37.8
14	NECN-14	GSL-04	40.1	42.7	44.8	40.7	42.0	2.9	1.8	2.1	1.9	2.2	8.28
15	NECN-15	WESTOR	39.7	43.7	-	42.8	42.0	3.1	-	-	3.4	3.2	0.93
16	NECN-16	SHIRALE	38.7	38.3	-	39.2	38.7	2.7	-	-	2.3	2.5	1.75
17	NECN-17	PBGS-91	40.1	40.1	-	41.4	40.5	3.9	-	-	2.2	3.1	41.7
GM			39.2	41.4	43.8	39.5	40.8	3.45	2.58	3.0	2.6	2.9	

TABLE 2.7.5 SHOWING THE RESULTS OF B.NAPUS STRAINS TESTED IN IVT UNDER NEW SEED POLICY IN ZONE III ,IV AND V DURING 1991-92

SN	CODE	STRAIN	OIL CONT. (%)			1000 SEED WEIGHT(g)					
			SKN	BERH	KAN	KAN	MORN	PANT	MEAN	SKN	BERH
1	NECN-1	ISN-733	139	122	43.3	3.1	3.7	3.79	3.53	3.1	3.3
2	NECN-2	ISN-602	137	125	43.5	3.2	3.9	2.94	3.34	2.8	2.6
3	NECN-3	ISN-114	139	127	42.2	3.6	3.8	3.34	3.58	2.9	3.4
4	NECN-4	SEMU-249/24	155	134	44.1	2.2	2.6	2.97	2.59	2.6	2.3
5	NECN-5	SEMU-86/223	154	137	42.6	2.3	2.3	2.89	2.49	2.9	1.2
6	NECN-6	GSL-8914	151	134	42.0	2.8	2.7	3.05	2.85	2.5	3.0
7	NECN-7	CULTURE-1	142	132	43.4	3.3	3.9	3.74	3.64	2.1	2.9
8	NECN-8	WW-1507	151	138	44.8	3.4	2.8	2.94	2.98	2.7	2.8
9	NECN-9	GSL-1	152	137	42.6	2.1	2.3	2.94	2.44	2.9	2.3
10	NECN-10	KRANTI(NC)	153	118	38.9	3.8	4.1	3.74	3.81	3.8	3.5
11	NECN-11	VARUNA(NC)	151	117	39.2	4.9	5.5	4.5	4.96	5.1	4.8
12	NECN-12	GSL-334	152	138	44.7	2.7	2.6	2.6	2.63	2.7	2.3
13	NECN-13	GSL-8851	152	139	43.2	2.1	2.6	2.78	2.49	2.4	1.4
14	NECN-14	GSL-04	152	137	43.1	2.6	2.2	2.52	2.44	2.6	2.5
15	NECN-15	WERTER	142	135	-	-	3.6	3.16	3.38	5.1	2.7
16	NECN-16	SHIRALE	141	136	-	-	2.4	3	2.7	3.8	2.8
17	NECN-17	PBGS-91	147	134	-	-	2.5	3.09	2.79	3.2	2.9
GM			147	131	42.6	2.99	3.13	3.17	3.09	3.1	2.7

TABLE 2.8.1 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER LATE SOWN CONDITIONS UNDER IVT IN ZONE II DURING 1991-92

			SEED YIELD (Kg/ha)			DAYS TO MATURITY			OIL CONTENT (%)	1000 SEED WEIGHT(g)		
SN	CODE	STRAIN	HSR	SGN	MEAN	HSR	SGN	MEAN	HSR	SGN	HSR	MEAN
1	MLS-1	RW-4/86	721	311	516	113	120	116	38.5	1.4	1.5	1.5
2	MLS-2	RW-4C-6-3,II	822	400	611	113	120	116	37.2	1.8	1.8	1.8
3	MLS-3	RH-8812	1169	311	740	122	123	122	36.2	2.8	3.4	3.1
4	MLS-4	PCR-3	945	489	717	120	126	123	36.9	3.6	3.8	3.7
5	MLS-5	RLC-962	747	489	618	118	126	122	41.1	3.4	3.1	3.3
6	MLS-6	PUSA BHAR	910	200	555	117	120	118	38.3	3.6	4.1	3.9
7	MLS-7	PUSA BASANT	926	289	607	118	120	119	38.9	4.1	3.9	4.1
8	MLS-8	RN-100	844	689	766	119	126	122	40.2	3.8	2.4	3.1
9	MLS-9	RK-9082	1095	444	769	122	126	124	40.7	3.1	2.4	2.8
10	MLS-10	RK-9046	1127	422	774	119	120	119	39.4	4.1	3.8	3.9
11	MLS-11	TM-21	910	533	721	117	126	121	41.7	3.2	3.6	3.4
12	MLS-12	TM-17	1244	333	788	118	126	122	41.3	2.3	3.5	2.9
13	MLS-13	RW-873	845	333	589	115	120	117	38.1	2.2	1.9	2.1
14	MLS-14	RW-8716	715	-	715	116	-	116	41.1	-	2.7	2.7
15	MLS-15	VARDAN	1147	400	773	116	120	118	39.4	2.7	2.4	2.6
16	MLS-16	RLM-619	1062	422	742	120	126	123	40.4	3.1	2.9	3.1
17	MLS-17	RK-918502	1131	422	776	119	126	122	41.5	3.1	2.9	3.1
18	MLS-18	RK-911256	692	289	490	119	126	122	42.3	3.2	3.1	3.2
19	MLS-19	PPMS	718	467	592	111	120	115	37.9	3.2	1.8	2.5
20	MLS-20	NDR-8602	936	422	679	120	120	120	36.6	3.8	4.5	4.2
21	MLS-21	NDR-389	910	422	666	121	126	123	40.7	3.6	3.5	3.6
22	MLS-22	VARUNA(NC)	900	311	605	118	120	119	41.4	3.2	3.7	3.5
23	MLS-23	KRANTI(NC)	1033	444	738	119	123	121	37.9	3.2	3.3	3.3
24	MLS-24	RH-7859(ZC)	942	467	704	122	124	123	41.8	3.1	2.7	2.9
25	MLS-25	SEJ-2	874	333	603	118	120	119	34.5	3.1	3.6	3.3
GM			934	401	674	113	122	120	39.36	3.1	3.1	3.1
SEM			44.3	56.5								
CD AT 5%			123	156								
CV%			8.22	24.3								

TABLE 2.8.2 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER LATE SOWN CONDITIONS UNDER IVT IN ZONE III DURING 1991-92

SN	CODE	STRAIN	SEED YIELD (Kg/ha) MOR	FZB	VAR	PANT	KAN	ETH	MEAN	DAYS TO MATURITY MOR	VAR	PANT	KAN	ETH	MEAN
1	MLS-1	RW-4/86	317	709	1050	417	426	534	575	101	103	105	108	117	106
2	MLS-2	RW-4C-6-3/II	303	[illegible]	980	495	444	912	617	101	103	104	115	150	114
3	MLS-3	RH-8812	717	1410	1400	1038	2296	2206	1511	112	115	124	106	137	118
4	MLS-4	PCR-3	755	1450	860	1025	3518	2158	1627	112	110	121	111	133	117
5	MLS-5	RLC-962	594	1103	950	1004	3037	2436	1520	110	109	121	113	135	117
6	MLS-6	PUSA BHAR	733	1087	1260	757	2110	1916	1310	110	105	125	112	132	116
7	MLS-7	PUSA BASANT	767	1040	1340	899	1963	1565	1262	112	109	127	112	134	118
8	MLS-8	RN-100	650	1387	1450	783	2222	2424	1486	112	110	123	110	135	118
9	MLS-9	RK-9082	469	1135	1160	809	1518	1566	1109	112	112	123	113	135	119
10	MLS-10	RK-9046	753	1708	1250	986	2148	2123	1491	112	111	125	112	135	119
11	MLS-11	TM-21	530	630	980	699	1926	772	972	107	108	113	109	125	112
12	MLS-12	TM-17	769	820	890	839	1703	1054	1012	111	112	120	106	129	115
13	MLS-13	RW-873	830	591	970	929	1259	1421	1000	105	103	109	111	122	110
14	MLS-14	RW-8716	672	890	970	832	1296	1224	980	106	106	115	111	124	112
15	MLS-15	VARDAN	572	1064	1260	1003	1963	1767	1271	104	116	115	108	126	113
16	MLS-16	RLM-619	617	930	1370	1007	2926	2029	1479	110	109	124	113	137	118
17	MLS-17	RK-918502	594	1245	1260	823	2222	1797	1323	110	110	122	112	134	117
18	MLS-18	RK-911256	733	1426	1150	785	1815	1923	1305	114	102	122	109	135	116
19	MLS-19	PPMS	355	363	1040	740	370	732	600	99	110	104	111	117	108
20	MLS-20	NDR-8602	705	1369	1240	748	1815	2174	1341	110	110	129	113	134	119
21	MLS-21	NDR-389	605	962	980	1077	2333	2474	1405	110	114	126	110	136	119
22	MLS-22	VARUNA(NC)	530	827	760	871	1666	1825	1079	110	112	129	108	133	118
23	MLS-23	KRANTI(NC)	592	1450	930	1153	2296	2334	1459	110	108	121	110	133	116
24	MLS-24	VARDAN	655	886	1240	1234	1999	1028	1173	112	109	115	112	134	116
25	MLS-25	SEJ-2	777	1064	1430	955	1852	1273	1225	110	112	126	113	133	118
GM			634	1044	1126	876	1884.92	1666	1205	108	109	119	110	131	115
SEM			66.6	87	52	85.5	199	143							
CD AT 5%			185	241	165	237	551	397							
CV%			17.9	14.3	12.3	16.8	18.3	14.9							

Contd....

TABLE 2.8.2 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER LATE SOWN CONDITIONS UNDER IVT IN ZONE III DURING '1991-92 (contd)

			OIL CONT.(%)	1000 SEED WEIGHT(g)					
SN	CODE	STRAIN	KAN	MOR	FZB	VAR	PANT	KAN	MEAN
1	MLS-1	RW-4/86	33.5	1.3	2.6	3.5	2.7	2.1	2.4
2	MLS-2	RW-4C-6-3/II	32.9	1.2	2.1	3.4	2.5	1.6	2.2
3	MLS-3	RH-8812	37.4	3.2	4.4	3.5	4.5	3.5	3.8
4	MLS-4	PCR-3	37.4	3.2	3.2	2.8	3.9	3.2	3.2
5	MLS-5	RLC-962	35.9	2.4	3.2	2.9	3.1	2.8	2.8
6	MLS-6	PUSA BHAR	36.8	2.9	4.6	3.5	4.3	3.4	3.7
7	MLS-7	PUSA BASANT	35.7	3.6	5.2	3.6	4.8	3.7	4.2
8	MLS-8	RN-100	36.2	2.3	3.4	2.9	3.2	2.4	2.8
9	MLS-9	RK-9082	34.9	2.8	4.2	3.2	2.9	2.3	3.1
10	MLS-10	RK-9046	36.9	2.6	4.5	3.9	3.9	3.4	3.6
11	MLS-11	TM-21	38.5	2.4	2.9	2.8	3.1	2.1	2.6
12	MLS-12	TM-17	36.7	2.1	2.8	3.1	3.1	2.1	2.6
13	MLS-13	RW-873	35.3	1.7	2.9	3.1	2.9	2.1	2.5
14	MLS-14	RW-8716	37.1	1.9	2.7	3.2	3.1	2.4	2.7
15	MLS-15	VARDAN	38.4	1.9	2.7	3.1	2.9	2.1	2.5
16	MLS-16	RLM-619	36.6	2.6	3.4	3.5	3.9	2.8	3.2
17	MLS-17	RK-918502	37.3	1.9	3.5	3.2	3.7	2.4	2.9
18	MLS-18	RK-911256	38.2	2.9	3.8	3.9	3.6	2.5	3.3
19	MLS-19	PPMS	33.6	1.2	2.9	3.7	2.7	2.4	2.5
20	MLS-20	NDR-8602	37.7	3.5	5.1	2.9	4.8	4.1	4.1
21	MLS-21	NDR-389	37.2	2.6	3.9	3.1	3.9	2.9	3.2
22	MLS-22	VARUNA(NC)	37.3	3.2	3.8	2.8	3.1	3.2	3.2
23	MLS-23	KRANTI(NC)	38.1	2.4	3.4	3.1	3.3	2.4	2.9
24	MLS-24	VARDAN	38.4	2.5	3.1	3.1	3.1	2.1	2.8
25	MLS-25	SEJ-2	35.8	3.1	3.5	3.2	4.8	2.4	3.4
GM			36.5	2.5	3.5	3.2	3.5	2.6	3.1

TABLE 2.8.3 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER LATE SOWN CONDITIONS UNDER IVT IN ZONE IV DURING '1991-92

			SEED YIELD (Kg/ha)				DAYS TO MATURITY				OIL CONTENT(%)	1000 SEED WEIGHT(g)		
SN	CODE	STRAIN	JAL	RAHU	MED	MEAN	JAL	RAHU	MED	MEAN	JAL	JAL	RAHU	MEAN
1	MLS-1	RW-4/86	1144	1164	2853	1720	120	100	95	105	36.8	5.1	4.1	4.6
2	MLS-2	RW-4C-6-3/1	1267	917	2613	1599	130	100	100	110	36.4	5.7	3.9	4.8
3	MLS-3	RH-8812	1711	897	3004	1870	131	115	107	117	38.1	6.2	4.6	5.4
4	MLS-4	PCR-3	2356	1307	2809	2157	131	116	105	117	38.1	5.7	6.3	6.1
5	MLS-5	RLC-962	1369	1040	3413	1940	130	117	107	118	37.4	6.8	4.6	5.7
6	MLS-6	PUSA BHAR	1767	1524	2640	1977	127	106	103	112	40.1	6.1	4.5	5.3
7	MLS-7	PUSA BASANT	1778	1304	2453	1845	122	107	100	109	38.5	6.8	3.4	5.1
8	MLS-8	RN-100	1578	853	3067	1832	135	112	109	118	38.2	6.1	5.7	5.9
9	MLS-9	RK-9082	1267	689	1947	1301	135	121	112	122	37.1	6.5	3.6	5.1
10	MLS-10	RK-9046	1944	1411	2373	1909	134	112	111	119	39.2	7.5	5.1	6.3
11	MLS-11	TM-21	1733	1398	2240	1790	130	101	98	109	36.5	6.8	6.3	6.5
12	MLS-12	TM-17	2033	1067	2053	1717	136	109	98	114	40.2	6.4	4.1	5.2
13	MLS-13	RW-873	2178	1184	2800	2054	127	98	98	107	36.2	6.9	5.4	6.1
14	MLS-14	RW-8716	1867	1063	2480	1803	122	95	95	104	38.6	8.6	4.2	6.4
15	MLS-15	VARDAN	1511	1405	2453	1789	129	107	104	113	38.1	6.3	4.5	5.4
16	MLS-16	RLM-619	1711	1037	2933	1893	129	115	107	117	39.1	6.1	4.3	5.2
17	MLS-17	RK-918502	1622	961	2850	1811	129	112	103	114	40.1	6.5	3.9	5.2
18	MLS-18	RK-911256	1671	924	3440	2011	119	112	107	112	38.2	5.8	3.5	4.7
19	MLS-19	PPMS	1156	962	2027	1381	121	95	98	104	39.8	5.9	3.8	4.9
20	MLS-20	NDR-8602	1747	763	2480	1663	134	116	101	117	37.6	7.4	7.3	7.3
21	MLS-21	NDR-389	1778	926	2480	1728	136	116	107	119	37.4	7.6	3.4	5.5
22	MLS-22	VARUNA(NC)	1400	676	1920	1332	131	114	103	116	36.4	6.3	6.7	6.5
23	MLS-23	KRANTI(NC)	1867	1176	2747	1930	133	114	104	117	37.1	6.7	6.1	6.4
24	MLS-24	SEETA	1711	1069	2747	1842	136	92	101	109	38.5	7.1	3.8	5.4
25	MLS-25	SEJ-2	2244	1268	2692	2068	132	110	98	113	36.8	7.1	6.4	6.7
GM			1696	1079	2620	1798	129	108	102	113	38.0	6.5	4.7	5.6
SEM			240	50.2	101									
CD AT 5%			484	142	280									
CV%			[illegible]	8.2	6.7									

TABLE 2.8.4 SHOWING THE RESULTS OF MUSTARD STRAINS TESTED UNDER LATE SOWN CONDITIONS UNDER IVT IN ZONE V DURING '1991-92

			SEED YIELD(Kg/ha)						DAYS TO MATURITY						1000 SEED WEIGHT(g)			
SN	CODE	STRAIN	CHAN	DHOL	RAN	BERH	BHV	MEAN	CHAN	DHOL	RAN	BERH	BHV	MEAN	CHAN	RAN	BERH	MEAN
1	MLS-1	RW-4/86	751	578	196	836	72	486	103	102	94	80	76	91	2.5	1.8	3.4	2.5
2	MLS-2	RW-4C-6-3/'I	618	526	384	792	-	580	104	102	93	85	-	96	2.2	2.1	3.4	2.6
3	MLS-3	RH-8812	770	667	411	556	83	497	110	101	101	99	74	97	4.1	4.9	3.2	4.1
4	MLS-4	PCR-3	1147	615	471	535	266	606	110	103	100	105	86	100	4.7	4.7	3.9	4.4
5	MLS-5	RLC-962	870	581	471	934	194	610	110	107	99	106	85	101	4.1	4.7	3.3	4.1
6	MLS-6	PUSA BAHAR	966	759	396	515	105	548	111	104	96	101	85	99	5.6	5.5	3.1	4.8
7	MLS-7	PUSA BASANT	1093	837	427	511	114	596	111	106	101	100	83	100	6.2	6.2	3.9	5.4
8	MLS-8	RN-100	862	644	289	755	69	523	111	111	101	108	81	102	3.9	3.5	3.8	3.8
9	MLS-9	RK-9082	732	604	309	738	389	554	112	102	99	110	86	101	3.1	3.5	3.1	3.3
10	MLS-10	RK-9046	1170	674	404	830	167	649	110	108	100	100	78	99	5.3	5.1	3.8	4.7
11	MLS-11	TM-21	832	626	400	492	125	495	107	101	93	90	84	95	3.1	3.7	3.5	3.4
12	MLS-12	TM-17	862	659	322	507	250	520	107	103	94	96	76	95	3.3	5.5	3.3	4.1
13	MLS-13	RW-873	955	585	344	580	283	549	105	102	92	90	83	94	3.4	3.2	3.7	3.4
14	MLS-14	RW-8716	1074	674	-	607	127	620	105	102	-	92	76	94	3.8	-	3.9	3.8
15	MLS-15	VARDAN	966	730	329	-	-	675	107	103	97	-	-	102	3.2	3.1	-	3.2
16	MLS-16	RLM-619	897	637	367	738	100	547	112	110	101	100	85	101	2.8	4.6	3.9	3.7
17	MLS-17	RK-918502	852	600	440	1045	216	630	110	112	97	100	84	100	3.2	3.3	3.6	3.4
18	MLS-18	RK-911256	839	856	451	529	136	562	110	109	99	100	85	100	3.4	4.1	3.7	3.8
19	MLS-19	PPMS	666	556	369	442	166	439	103	103	93	81	74	91	2.3	2.6	3.2	2.7
20	MLS-20	NDR-8602	847	874	522	457	78	555	111	107	99	100	86	100	6.4	6.5	3.8	5.5
21	MLS-21	NDR-389	933	674	487	755	205	610	111	106	100	109	86	102	4.6	4.8	3.6	4.3
22	MLS-22	VARUNA(NC)	862	726	329	521	216	530	110	108	100	103	81	100	5.4	4.7	3.5	4.5
23	MLS-23	KRANTI(NC)	809	630	387	719	169	542	109	112	99	108	86	102	3.1	3.8	3.9	3.6
24	MLS-24	SARMA	764	593	429	521	67	474	106	106	94	98	80	97	3.1	3.1	3.9	3.3
25	MLS-25	SEJ-2	1043	696	460	-	167	591	111	102	97	-	85	99	5.1	5.7	-	5.4
GM			887	664	375	596	164	559	108	105	94	90	82	98	3.9	4.1	3.3	3.9
SEM			87.8	42.1	35.5	73	25											
CD AT 5%			244	117	98.3	290	69											
CV%			17.5	10.9	15.4	15.4	26.3											

TABLE 9.11.1 SHOWING THE RESULTS OF YELLOW SARSON STRAIN TESTED UNDER IVT IN ZONE V DURING (1991-92)

			SEED YIELD(Kg/ha)			DAYS TO MATURITY			1000 SEED WEIGHT		
SN	CODE	STRAIN	BERH	CHAN	MEAN	BERH	CHAN	MEAN	BERH	CHAN	MEAN
1	YSCN-1	YSBW-877	720	557	639	110	104	107	2.7	3.7	3.[illegible]
2	YSCN-2	YSBW-881	1196	513	855	101	99	100	3.5	3.6	3.[illegible]
3	YSCN-3	YS-6	916	821	869	101	114	108	3.5	4.2	3.[illegible]
4	YSCN-4	YS-7	610	1032	821	107	114	111	3.2	4.2	3.[illegible]
5	YSCN-5	YS-8	620	872	746	110	117	114	3.5	5.3	4.[illegible]
6	YSCN-6	YST-151	720	764	742	108	123	116	3.1	4.1	3.[illegible]
7	YSCN-7	SU-BENOY	1656	-	1656	99	-	99	2.9	-	2.[illegible]
8	YSCN-8	YSBW-9	1960	652	1306	97	111	104	3.6	4.3	3.[illegible]
9	YSCN-9	SSK-6	610	1161	886	115	116	116	2.8	6.1	4.[illegible]
10	YSCN-10	SSK-13	796	1064	930	115	116	116	2.7	3.6	3.[illegible]
GM			980	743	945	106	101	109	3.2	3.9	3.[illegible]
SEM			77.4	81.6							
CD AT 5%			230.	245							
CV%			13.6	17.1							

TABLE 2.12.1 SHOWING THE RESULTS OF IVT- TARAMIRA UNDER RAIN-FED CONDITIONS DURING 1991-92

			SEED YIELD kg/ha				DAYS TO MATURTITY				OIL %	1000 SEED WEIGHT gms		
SN	CODE	STRAIN	BTH	SGN	MOR	MEAN	BTH	SGN	MOR	MEAN	BTH	SGN	MOR	MEAN
1	TMCN-1	PBTM-1	1153	963	908	1008	148	140	145	144	33.1	2.6	3.7	3.1
2	TMCN-2	MTM-1	792	963	616	790	150	140	140	143	32.9	3.4	4.1	3.7
3	TMCN-3	MTM-2	831	993	655	826	147	140	138	142	31.9	2.8	3.7	3.2
4	TMCN-4	MTM-3	782	874	765	807	152	140	140	144	31.7	3.1	3.6	3.3
5	TMCN-5	JMTA-902	667	844	705	739	145	127	135	136	33.3	4.1	4.1	4.1
6	TMCN-6	T-27(NC)	884	1022	857	921	144	141	140	142	34.5	3.1	3.6	3.3
	GM		851	943	753	849	147	138	140	142	32.9	3.2	3.8	3.5
	SEM		62	65	43									
	CD AT 5%		49	NS	127									
	CV %		3.8	11.9	11.8									

TABLE 2.12.2 SHOWING THE RESULT OF AVT-1 TARAMIRA UNDER RAINFED CONDITIONS DURING 1991-92

			SEED YIELD kg/ha				DAYS TO MATURITY				1000 SEED WT gm		
SN	CODE	STRAIN	MOR	BTH	JOB	MEAN	MOR	BTH	JOB	MEAN	MOR	JOB	MEAN
1	TMCN-9	JMTA-901	667	731	965	787	135	145	123	134	4.4	3.9	4.2
2	TMCN-10	TMH-9002	774	785	1098	885	144	148	124	138	3.8	3.4	3.6
3	TMCN-11	TMH-9001	855	823	1156	944	145	150	123	139	3.2	3.3	3.3
4	TMCN-12	RTM-312	815	935	1019	923	142	147	123	137	3.2	3.3	3.3
5	TMCN-13	TMH-9003	865	713	1142	906	144	150	123	139	3.7	3.3	3.5
6	TMCN-14	T-27(NC)	821	844	1283	983	143	142	125	136	4.1	3.5	3.8
GM			799	797	1076	905							
SEM			46	23	113								
CD AT 5%			NS	69	NS								
CV%			15	7.2	21								

TABLE 2.12.3 - SHOWING THE RESULTS OF AVT-II TARAMIRA UNDER RAINFED CONDITIONS DURING 1991-92

			SEED YIELD kg/ha				DAYS TO MATURITY				1000 SEED WT gm		
SN	CODE	STRAIN	MOR	BTH	JOB	MEAN	MOR	BTH	JOB	MEAN	MOR	JOB	MEAN
1	TMCN-16	RTM-314	958	992	1361	1103	141	148	126	138	3.8	3.5	3.7
2	TMCN-17	RTM-112	853	832	1447	1044	141	147	121	136	3.9	3.7	3.8
3	TMCN-18	T-27(NC)	821	745	1283	949	143	142	125	136	4.1	3.5	3.8
GM			871	856	1364	-	-	-	-	-			
SEM			34	69	1.39	-	-	-	-	-			
CD AT 5%			63	NS	NS	-	-	-	-	-			
CV%			5.8	10.5	25	-	-	-	-	-			

Table 2.13.1
SHOWING THE RESULTS OF B.CARINATA STRAINS TESTED UNDER
IN AVT-I RAINFED IN ZONE I, II AND IV DURING (1991-92)

			SEED YIELD (Kg/ha)						DAYS TO MATURITY					
SN	CODE	STRAIN	KNG	DLH	LDH	BTH	BWL	MEAN	JAL	KNG	LDH	BTH	BWL	MEAN	JAL
1	BCCN-1	DLSC-1	988	3125	2103	1852	1654	2183	1777	172	176	172	166	171	158
2	BCCN-2	NPC-2	864	2639	1474	2170	1444	1931	1517	174	184	170	166	173	154
3	BCCN-3	HC-9001	1324	2812	2400	2117	1296	2156	1667	178	161	171	164	165	161
4	BCCN-4	BCRS-84	1022	2465	1629	1549	1457	1775	1593	179	160	172	166	166	160
5	BCCN-5	PCC-2	825	1909	1511	1956	1852	1807	1500	181	176	168	165	169	153
6	BCCN-6	VARUNA(NC)	459	1562	1924	1407	1061	1488	1617	161	160	148	136	148	132
7	BCCN-7	KRANTI(NC)	889	1944	859	1583	1407	1448	1600	161	158	149	138	153	135
8	BCCN-8	RL-1359(ZC)	627	1944	933	1321	1283	1370	1550	161	164	148	138	150	135
GM			874	2300	1604	1744	1431	1770	1602	170	167	162	154	164	148
SEM			40	-	220	37.4	57		55						
CD AT 5%			119	-	665	113	172		114						
CV%			7.6	-	23.7	3.71	9.3		3						

OIL CONTENT(%)		1000 SEED WT.(g)			
LDH	JAL	KNG	LDH	MEAN	JAL
38.9	36.2	2.6	3.7	3.2	6.43
40.9	36.6	2.9	2.9	2.9	6.05
37.6	37.1	2.8	3.2	3.1	5.93
39.4	37.4	3.1	3.4	3.3	5.78
34.5	37.8	3.5	1.6	2.6	6.33
39.5	38.2	4.2	1.7	2.9	7.58
38.1	39.2	2.8	4.1	3.5	6.28
41.7	37.7	4.2	3.9	4.1	6.03
38.825	32.88	3.262	3.06	3.2	6.30

3. AGRONOMY

During the year under report, seven agronomical experiments/ trials were formulated and allotted to co-operating centres. The results of each trial conducted by co-operating centres have been discussed below:-

3.1

Name of the Project : Contribution of different factors of production on the yield of mustard, taramira and brown sarson

Objectives : To study the effect of different factors contributing towards seed yield of mustard, taramira and brown sarson

Locations : Khudwani, Hisar, Navgaon, Dholi and Jobner (for taramira)

Progress of work :

Khudwani:

Significantly, higher seed yield of brown sarson was recorded when full package of practices was adopted (Table 3.1.1). The reduction in yield was maximum when fertilizer and irrigation were missing.

Table 3.1.1: Contribution of different factors of production on the seed yield of brown sarson at Khudwani during 1991-92

Treatment	Seed yield (Kg/ha)
Reccomended Package (RP)	1048
RP-Improved Variety	746
RP-Fertilizer	741
RP-Irrigation	946
RP-Plant Protection	821
RP-Fertilizer+Irrigation	617
RP-Fertilizer+Plant Protection	455
RP-Irrigation+Plant Protection	793
CD at 5%	267

Hisar:

The perusal of data in Table 3.1.2 reveals that the highest seed yield of mustard (1229 Kg/ha) has been recorded in the treatment where full package technology has been adopted followed by the treatment where only plant protection is missing. Further, the results revealed that the maximum contribution is by tne application of the fertilizer (53.7%).

The varietal contribution is about 15%. The irrigation has contributed only 4% this may be due to the reasons that:-

a) The crop was sown after pre-sowing irrigation.
b) During Dec.-Feb. a total of 37.4mm rain distributed in 8 days was received.

The oil content was not much affected and ranged from 43.5 to 45.8%. Maximum thousand seed weight (6.83 g) was obtained from the treatment where no irrigation was applied and the minimum (4.27 g) where no fertilizer was applied. The oil yield followed the trend of seed yield.

On the basis of two years average, the highest seed yield of 2003 Kg/ha was recorded when full package of practices were followed. The minimum seed yield of 1646 Kg/ha was recorded when fertilizer and plant protection measures were missing.

Navgaon:

Data presented in Table 3.1.3 reveals that the maximum seed yield of mustard was realised (during both the years) by adopting full recommended package of practices. Seed yield decreased significantly to the minimum when fertilizer and irrigation were not applied. When compared individually, fertilizer proved to be the most crucial factor of production. In the absence of fertiliser application, yield decreased to the extent of 31.5 and 43.0 per cent in 1990-91 and 1991-92, respectively as compared to the yield obtained under full package of practices; the corresponding decrease with no irrigation was 18.3 and 30.8 per cent. Adoption of no plant protection measure did decrease seed yield but not significantly. Significant increase in seed yield was obtained when improved variety(Varuna) was not used during 1990-91.

Pantnagar:

The perusal of Table 3.1.4 reveals that the highest net returns were obtained from fodder cowpea-toria-wheat rotation followed by green gram-toria-wheat and black gram-toria-wheat rotation.

Kanpur:

The highest gross and net returns were recorded from maize-toria-wheat followed by green gram - wheat sequences (Table 3.1.5). The effect of different kharif crops and nitrogen levels for toria crop were found significant on seed yield of toria. The highest significant seed yield (2064 and 2060 Kg/ha) was recorded with green gram/black gram over other crops. The seed yield of toria was recorded at par due to 50% and 100% recommended dose of nitrogen application.

Dholi:

TABLE 3.1.3: CONTRIBUTION OF DIFFERENT FACTORS OF PRODUCTION ON SEED YIELD OF MUSTARD AT HISAR DURING 1990-91 AND 1991-92

SN	TREATMENTS	SEED YIELD (Kg/ha)			% REDUCTION IN YIELD OVER RP			OIL CONTENT (%)		
		90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN
1	RECOMMENDED PACKAGE	2778	1229	2003	-	-		43.9	43.5	43.7
2	RP-IMPROVED VARIETY	2346	1043	1694	15.5	15.1	15.3	41.9	44.8	43.4
3	RP-FERTILIZER	1810	569	1189	34.8	53.7	44.2	44.1	45.6	44.8
4	RP-IRRIGATION	2190	1178	1684	21.2	4.1	12.7	43.1	44.6	43.9
5	RP-FERT.	2284	1224	1754	17.8	0.3	9.1	42.6	43.8	43.2
6	RP-FERT.+PL PROT.	1646	496	1071	40.7	59.6	50.1	44.2	44.5	44.5
7	RP-FERT.+PL.PROT.	1661	443	1052	40.2	63.9	52.1	44.1	45.8	44.9
8	RP-IRRIGATION+PL.PROT.	2078	1022	1550	25.2	16.8	21.1	42.5	43.8	43.1
	CD AT 5%	327	216	1499			29.2			
	CV %	9.1	13.7							

TABLE 3.1.3.CONTRIBUTION OF DIFFERENT FACTORS OF PRODUCTION ON THE SEED YIELD OF MUSTARD AT NAVGAON DURING 1990-91 AND 1991-92

SN	TREATMENTS	SEED YIELD (Kg/ha) NAVGAON		
		1990-	1991	MEAN
1	RECOMMENDED PACKAGE	941	1720	1330
2	RP-IMPROVD VARIETY	666	1590	1128
3	RP-FERTILIZER	644	980	812
4	RP-IRRIGATION	768	1190	979
5	RP-FERT.	875	1570	1222
6	RP-FERT.+PL PROT.	551	730	640
7	RP-FERT.+PL.PROT.	630	920	775
8	RP-IRRIGATION+PL.PROT.	746	1140	943
	CD AT 5%	182	164	979
	CV %	17.0	9.1	

The results presented in Table 3.1.4 reveals that the highest seed yield of 1192 Kg/ha was recorded when full recomended package of practices were followed. The minimum seed yield of 717 Kg/ha was recorded for the treatment recommended package - fertilizer + plant protection. The minimum reduction in seed yield was from the treatment where improved variety was missing.

Bhubaneswar:

The results presented in Table 3.1.5 reveals that the highest seed yield of 559 Kg/ha (Toria) was recorded when full package of practices were adopted. The minimum seed yield of 173 Kg/ha was obtained when recommended package minus fertilizer + plant protection was followed.

Jobner:

The experiment was started initiated during 1989-90. The results of three years (1989-90 to 1991-92) of taramira reveals that almost all the growth and yield contributing characters and yield were significantly better under recommended packages followed by recommended packages - plant protection in all the three years. The treatment recommended packages - fertilizer + weed control was most detrimental (Table 3.1.6).

The mean highest net income of Rs. 9429.17 was obtained with recommended packages of practices followed by Rs.9062.42 with recommended packages - plant protection. The treatment recommended packages - fertilizer + weed control gave minimum returns in all the three years.

TABLE 3.1.4. CONTRIBUTION OF DIFFERENT FACTORS OF PRODUCTION ON SEED YIELD OF MUSTARD AT DHOLI DURING 1991-92

TREATMENTS	SEED YIELD (kg/ha)
RECOMMEND PACKAGE	1192
RP-IMPROVED VARIETY	1150
RP-FERTILIZER	858
RP-IRRIGATION	967
RP-PLANT PROTECTION	1117
RP-FERT.+IRRIG.	717
RP-FERT.+PLANT PROT.	725
RP-IRRIGATION+PLANT PROT.	908
GM	954
SEM	87
CD AT 5%	121
CV%	8.6

TABLE 3.1.5. CONTRIBUTION OF DIFFERENT FACTORS OF PRODUCTION ON SEED YIELD OF TORIA AT BHUVNESWAR DURING 1991-92

TREATMENTS .	SEED YIELD(Kg/ha)
RECOMMEND PACKAGE	559
RP-IMPROVD VARITY	467
RP-FERTILIZER	335
RP-IRRIGATION	431
RP-PLANT PROTECTION	450
RP-FERT.+IRRIGATION	153
RP-FERT.+PLANT PROT.	173
RP-IRRIGATION+PLANT PROT.	292

TABLE 3.1.6. ECONOMICS OF TARAMIRA AS INFLUENCED BY DIFFERENT FACTORS OF PRODUCTION AT JOBNER DURING THE YEAR'1989-90 TO 1991-92

TREATMENTS	SEED YIELD (Kg/ha)				Gross Returns(Rs/ha)			AV.	NET RETURNS (Rs/ha)			MEAN NET
	89-91	90-91	91-92	MEAN	89-90	90-91	91-92	COST	89-9	90-91	91-92	RETURN(Rs/h
RECOMMEND PACKAGE (RP)	1392	1963	1750	1701	8358	12759	13125	1985	6373	10774	11140	9429
RP-IMPROVD VARITY	1124	1472	1322	1306	6744	9568	9915	1975	4769	7593	7940	6767
RP-FERTILIZER	1181	1778	1354	1437	7086	11557	10155	1687	5398	9869	8467	7912
RP-WEED CONTROL	1212	1704	1458	1459	7278	11078	10935	1845	5433	9231	9090	7918
RP-PLANT PROTECTION	1324	1852	1510	1562	7944	12038	11325	1375	6569	10663	9950	9062
RP-FERT.+WEED CONTROL	889	1322	1093	1101	5334	8593	8197	1545	3788	7048	6652	5829
RP-FERT.+PLANT PROTECTION	992	1352	1271	1205	5958	8788	9532	1523	4435	7265	8010	6570
RP-WEED CONTROL+PLANT PRO	1068	1418	1292	1258	6408	9204	9690	1230	5178	7974	8460	7204

RATE OF TARAMIRA :DURING (1989-90) (1990-91) (1991-92)
600Rs/q. 650Rs/750Rs/q.

3.2

Name of the Project : Effect of starch polymer (Jalshakti) under rainfed conditions on seed yield of mustard

Objectives : To see the effect of starch polymer on seed yield of mustard under rainfed conditions

Locations : Faizabad, Junagarh, Navgaon and Jobner (for taramira)

Progress of work:

Bathinda:

The results presented in Table 3.2.1 reveals that the highest seed yield of 1288 Kg/ha was recorded under the treatment seed coating @ 3% + soil application @ 6 Kg/ha with 2 irrigations. The lowest seed yield of 854 Kg/ha was recorded when no irrigation and Jalshakti was applied. Further the application of jalshakti as seed coating, soil application or both increased the seed yield significantly over control. Irrigation also recorded a significant increase in seed yield from no irrigation to one irrigation and one to two.

Navgaon:

The results presented in Table 3.2.2 reveals that the effect of Jalshakti was not significant during both the years (1990-91 and 1991-92). However, the maximum seed yield was obtained with the application of Jalshakti @ 4 Kg/ha + seed coating @ 3%.

Junagarh:

The results presented in Table 3.2.3 reveals that significantly higher seed yield of (1615 Kg/ha) was recorded under the treatment of recommended practices with 6 irrigations followed by the treatment of 3% seed coating and 6 Kg/ha soil application of Jalshakti with 3 irrigations at 15, 45 and 65 days after sowing and the treatment of soil application @ 6 Kg/ha Jalshakti with 3 irrigations at 15, 45 and 65 days after sowing. The lowest seed yield of 969 Kg/ha was recorded under the treatment seed coating @ 3% with Jalshakti with 2 irrigations at 20 and 55 days after sowing during 1991-92.

On the basis of two years average, the highest seed yield of 1028 Kg/ha was recorded under recommended package (6 irrigations) followed by seed coating @ 3% + soil application @ 6 Kg/ha + 3 irrigations. The minimum average seed yield of 623 Kg/ha was obtained for a treatment soil application of Jalshakti @ 6 Kg/ha + 2 irrigations. There was not much appreciable variation in the per cent oil content during both the years i.e. 1990-91 and 1991-92.

TABLE 3.2.1. EFFECT OF STARCH POLYMER (JALSHAKTI)ON THE SEED YIELD (Kg/ha) OF INDIAN MUSTARD UNDER DIFFERENT LEVELS OF IRRIGATION AT BHATINDA DURING 1991-92

TREATMENT	CONTROL	SEED COATING @3%	SOIL APPLICATION @ 6 Kg/ha	SEED COATING @3%+ SOIL APPLICATION @6Kg/ha	MEAN
NO IRRIGATION	854	1015	1045	1151	1016
ONE IRRIGATION	992	1101	1126	1173	1098
TWO IRRIGATIONS	1135	1192	1234	1288	1212
MEAN	994	1102	1135	1204	
CD AT 5% IRRIGA	27				
JALSHAK	34				
IRRIGAT JALSHAKTI	55				

TABLE 3.2.2. EFFECT OF STARCH POLYMERS(JAL SHAKTI) UNDER RAINFED CONDITION ON SEED YIELD OF MUSTARD AT NAVGAON DURING 1990-91&1991-92

TREATMENTS	1990-91	1991-92	MEAN
SEED COATING @1.5%	710	1118	914
SEED COATING @3%	666	1238	952
SOIL APPLICATION @4Kg/ha	727	1114	920
SOIL APPLICATION @4Kg/ha+ SEED COATING @1.5%	694	1155	925
SOIL APPLICATION @4Kg/ha+ SEED COATING @3%	710	1203	957
NO SEED COATING/OR SOIL APPLICATION	649	1107	878
SEM	-		69
CD AT5%	NS		NS
CV%	-		11.9

TABLE 3.2.3. EFFECT OF JALSHAKTI UNDER IRRIGATED CONDITIONS ON SEED YIELD AND OIL CONTENT OF MUSTARD AT JUNAGADH DURING 1990-91& 1991-92

	SEED YIELD (Kg/ha)			OIL CONTENT(%)		
TREATMENTS	1990-91	1991-92	MEAN	1990-91	1991-	MEAN
SEED COATING @3%+ TWO IRRIGATIONS	191	969	580	35.5	38.1	36.8
SOIL APPLICATIONS@6Kg/ha +TWO IRRIGATIONS	222	1024	623	35.6	37.8	36.7
SEED COATING @3%+ THREE IRRIGATIONS	274	1226	750	36.1	37.8	36.9
SOIL APPLICATIONS@6Kg/ha +THREE IRRIGATIONS	330	1490	910	36.1	37.9	37
SEED COATING @3%+ SOIL APPLICATIONS@6Kg/ha TWO IRRIGATIONS	337	1003	670	35.8	38.2	37
SEED COATING @3%+ +SOIL APPLICATION @6Kg/ha+THREE IRRIGATIONS	344	1535	939.5	35.8	38.2	37
RECOMMEND PACKAGE (6 IRRIGATIONS)	441	1615	1028	36.1	37.9	37
CD	60.4	54.5				
CV	13.3	5.8				

3.3

Name of the Project : Performance of promising varieties (identified) of mustard under different levels of Nitrogen

Objectives : To find out optimum nitrogen level required for the better performance of strain CS-52

Locations : Hisar, Bathinda, Ludhiana, Pantnagar, Kanpur, Jobner and Navgaon.

Progress of work :

Hisar:

The results presented in Table 3.3.1 reveals that the yield of mustard crop increse with the increasing dose of nitrogen from 40 to 80 Kg/ha and the differences were statistically significant. Not much difference was observed in the oil content and 1000 seed weight.

Amongst varieties, the highest seed yield of 1016 Kg/ha was recorded by Kranti followed by 891 Kg/ha of CS-52 and 780 Kg/ha of RH-30 and the differences were statistically significant. CS-52 recorded maximum oil content(44.8%) while maximum 1000 seed weight was recorded for variety RH-30, 5.69(g).

Bathinda:

The data presented in Table 3.3.2 reveals that the seed yield of different varieties increased significantly with 125 Kg N/ha except with 100 Kg N/ha. All the three varieties(CS-52, Kranti and RLM-619) recorded significantly higher seed yield than RL-1359 which recorded lowest seed yield of 876 Kg/ha. The variety CS-52 recorded highest seed yield (1142 Kg/ha) at 75 Kg N/ha; Kranti(1188 Kg/ha) and RLM-619(1173 Kg/ha) recorded the highest seed yield at 125 Kg N/ha.

Ludhiana:

The perusal of Table 3.3.3 reveals that the highest significant seed yield of CS-52 was recorded under recommended dose of nitrogen against the check variety, Kranti and RLM-619. The yield of different varieties increased with increasing level of nitrogen. However, the non-significant differences were observed between recommended nitrogen dose and the 75% of the recommended nitrogen dose.

Pantnagar:

TABLE 3.3.1 SHOWING THE PERFORMANCE OF PROMISING STRAINS OF MUSTARD UNDER DIFFERENT NITROGEN LEVELS AT HISAR DURING 1991-92

TREAMENTS	YIELD (Kg/ha)	OIL (%)	OIL YIELD (Kg/ha)	1000 SEED WEIGHT(g)
N-40	777	44.1	343	4.76
N-60	901	44.4	400	4.60
N-80	1010	43.5	442	4.77
CD AT 5%	103			
SEM	29			
RH-30	780	43.3	338	5.69
KRANTI	1016	43.3	445	4.22
CS-52	891	44.8	399	4.23
CD AT 5%	87			
SEM	29			

TABLE 3.3.2. EFFECT NITROGEN RATES ON THE SEED YIELD (Kg/ha)OF DIFFERENT ENTRIE OF INDIAN MUSTARD AT BATHINDA DURING 1991-92

TREATMENTS	NITROGEN Kg/ha			MEAN
	N 100 RECOMMENDED	N 75(3/4 OF RECOMMANDED)	N 50(1/2 OF RECOMMANDED)	
CS-52	1207	1131	1082	1140
KRANTI	1050	998	927	992
RLM-619 (LOCAL CHECK)	1018	953	865	945
MEAN	1092	1022	958	

TABLE 3.3.3. EFFECT OF DIFFERENT LEVELS OF NITROGEN ON SEED YIELD BRASSICA VARIETIES AT LUDHIANA DURING 1991-92

TREATMENT	SEED YIELD (Kg/ha)				
	CS-52	KRANTI	RLM-619	RL-1359	MEAN
N50 Kg/ha	972	957	895	745	892
N75 Kg/ha	1142	1019	957	824	986
N100 Kg/ha	1034	1034	995	957	1005
N125 Kg/ha	1095	1188	1173	979	1109
MEAN	1061	1050	1005	876	-

CD AT 5% NITROGEN(M):30 Kg/ha
VARIETIES (S):60 Kg/ha
INTERACTION(MxS):85 Kg/ha

TABLE 3.3.4 SEED YIELD (Kg/ha) OF MUSTARD ENTRIES AS INFLUENCED BY NITROGEN RATES AT PANTNAGAR DURING 1991-92

ENTRIES	NITROGEN (Kg/ha)			
	50 % OF RECOMMENDED 60(Kg N/ha)	75 % OF RECOMMENDED 90(Kg N/ha)	RECOMMENDED 120(Kg N/ha)	MEAN
CS-52	1356	1523	1650	1509
PR-8903	1340	1478	1630	1482
KRANTI	1313	1482	1607	1467
MEAN	1336	1494	1629	

	SEM	CD AT 5%	CV%
VARIETY (V)	23	NS	
NITROGEN RATES (N)	23	68	
VARIETY x NITROGEN RATES	40	119	14.6

The result presented in Table 3.3.4 reveals that the varietal effect of entries was recorded non-significant. However, entry CS-52 recorded highest seed yield followed by PR-8903 and the check variety, Kranti. Nitrogen rate differed significantly among themselves. The recommended dose(120 Kg N/ha) gave significantly higher seed yield over 90 and 60 Kg N/ha. Similarly, 90 Kg N/ha recorded significantly higher seed yield over 60 Kg N/ha. The interaction effect among entries and nitrogen rates was also recorded to be significant and entry CS-52 recorded significantly higher seed yield at 120 Kg N/ha but the seed yield of all the varieties was statistically at par.

Kanpur:

The perusal of data in Table 3.3.5 reveals that the strain CS-52 and variety Kranti were at par in seed yield but gave highly significant seed yield over Rohini variety of Mustard. The effect of nitrogen levels were recorded in linear fashion upto 120 Kg N/ha. The interaction effects were also significant, entry CS-52 gave maximum significant seed yield (2599 Kg/ha) with recommended dose of nitrogen (120 Kg/ha), whereas, Kranti variety recorded maximum seed yield (2030 Kg/ha) with 75% of recommended dose of nitrogen (90 Kg/ ha) and Rohini variety of mustard gave maximum seed yield(2079 Kg/ha) with 100% recommended dose of nitrogen(120 Kg/ha). The previous crop was Sorghum (Green fodder).

Navgaon:

The results presented in Table 3.3.6 reveals that varieties under test did not vary significantly among themselves in relation to seed yield. Significantly higher seed yield was obtained with application of 100% of the recommended nitrogen (60 Kg N/ha). Yield did not decrease significantly with lowering the rate of nitrogen application to 75% of the recommended dose of nitrogen. However, when nitrogen was applied at 50% of the recommended dose, seed yield decreased significantly as compared to both 100 and 75% levels of recommended dose.

Jobner:

The results presented in Table 3.3.7 reveals that different growth and yield contributing factors were influenced significantly by varying fertility levels. The application of recommended dose of nitrogen(60 Kg N/ha) was significantly better as compared to application of 50% of recommended dose (30 Kg N/ha). However, the differences in seed yield under treatment, 60 Kg N/ha were non-significant as compared to 45 Kg/ha. The highest seed yield of 1333 Kg/ha was recorded for a strain CS-52 compared to 1283 Kg/ha of Kranti, the highest yielding check variety under 60 Kg N/ha.

TABLE 3.3.5. SEED YIELD (Kg/ha) AS INFLUENCED BY VARITIES AND NITROGEN LEVELS ON MUSTARD AT KANPUR DURING 1991-92

VARIETIES	N-LEVELS Kg/ha 100%R.D. (120)	75%R.D. (90)	50%R.D. (60)	CONTROL (0)	MEAN FOR VARIETY
CS-52	2599	1852	1462	1045	1740
KRANTI	1839	2030	1647	1329	1711
ROHINI	1733	1336	1190	979	1310
MEAN	2057	1739	1433	1118	1587

	VARIETY **	NITROGEN **	V x N **
SEM	27	31	54
CD AT 5%	79	92	159
CV%	5.9		

TABLE 3.3.6. COMPARATIVE PERFORMANCE OF MUSTARD VARIETIES UNDER DIFFERENT LEVELS OF NITROGEN APPLICATION AT NAVGAON DURRING 1990-91 AND 1991-92

TREATMENT	SEED YIELD (Kg/ha)
VARITIES	
CS-52	1540
KRANTI	1640
VARUNA	1580
	42
CD AT 5%	NS
CV%	8
NITROGEN LEVELS	
RD. 60KG/ha	1720
	1650
	1390
SEM	42
CD AT 5 %	126
CV %	8

TABLE 3.3.7. SEED YIELD (Kg/ha) AS INFLUENCED BY VARITIES AND NITROG LEVELS ON MUSTARD AT JOBNER DURING 1991-92

VARIETIES	N-LEVELS Kg/ha		
	100%R.D. (60)	75%R.D. (45)	50%R.D. (30)
CS-52	1333	1194	1083
KRANTI	1283	1264	1142
VARUNA	1283	1172	1117
MEAN	1300	1210	1114

SEM		72
CD AT 5%	NS	
CV%		14.9

3.4

Name of the Project : Studies on the source, method and rate of sulphur application in mustard

Objective : To find out the source, method and rate of sulphur application at different locations

Locations : Pantnagar, Kanpur, Bathinda, Faizabad, Navgaon, Khudwani, Kangra, Dholi, Shillongani, Kalyani, Bhubaneswar, Jobner and Diggi (for taramira)

Progress of work :

Kangra:

The seed yield of mustard presented in Table 3.4.1 indicate that the application of sulphur @ 25 Kg/ha through pyrite, one week befoe sowing was proved significantly superior over control, 25 Kg S/ha through gypsum at the time of sowing and 25 Kg S/ha through pyrite at the time of sowing whereas was non-signficant to rest of the treatments. In general, maximum seed yield of 1606 Kg/ha was recorded in under the treatment 25 Kg S/ha through pyrite, one week before sowing. During 1990-91, all the treatments were found to be non-significant.

On the basis of two years average, the highest seed yield of 1158 Kg/ha was observed when 50 Kg S/ha through pyrite at the time of sowing was applied. The average seed yield of both the treatments viz; 50 Kg S/ha through gypsum, one week before sowing and 50 Kg S/ha through pyrite, one week before sowing was observed as 1128 Kg/ha.

Bathinda:

The results presented in Table 3.4.2 reveales that the application of sulphur significantly affect the seed yield of Indian mustard cv. RL-1359 during both the years(1990-91 and 1991-92). The seed yield increased significantly upto 50 Kg/ha during both the years. The different sources and method of sulphur application did not affect the seed yield.

In another experiment, the three different doses of sulphur i.e. 20, 40 and 60 Kg were tested for four different Brassica varieties. The results presented in Table 3.4.3. have shown that seed yield of different Brassica varieties increased significantly upto 40 Kg S/ha. The differences in seed yield among different cultivars and due to interaction effect were non-significant.

Navgaon:

TABLE 3.4.1. EFFECT OF SOURCE ,METHOD AND RATE OF SULFHUR APPLICATION ON SEED YIELD OF MUSTARD AT KANGRA DURING 1DURING 1990-91 &1991-9

TREATMENTS	SEED YIELD (Kg/ha 1990-91	1991-92	MEAN
CONTROL	699	1256	978
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	678	1460	1069
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	711	1606	1159
25Kg/ha SULPUR THROUGH GYPSUM AT THE TIME OF SOWING	615	1380	998
25Kg/ha SULPHUR THROUGH PYRITE AT THE TIME OF SOWING	687	1413	1050
50Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	725	1530	1128
50kg/ha SULPUR THROUGH PYRITE ONE WEEK BEFORE SOWING	697	1558	1128
50Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	716	1513	1115
50kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	779	1536	1158
CD AT 5%	NS	162.14	

TABLE 3.4.2. EFFECT OF SULPHER ON THE YIELD OF MUSTARD AT BATHINDA DURING 1990-91&1991-92

	SEED YIELD (Kg/ha) 1990-91	1991-92	MEAN
CONTROL	1013	665	839
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1170	834	1002
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1160	805	983
25Kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	1152	824	988
25Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	1176	818	997
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1332	947	1139
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1296	943	1119
25Kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	1337	924	1130
25Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	1318	966	1142
CD AT 5%	81	66	
CV%	4.57	5.22	

The results presented in Table 3.4.4 indicated that neither source nor time of application of sulphur had significant influence on the seed yield of mustard. When compared with control or 25 Kg S/ha, application of 50 Kg S/ha significantly increased seed yield of mustard in 1990-91 that too when applied one week before sowing. In 1991-92, application of 50 Kg S/ha seems to be significantly superior when applied one week before sowing only when compared with control. Application of 50 Kg S/ha at sowing was at par with 25 Kg S/ha either at sowing or one week before sowing and even with control.

Pantnagar:

The results presented in Table 3.4.5 reveals that during 1990-91, significantly higher seed yield was recorded when sulphur was applied @ 50 Kg/ha over control but remained at par with 25 Kg S/ha. The effect, sources and methods of applications was recorded non-significant. In case of sources, pyrite gave high seed yield than gypsum. An increase of 19.32 and 12.40 per cent over control was recorded due to pyrite and gypsum respectively. The maximum seed yield was recorded when 50 Kg S/ha was applied, one week before sowing, an increase of 8.25 per cent was recorded when 25 Kg S/ha was applied one week before sowing. The interaction effect between sources, rates and methods of application was recorded significant and significantly higher seed yield was recorded when 50 Kg S/ha was applied, one week before sowing through gypsum followed by 50 Kg S/ha through pyrite applied at the time of sowing.

During 1991-92, the treatment effect was recorded significant in comoparison with control. The sources and methods have non-significant differences. The sources i.e gypsum and pyrite recorded 16.07 and 18.25% higher seed yield respectively over control. Among the methods, application of sulphur at the time of sowing gave slightly higher seed yield. The effect of rate of application was significant and 50 Kg S/ha recorded significantly higher seed yield over 25 Kg S/ha as well as control. The application of 50 Kg S/ha recorded 19.60 per cent higher seed yield over 25 Kg S/ha and 27.62 per cent higher over control. Similarly, 25 Kg S/ha had 6.70 per cent increase over control.

Kanpur:

The results presented in Table 3.4.6.a,b & c shows that the effect of sulphur source, time of application and rate of sulphur application was found non-significant for seed yield. Although, 25 Kg S/ha through pyrite applied before sowing gave 200 Kg/ha more seed yield against control. After the harvest of mustard crop, cowpea as green fodder was taken and its yield was not afffected by the residual effects of source, timings and rate of sulphur application.

TABLE 3.4.3. EFFECT OF DIFFERENT LEVELS OF SULPHUR ON THE SEED YIELD (Kg/ha)OF BRASSICA CULTIVARS AT BHATINDA DURING 1991-92

TREATMENTS	SULPHAR Kg/ha				MEAN
	0	20	40	60	
RLM-514	866	971	1049	1064	987
RLM-619	914	856	1014	946	907
RL-1359	729	795	942	885	838
GSL-1	849	922	996	1011	945
MEAN	815	886	1000	976	

CD AT 5% CULTIVARS	NS
SULPHUR	60
INTERACTION	NS

TABLE 3.4.4. SHOWING THE RESULTS OF SOURCE,RATE AND METHOD OF SULPHUR APPL IN MUSTARD AT NAVGAON DURING (1990-91&1991-92)

	TREATMENTS	(1990-91)	(1991-92)	MEAN
1.	CONTROL	746	1040	893
2.	25 KgS/ha THROUGH GYPSUM ONE WEEK BEFORE SOWING	755	1110	933
3.	25 KgS/ha THROUGH GYPSUM AT THE TIME OF SOWING	773	1070	922
4.	50 KgS/ha THROUGH GYPSUM ONE WEEK BEFORE SOWING	901	1430	1166
5.	50 KgS/ha THROUGH GYPSUM AT THE TIME OF SOWING	821	1350	1086
6.	25 KgS/ha THROUGH PYRITE ONE WEEK BEFORE SOWING	-	1180	590
7.	25 KgS/ha THROUGH PYRITE AT THE TIME OF SOWING	-	1160	580
8.	50 KgS/ha THROUGH PYRITE ONE WEEK BEFORE SOWING	-	1370	685
9.	50 KgS/ha THROUGH PYRITE AT THE TIME OF SOWING	-	1260	630
	SEM	-	110	
	CD AT 5%	93	320	
	CV%	-	18.1	

TABLE 3.4.5. SEED YIELD (Kg/ha) AS AFFECTED BY SOURCES, METHOD AND RATE OF THEIR APPLICATION AT PANTNAGAR DURING 1991-92

TREATMENT	SEED YIELD (Kg/ha)
CONTROL	1238
CONTROL VS REST TREATMENT	1450
SOURCES	
i) GYPSUM	1437
ii) PYRITE	1464
METHOD OF APPLICATION	
i) ONE WEEK BEFORE SOWING	1423
ii) AT THE TIME OF SOWING	1478
RATE OF APPLICATION(Kg S/ha)	
i) 25	1321
ii) 50	1580
SEM	44
CD AT 5%	132
CV%	17.55

TABLE 3.4.6a. SEED YIELD OF MUSTARD GREEN FODDER AND DRYMATTER YIELD OF COWPEA AT KANPUR DURING 1991-92

SN. TREATMENTS	MUSTARD SEED YIELD (Kg/ha) 1990-91	G.F.COWPEA YIELD(Kg/ha	DRY MATTER AT HARVEST OF COWPEA (Kg/ha)
1. PYRITExBEFORE SOWING x '25 Kg S/h.	3016	24200	1787
2. PY.x B.S.x 50 KgS/h.	2921	26000	2208
3. PY.x SOWING TIME x 25 kg S/h	2706	24400	1825
4. PY.xS.T.x 50kg S/ha	2841	27200	1956
5. GYPSUM xB.S.x50kg S/ha	2643	25800	1864
6. GY.x B.S.x50kg S/ha	2853	25400	2303
7. GY.x S.T.x25kg S/ha	2563	25300	1878
8. GY.x S.T.x50kg S/ha	2738	24300	1943
9. CONTROL	2754	25300	2346
MEAN	2782		
SEM	134		
C.D..(5CD AT 5%	NS.		
C.V.%	9.6		
	1991-92		
1. PYRITE x BEFORE SOWING x 25 Kg S/ha	1799	34278	6291
2. PY.x B.S.50 kg S/ha	1667	34954	6511
3. PY.xSOWING TIME x25kg/ S/ha	1808	36497	6624
4. PY.xS.T.50Kg S/ha	1772	35397	6372
5. GYPSUM xB.S.x25kg S/ha	2328	36072	6842
6. GY.xB.S.x 50kg S/ha	1817	35763	6413
7. GY.xS.T.x25kg S/ha	1931	35243	6922
8. GY.x S.T.x50kg S/ha	2019	34047	6432
9. ELEMENTAL xB.S.x25kg S/ha SULPHUR.	1861	34278	6465
10.ES.xB.S.50kg S/ha	1817	31481	6238
11.ES xS.T.25kg S/ha	1896	35590	6388
12.ES xS.T.50kg S/ha	1896	33989	6036
13.SINGLE SUPER x B.S.x 25kg PHOSPHATE S/ha	1975	35590	6855
14.SSP x B.S.x50kg S/ha	1658	37654	7112
15.SSP x S.T.x25kg S/ha	1764	36844	6407
16.SSP x S.T.x50kg S/ha	1658	35783	6514
17.CONTROL	1922	34432	6750
G.M.	1857	35231	6543
SEM (SOURCES)	48	560	151
**CD (SOURCES)	134*	1594*	-
SEM (RATE OF SULPHUR)	33	396	107
SEM(TIME OF APPLICATION)	33	396	107
**CD TIME OF APPLICATION-CATION	00**	-	-
SEM(SOURCES x RATE)	67	792	213
SEM(SOURCES x TIME OF APPLICATION	67	792	213
SEM(RATE XTIME)	48	560	151
CD RATE XTIME	134*	-	-
SEM+(SOURCES x TIME x RATE)	95	1120	302
CV %	10.2	6.4	9.2

TABLE 3.4.6B: EFFECT OF SOURCES OF SULPHUR ON
MUSTARD SEED YIELD (Kg/ha)
AT KANPUR DURING 1991-92

SOUCES	SEED YIELD
PYRITE	1762
GYPSUM	2024
ELEMENTAL SULPHUR	1868
SSP	1764
CD AT 5%	134

TABLE 3.4.6C. EFFECT OF RATE OF SULPHUR APPLICATION AND
RATE x TIME OF APPLICATION ON SEED YIELD
OF MUSTARD(Kg/ha)AT KANPUR DURING 1991-92

RATE OF SULPHUR (Kg/ha)	TIME OF APPLICATION BEFORE SOWING	SOWING TIME	MEAN
25	1990	1849	1919
50	1739	1835	1787
MEAN	1864	1842	
CD AT ** FOR RATE		96	
CD AT 55		134	

During the year 1991-92, sources and date of sulphur application were found highly significant affect on seed yield of mustard. The interactaon effect, Rate x Time of application was also found significant(5%) on seed yield. Gypsum gave highly significant seed yield (2024 Kg/ha) over other sources and other sources i.e. Pyrite, elemental sulphur and SSP were recorded at par in seed yield, 25 Kg S/ha x before sowing application recorded significantly higher seed yield than other combinations.

After the harvest of mustard crop cowpea as green fodder was green fodder recorded significantly (only 51%) higher over the control. The maximum green fodder yield was recorded with single superphosphte (36468 Kg/ha) against control (34432 Kg/ha). Dry matter control was not affected by the various treatments.

Shillongani:

The results presented in Table 3.4.7 reveals that gypsum was found to be the better source of sulphur as compared to pyrite. There was no significant difference in seed yield of mustard due to increase of sulphur level from 25 to 50 Kg S/ha. Application of gypsum @ 25 Kg S/ha in addition to recommended dose of N,P and K one week before sowing resulted in an increase of more than 200 Kg seed yield Kg/ha over no applicaation of sulphur.

Dholi:

The results presented in Table 3.4.8 reveals that although there was an increase in the seed yield of mustard due to the application of sulphur to the crop. However, the effects did not attain the level of statistical significance. The effect due to source, methods and rate of application were non-significant.

Kalyani:

The results presented in Table 3.4.9 indicated that the seed yield was higher when sulphur was applied 7 days before sowing either as gypsum or pyrite. Higher seed yield was recorded when sulphur through gypsum was applied 7 days before sowing. There was no difference in seed yield betaween 25 and 50 Kg S/ha through gypsum. When sulphur was applied 7 days before sowing through pyrite, the seed yield was higher than application at sowing. Higher rate of application has no significant effect. Application of sulphur significantly increased yield over control.

Jobner:

The results presented in Table 3.4.10 reveals that the application of sulphur significantly increased all the growth, yield contributing characters and yield of taramira Taramira as compared to control (no sulphur). The application of 50 kg S/HA gave the highest seed yield per hectare as compared to control.

TABLE 3.4.7. PERFORMANCE OF MUSTARD C.V.TM 2 AS INFLUENCED BY VARIOUS SOURCES RATE AND METHODS OF APPLICATION OF SULPHUR AT SHILLIONGANI DURING 1991-92

Treatment	SEED YIELD (Kg/ha)
1 25Kg S THROUGH GYPSUM APPLIED 1 WBS*	682
2 25Kg S THROUGH PYRITE APPPLIED 1 WBS	498
3 25Kg S THROUGH GYPSUM APPLIED AT SOWING	630
4 25Kg S THROUGH PYRITE APPPLIED AT SOWING	504
5 25Kg S THROUGH GYPSUM APPLIED 1 WBS	725
6 25Kg S THROUGH PYRITE APPPLIED 1 WBS	556
7 25Kg S THROUGH GYPSUM APPLIED AT SOWING	756
8 25Kg S THROUGH PYRITE APPPLIED AT SOWING	688
9 CONTROL	475
SEM	64.2
CD AT 5%	191.36
CV%	18.03

*WBS -WEEK BEFORE SOWING

TABLE 3.4.8. EFFECT OF SULPHER ON THE YIELD OF MUSTARD AT DHOLI DURING 1991-92

TREATMENTS	SEED YIELD (Kg/ha)
CONTROL	1033
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1078
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1111
25Kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	1144
25Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	1133
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1067
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1111
25Kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	1044
25Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	1133
SEM	49
CD AT 5%	NS
CV%	4.64

TABLE 3.4.9. EFFECT OF DIFFERENT SOURCES, METHOD OF APPLICATION AND RATE O SULPHUR APPLICATION ON MUSTARD AT KALYANI DURING 1991-92

TREATMENTS		SEED YIELD (Kg/ha)
1.	CONTROL	1065
2.	25 Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1550
3.	25 Kg/ha SULPHUR THROUGH GYPSUM AT SOWING	1496
4.	25 Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1343
5.	25 Kg/ha SULPHUR THROUGH PYRITE AT SOWING	1275
6.	50 Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1510
7.	50 Kg/ha SULPHUR THROUGH GYPSUM AT SOWING	1360
8.	50 Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1320
9.	50 Kg/ha SULPHUR THROUGH PYRITE AT SOWING	1223
	SEM	13.66
	CD AT 5%	36.97

TABLE 3.4.10. EFFECT OF SULPHER ON THE YIELD OF TARAMIRA AT JOBNER DURING 1991-92

TREATMENTS	SEED YIELD (Kg/ha)
CONTROL	1183
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1627
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1696
25Kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	1645
25Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	1668
25Kg/ha SULPHUR THROUGH PYRITE ONE WEEK BEFORE SOWING	1632
25Kg/ha SULPHUR THROUGH GYPSUM ONE WEEK BEFORE SOWING	1655
25Kg/ha SULPUR THROUGH PYRITE AT THE TIME OF SOWING	1686
25Kg/ha SULPHUR THROUGH GYPSUM AT THE TIME OF SOWING	1690
SEM	120
CD AT 5 %	361
CV%	8.65

3.5

Name of the Project : Cropping sequence trial taking Toria as a catch crop

Objectives : To see the effect of cropping sequences on toria

Locations : Bathinda, Ludhiana, Sriganganagar, Morena, Pantnagar, Kangpur

Progress of work :

Bathinda:

On the basis of two years data (1990-91 and 1991-92), the highest gross income of Rs. 16147/ha was recorded for the treatment toria + gobhi sarson intercrop followed by toria-wheat sequence (Table 3.5.1). However, on the basis of only one year data, the highest gross income of Rs. 18296/- was recorded for toria followed by sunflower sequence.

Ludhiana:

It was observed that maximum gross income of Rs. 22492/ha was obtained by toria followed by sunflower (Table 3.5.2). The next best crop sequence was found, toria followed by transplanted gobhi sarson, where, a gross income of Rs. 22467/ha which was almost equally best rotation. These sequences were closely followed by toria-wheat rotation (Rs. 20158/ha). There income was to give an extra gain of Rs. 9479, 9454 and 7145, respectively. Toria followed by mustard sequence gave lower income of Rs. 14614/ha only.

Morena:

The data presented in Table 3.5.3 reveals that on the basis of two years average, during Kharif' black gram recorded an average yield of 768 Kg/ha followed by 608.5 Kg/ha. Fellow-toria/mustard sequence recorded the average seed yield of 2545 Kg/ha followed by fellow - toria-wheat sequence. The highest average net return of Rs.19821 per ha was recorded where intercropping of toria + gobhi sarson sequence was followed. The minimum average net return of Rs. 12471/- per ha was recorded for the crop sequence green gram-toria-wheat.

Sriganganagar:

Due to late harvesting of toria succeeding crops of wheat and mustard could not be taken.

Pantnagar:

The results presented in Table 3.5.4 reveals that on the basis of two years average, the highest total net return of

TABLE 3.5.1 SEED YIELD OF TORIA AND OTHER CROPS UNDER DIFFERENT SEQUENCES AT EHATINDA DURING 1990-91 AND 1991-92

TREATMENTS	SEED YIELD (Kg/ha)						GROSS INCOME (Rs/ha)						TOTAL GROSS INCOME (Rs/ha)		
	TORIA			OTHER CROPS											
	90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN
TORIA FB	1510	728	1119	2970	4095	3532	7500	3806	5653	6683	11466	9074	14233	15272	14752
TORIA FB GOBHI SARSON	1510	728	1119	350	631	490	7550	3806	5678	2100	4228	3164	9650	8034	8842
TORIA FB	1510	728	1119	200	325	262	7550	3806	5678	1200	2178	1689	8750	5984	7367
TORIA FB	1510	728	1119		207	207	6550	3808	5178	-	14490	14490	-	10298	10298
TORIA+ G INTERCROP	950	285	618	1880	2204	2042	4750	1496	3123	11280	14769	13024.5	16030	16265	16147
GOBHI SA	-	-	-	2260	2333	2296	-	-	-	13560	15631	14595.5	13560	15631	14595

PRICES OF 1990-91 Rs./q. !WHEAT 225 ,RAYA AND GOBHI SARSON -600, TORIA -500
FB. DENOTES FOLLOWED BY. *CROP FAILED .
PRICES OFWHEAT 280, RAYA AND GOBHI SARSON 670,TORIA 525,SUNFLOWER 700

TABLE 3.5.2. SEED YIELD OF TORIA AND OTHER CROPS UNDER DIFFERENT SEQUENCES LUDHIANA DURING 1991-92

TREATMENTS	SEED YIELD (Kg/ha)						GROSS INCOME (Rs/ha)					
	TORIA			OTHER CROPS		MEAN	TORIA			OTHER CROPS		
	90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN
GOBHI SARSON (GS)	-	-	-	2072	2002	2037	-	-	-	12432	13013	12722.5
TORIA+GS(INTERCROP)	1736	1510	1623	1488	1520	1506	8080	9000	8570	8994	9880	9437
TORIA FOLLOWED BY GS(TRANSPLANTING)	1586	1840	1713	1875	1750	1812	7930	11040	9485	11250	11427	11338.5
TORIA FOLLOWED BY WHEAT	1678	1836	1757	3148	3265	3206	8390	11016	9703	7083	9142	8112
TORIA FOLLOWED BY RAYA	1678	1829	1753	747	564	655	8390	10974	9682	4482	3666	4074
TORIA FOLLOWED BY SUNFLOWER	1640	1835	1742	-	1531	1531	8245	11010	9627.	-	11482	

PRICE (Rs/q):TORIA=600/-,RAYA AND GOBHI SARSON=650/
SUNFLOWER=750/-AND WHEAT=280/-

Cont.

cont'd 3.5.3

SN	CROP SEQUENCE	GROSS RETURNS (Rs/ha) TORIA MUSTARD			WHEAT G.SARSOON			TOTAL			CULTIVATION (Rs/ha)		RETURNS CULTIVA (RS/ha)
		90-91	91-92	MEAN	90-91	91-92	MEAN	90-91	91-92	MEAN	91-92	90-91	91-92
1	GREAMGRAM-TORIA WHEAT	6681	11025	8853	9127	14819	11973	18736	30746	24741	14560	10261	16166
2	BLACKGRAM-TORIA-WHEAT	8010	11076	9043	9472	14560	12016	21011	32030	26520	14323	12516	17707
3	COWPEA(F)-TORIA-WHEAT	8620	11367	9993	86807	14020	50413.5	20207	32049	26128	13933	12277	18116
4	GUAR(FODDER)-TORIA-WHEAT	10300	13208	11754	9601	14415	12008	22429	31203	26816	13820	13939	17383
5	FALLOW-TORIA-WHEAT	12256	16100	14178	9128	14487	11807.5	21374	30587	25980	11462	14699	19125
6	FALLOW-MUSTARD(S.CHECK)	16539	18068	17303	-	-	-	16539	18068	17303	6049	12924	12019
7	FALLOW-TORIA+GOBHI SARSON INTER CROPPING	-	9141	9141	-	16898	16898	-	26039	26039	6218	-	19821

TABLE 3.5.3. YIELD AND ECONOMICS OF DIFFERENT CROP SEQUENCES AT MORENA DURING (1990-91&91-92)

SN	CROP SEQUENCE	SEED YIELD (Kg/ha) KHARIF 90-91	KHARIF 91-92	KHARIF MEAN	TORIA/ MUSTARD 90-91	TORIA/ MUSTARD 91-92	TORIA/ MUSTARD MEAN	WHEAT/ G.SARSON 90-91	WHEAT/ G.SARSON 91-92	WHEAT/ G.SARSON MEAN	STRAW /STOVER YIELD KHARIF 91-92	TORIA MUSTARD 91-92	WHEAT/G SARSON 91-92
1	GREAMGRAM-TORIA WHEAT	410	807	608	1095	1575	1335	2615	3958	3286	1009	6300	3927
2	BLACKGRAM-TORIA-WHEAT	615	921	768	1290	1701	1495	2696	3880	3288	1151	6605	3894
3	COWPEA(F)-TORIA-WHEAT	12775	26650	19712	1565	1621	1593	2503	3736	3119	-	6623	3750
4	GUAR(FODDER)-TORIA-WHEAT	12639	14323	13481	1686	1887	1786	2736	3840	3288	-	7550	3861
5	FALLOW-TORIA-WHEAT	-	-	-	2004	2303	2153	2540	3857	3198	-	9071	3889
6	FALLOW-MUSTARD(S.CHECK)	-	-	-	2615	2475	2545	-	-	-	-	9899	-
7	FALLOW-TORIA+GOBHI SARSON INTER CROPPING	-	-	-	-	1303	1303	-	2297	2297	-	5349	10064
	CD AT 5%					425		-	551				
	CV%					15.5		-	10.1				

RATE OF PRODUCE (1991-92)	GREEN GRAM	BLACK GRAM	COWPEA	GUAR	TORIA	MUSTARD
SEED(RS/QUINTAT)	545=00	545=00			640=00	670=00
STRAW/GREEN FODDER/STOVER (RS/Q)	50=00	50=00	25=00	25=00	15=00	15=00

7 FALLOW-TORIA+GOBHI SARSON 16538 18044 18144 - 16898 16898 [illegible] 26030 26030 6218 12924 18021

TABLE:3.5.4.SEED YIELD AND ECONOMICS OF DIFFERENT CROP ROTATIONS
AT PANTNAGAR DURRING 1990-91 AND 1991-92

SN	ROTATION	YIELD(KG/ha) 90-91	91-92	MEAN	NET RETURNS(Rs/ha) 90-91	91-92	MEAN	TOTAL RS/ha 90-91	91-92	MEAN
1	GREEN GRAM-	1018	1233	1125	1758	4375	3066			
	TORIA-	2300	1619	1959	11595	8087	9841			
	WHEAT	1902	2896	2399	668	3396	2032	14021	15858	14939.5
2	BLACK GRAM-	911	1144	1027	1692	3863	2777			
	TORIA-	2268	1606	1937	11373	7933	9653			
	WHEAT	2027	2732	2379	950	2945	1947	14015	14741	14378
3	FODDER(COWPEA)	40922	48500	44711	3003	5082	4042			
	TORIA	2356	1600	1978	11901	7893	9897			
	WHEAT	1944	2772	2358	763	3055	1909	15667	16030	15848.5
4	GREEN MANURING-									
	TORIA	2258	1862	2060	11313	9648	10480.5			
	WHEAT	1872	3544	2708	601	5178	2889	11914	14826	13370
5	FALLOW-									
	TORIA	2203	1570	1886	10983	7692	9337			
	WHEAT	1977	2584	2280	839	2538	1688		10230	10230
6	MAIZE	3436	3318	3377	2485	3375	2930			
	TORIA	2225	1508	1866	11115	7277	9196			
	WHEAT	1855	2610	2232	837	2609	1723		13261	13261
7	RICE	4800	4915	4857	5203	6228	5715			
	WHEAT	3655	4381	4018	4612	7180	5896		13408	13408
8	MAIZE	-	3256	1628	-	3232	1616			
	TORIA+GS.	-	640	320	-					
		-	1568	784	-	11310	5655		14542	14542

SUPPORT Rs/q DURING 1990-91 WHEAT 225,TORIA 600,MABLACK GRAM 395,GREEN GRAM 360.
COST OF CULTIVATION Rs/ha WHEAT:3611,TORIA 2235,MAIZ 2840,GRTORIA SARSON 3168,
SUPPORT Rs/ha DURING 1991-92 WHEAT 275,TORIA 670,MMAIZE 210.PADY
COWPEA FODDER 15 TORIA +GOBHI SARSON 670.
COST OF CULTIVATION Rs/ha WHEAT AFTER TORIA 4568,WHEAT AFTER RICE 4868,TORIA 2827,
PADDY 5076,BLACKGRAM AND GREENGRAM 2372,FODDER COWPEA 2193,TORIA+GOBHI SARSON 3484

Rs. 15848/ha was recorded for the crop sequence Fodder (Cowpea)-Toria-Wheat followed by Green gram-Toria-Wheat sequences (14939/ha).

Kanpur:

The perusal of Table 3.5.5 indicated highly significant differences were recorded due to different crop sequences. The highest net returns were obtained from Maize - Toria - Wheat followed by Green gram - Toria - Wheat crop sequences. However, the highest cost benefit ratio (CBR) 3.25 was recorded from Fallow - Toria - Wheat followed by Maize - toria - wheat crop sequences.

TABLE 3.5.5. YIELD AND ECONOMICS OF CROP SEQUENCE TRIAL AT KANPUR DURING 1991-92

SN.	CROP SEQUENCE	YIELD(Kg/ha) SEED	BY PRODUCT g.f.	INCOME(Rs/ha) GROSS	NET	C.B.R.
1	GREEN GRAM-	309	9506			
	TORIA-	2064	5328	49402	33902	3.00
	WHEAT	4422	7830			
2	BLACK GRAM-	222	7253			
	TORIA-	2060	6296	47477	30477	2.79
	WHEAT	4398	7022			
3	LOBIA(g.f.)	-	34568			
	TORIA	1635	5552	47543	31043	2.88
	WHEAT	4496	7541			
4	GREEN MANURING	-	-			
	TORIA	1879	6042	43627	27837	2.76
	WHEAT	4477	7531			
5	MAIZE	2472	27160			
	TORIA	1840	6277	53721	36021	3.04
	WHEAT	4477	6852			
6	FALLOW-	-	-			
	TORIA	1593	5120	40472	28022	3.25
	WHEAT	4684	7415			
G.M.				47041		
S.EM				1719		
CD AT 5%				5179		
CV%				7.3%		

3.6

Name of the Project : To study the efficacy of seed drill in mustard

Objectives : To find out the suitable seed drill for the sowing of Rapeseed-Mustard

Locations : Morena

Progress of work :

The results presented in Table 3.6.1a reveals that highest seed yield of 1628 Kg/ha was recorded with tractor drawn seed drill sowing followed by conventional method of mustard sowing i.e. Desi plough attached with metal funnel (1409 Kg/ha). While minimum mustard seed yield of 1014 Kg/ha was obtained with sowing of seed cum fertilizer drill (CIAE, Bhopal). For obtaining the maximum seed yield of mustard, first preference is to be given for tractor drawn seed drill followed by Desi plough attached funnel in light soils of the area. The ancillary observation reported have been presented in Table 3.6.1b.

Suggestions for improvement:

Width of seed drill should be at par with that the tine of tractor seed drill or desi plough so that proper opening of furrows and sowing of seed may be done at proper depth.

There is narrow gap between seed and fertilizer placement which required improvement.

Caliberation of seed distriution is also not working efficiently which resulted into irregular seed distribution.

At corners, there is regular falling of seed due to driven wheels movement. It resulted more plant population at the corner of the field.

TADLE 3.6.1A SEED YIELD AS INFLUENCED BY DIFFERENT SOWINGS THROUGH SEED DRILL AT MORENA DURING 1991-92

SN.	TREATMENTS	SEED YIELD (Kg/ha)	NO.OF PLANTS (Kg/ha)
1	TRACTOR DROWN SEED DRILL	1628	343248
2	SEED-CUM FERTILIZER DRILL	1014	84296
3	DESIPLOUGH	1409	247473

TABLE 3.6.1B OBSERVATION AND OTHER PARTICULARS UNDER DIFFERENT TREATMENTS AT MORENA DURING 1991-92

PARTICULARS	TRACTER DRAN SEED DRILL	BULLOCK DRIVEN CUM-FERTILIZER	CONVENTIONAL DESIPLOUGH
SEED RATE(Kg/ha)	7.500	3.000	5.500
SEED DISTRIBUTION	UNIFORM & THICK	IRREQULAR & TUNIFORM	
PLANT TO PLANT SPACING	9-10cm	25-30cm/A	10-15cm
DEPATH OF SOWING	2.5cm	5-6cm(UNDISERAB	3-4cm
(SOILLATERON)SEED	3.0cm		
GERMINATION PERCENTAGE	60-70%	25-30%	60-70%
FINAL PLANT STARD/NET POD	1246	306	898
CROP YIELD (Kg/ha)	1628	1014	1409
CAPACITY OF MACHINE	1.0	0.50	0.20
POWER REQUIREMENT	TRACTOR 35 HP WITH ONE DRIVER AND ONE HELPER	BULLOCK PAIR(NO ONE HALI AND ON HELPER	BULLOCK PAIR(NORMAL) ONE HALI AND ONE TRAINER ON FOR SOWIN
COST OF OPERALION(Rs/ha)	Rs.640@Rs.80/ Hrs for Hrs	Rs.300@150/DAYS 2DAYS(16 Hrs)	Rs.600 @ Rs.120/DAYS FOR 5 DAYS

3.7

Name of the Project : Effect of dates of sowing and row spacing on mustard under late planting conditions

Objectives : To find out the appropriate date of sowing and row spacing of mustard under late planting conditions

Locations : Pantnagar, Ludhiana, Bathinda, Kanpur, Morena and Bhubaneswar

Progres of work :

Bathinda:

The perusal of data on seed yield presented in Table 3.7.1 indicates that each delay in sowing after 25th October resulted significant reduction in seed yield. Similarly, closer row spacing of 15 cm produced significantly higher seed yield and it decreased significantly with increasing space between the rows. The response to nitrogen was observed upto 125 Kg/ha.

Ludhiana:

To study the effect of row spacing on mustard, a trial was laid-out using mustard variety RLM-619. The data reported in Table 3.7.2 reveals that sowing on October 25th recorded significantly higher seed yield than other delayed sowings tried in the experiment. The 20 cm row spacing gave the maximum seed yield but not significantly different than 30 cm and 40 cm row spacings. The Oct.25 sowings at 40 cm row spacing gave the highest seed yield(1644 Kg/ha) which was significantly better than other combinations. The next best combination was Oct. 25th sowing at 30 cm(1493 Kg/ha) and followed by sowing on Nov.9th at 30 cm(1458 Kg/ha).

Pantnagar:

The experiment was conducted with an objective to find out optimum row spacings under late sowing conditions. The sowing was done in spliit- plot design taking 4 dateas(25 Oct., 9 Nov., 25 Nov. and 9 Dec.) as main plot treatment and 4 row spacings levels(20, 30 and 40 cm) as sub-plot treatment. Plant to plant spacing of 15 cm was maintained by thinning done 15 days after sowing. An uniform basal applicartion of 60 Kg N alongwith 40 Kg P205 and 20 Kg K20/ha was made as basal and remaining 60 Kg N/ha was top dressed after first irrigation in each date of sowing.

The spacing dates differed significantly among themselves and a decreasing trend was observed with successive delay in sowing after October 25 (Table 3.7.3). The effect of row

TABLE 3.7.1. EFFECT OF DATE OF SOWING, ROW SPACING AND NITROGEN ON THE SEED YIELD OF INDIAN MUSTARD AT BHATINDA DURING 1991-92

TREATMENTS	SEED YIELD (kg/ha)
DATE OF SOWING	
25 OCT.	1431
15 NOV.	1083
5 DEC.	933
CD AT 5%	137
ROW SPACING	
15cm	1315
22.5cm	1139
30cm	993
CD AT 5%	61
NITROGEN(Kg/ha)	
75	961
100	1105
125	1257
150	1272
CD AT 5%	70

TABLE 3.7.1. EFFECT OF ROW SPACINGS ON SEED YIELD ON MUSTARD UNDER LATE PLANTING CONDITIONS AT LUDHIANA DURING 1991-92

TREATMENT	SEED YIELD Kg/ha			MEAN
	20cm	30cm	40cm	
OCTOBER 25	1296	1493	1644	1478
NOVEMBER 9	1296	1458	1319	1358
NOVEMBER 24	677	677	469	608
DECEMBER 9	220	197	182	200
MEAN	922	907	904	-

CD AT 5% SOWING DATE(M):39 Kg/ha
SPACINGS (S):NS
INTERACTION(MxS):70 Kg/ha

spacing was also recorded significant and significantly higher seed yield was recorded when sowing was done in 20 cm apart rows over other row spacings. The interaction effect between dates of sowing and row spacings was recorded to be non-significant. However, higher seed yield was recorded when sowing was done in 30 cm apart rows on October 25 but in later dateas, 20 cm gave higher seed yield in comparison with 30 cm row spacing level.

Kanpur:

Sowing dates recorded highly significant differences on the seed yield of mustard among themselves (Table 3.7.4). It is interesting to note that the reduction over first date of sowing (25th October) were recorded 14.0, 16.9 and 26.6 Kg/day with November 9, 24 and December 9, respectively.

Kanpur:

The results presented in Table 3.7.3 reveals that the sowing dates recorded highly significant differences on seed yield of mustard. Row spacing and interaction of dates x row spacings were found non-significant on seed yield of mustard. In all sowing dates gave highly significant differences among themselves. It is interesting to note that the reduction over first date of sowing(25th Oct.) were recorded as 14.0, 16.9 and 26.6 in Kg/day with Nov.9, 24 and Dec.9, 91, respectively. It was recorded that the thousand seed weight in all the sowing dates was same. However, the harvest index is very low in last date of sowing(10.7).

Sriganganagar:

The results presented in Table 3.7.5 reveals that the planting of mustard crop around 25th Oct. recorded significantly higher seed yield over all the three dates of sowing(1641.6 Kg/ha). As regards, row spacing 20, 30 and 40 cm were statistically at par.

Bhubaneswar:

The results presented in Table 3.7.6 reveals that the sowing dates did not differed much. The higher seed yield of 606 Kg/ha was recorded when the sowing was done on Oct.5th following spacing of 25 cm apart between rows for toria variety, M-27. The lowest seed yield was recorded when delayed sowing (5th Nov.) was done following a spacing of 30 cm apart between rows. Interestingly, very high harvest index of 0.81 and 0.78 was recorded under 5th Oct. sowing following the spacings of 20 cm and 30 cm between rows. The thousand weed weight varied from 2.65 to 3.06 g.

TABLE 3.7.3. SEED YIELD (Kg/ha)OF MUSTARD AS INFLUENCED BY DATE OF SOWING AND ROW SPACINGS LEVELS AT PANTNAGAR DURING 1991-92

DATES OF SOWING	ROW SPACING LEVELS (cm)			MEAN
	20	30	40	
OCTOBER 25	1324	1340	1241	1302
NOVEMBER 9	1059	971	907	979
NOVEMBER 25	814	705	598	706
DECEMBER 9	392	298	257	336
MEAN	897	828	791	

	SEM	CD AT 5%	CV%
DATE OF SOWING(D)	44	154	17.26
ROW SPACING(R)	22	67	10.07
TO COMPARE TWO R OR DIFFERENT D LEVELS	45	NS	
TO COMPARE TWO D OR DIFFERENT R LEVELS	72	NS	

TABLE 3.7.4. SEED YIELD Kg/ha AS INFLUENCED BY SOWING DATES AND ROW SPACINGS ON MUSTARD AT KANPUR DURING 1991-92

DATES OF SOWING	ROW SPACING LEVELS (cm)			MEAN	REQUCATION IN Kg/ DAY OVER Ist DATE OF SOWING
	20	30	40		
OCTOBER 25	2122	2145	2122	2130	-
NOVEMBER 9	1890	1883	1968	1914	14.0
NOVEMBER 24	1628	1535	1682	1615	16.9
DECEMBER 9	1011	672	887	923	26.6
MEAN	1662	1609	1665		

GM	1646
S.EM+(DATE)	36Kg/ha
**CD(DATE)	114 Kg/ha HIGHLY SIGNIFICANT
S.EM(ROW)	39Kg/ha N.S.
S.EM AT THE SAME LEVEL OF ROW	8Kg/ha N.S.
CV%	73Kg/ha N.S.

TABLE 3.7.5. EFFECT OF DATE OF SOWING AND ROW SPACING AT SRIGANGANAR SRIGANGANAGAR

TREATMENT		SEED YIELD (Kg/ha)
D1	25 OCTOBER	1642
D2	9 NOVEMBER	1069
D3	25 NOVEMBER	597
D4	9 DECEMBER	314
SEM		33.53
CD AT 5%		107.26
S1	20cm	960
S2	30cm	902
S3	40cm	852
SEM		35.35
CD AT 5%		N.S.

TABLE 3.7.6. EFFECT OF DATES OF SOWING AND SPACING ON RAPESEED (RAINFED) AT BHUNANESHUAR DURING 1991-92

SN.	TREATMENTS	SEED YIELD (Kg/ha)	1000 SEEDS WEIGHTS	HARVEST INDEX
1	5 OCTOBER WITH 20cm SPACINGS	510	2.7	0.8
2	5 OCTOBER WITH 25cm SPACINGS	606	2.8	0.7
3	5 OCTOBER WITH 30cm SPACINGS	460	2.9	0.8
4	15 OCTOBER WITH 20cm SPACINGS	520	2.7	0.5
5	15 OCTOBWER WITH 25cm SPACINGS	528	2.8	0.5
6	15 OCTOBWER WITH 30cm SPACINGS	500	2.9	0.7
7	25 OCTOBWER WITH 20cm SPACINGS	459	2.7	0.5
8	25 OCTOBWER WITH 25cm SPACINGS	553	2.9	0.5
9	25 OCTOBER WITH 30cm SPACINGS	478	2.7	0.5
10	5 NOV. WITH 20cm SPACINGS	470	3.0	0.5
11	5 NOV. WITH 25cm SPACINGS	250	2.9	0.5
12	5 NOV. WITH 30cm SPACINGS	134	3.1	0.5

3.8 Station trial:

The major experiments/trials conducted at different centres during the year under report have been discussed as follows:

Pantnagar

Defoliation studies in mustard.

The experiment was conducted at Pantnagar to see the effect or defoliation on seed yield. Sowing was done in 30 cm Per eoqa on October 15th, 1991 in RBD taking six treatments (Table 3.8). The plant to plant spacing of 15 cm was maintained by thinning done 15 days after sowing. Uniform basal application of 60 Kg N alongwith 40 Kg P2 O5 and 20 Kg K2O/ha was made and remaining 60 Kg N/ha was top-dressed after first irrigation.

The effect of different difoliation treatments was recorded to be non-significant. However, highest seed yield was recorded in control in comparison with the treatment where defoliation was done. Among the defoliation treatments, higher seed yield was recorded when defoliation of all tertiary branches was done in comparison with other treatments.

Performance of new Brassica entry at different row spacing levels:

The experiment was conducted with an objective to find out the optimum row spacing for different Brassica entries to get the higher yield. Sowing was done on 15 Oct.1991 in RBD taking 9 treatments combinations (Table 3.9). Plant to plant spacing of 15 cm was maintained by thinning done 15 days after sowing. A uniform basal application of 45 Kg N/ha alongwith 40 Kg P2O5 and 20 Kg K2O/ha was made and remaining 45 Kg N/ha was top-dressed after first irrigation and 25 days after sowing.

Mustard variety Krishna recorded significantly higher seed yield over new mustard entry PPMS but remained at par with toria(Variety PT-303). Similarly, toria(PT-303) yielded at par with mustard(PPMS). The effect of row spacing was recorded to be non-significant. However, higher seed yield was recorded at 30 cm row spacing level. The interaction effect was recorded to be non-significant.

Performance of Brassica species under different sowing dates:

The experiment was conducted with an objective to find out the optimum time of sowing for Brassica species. Sowing was done in split plot design taking four dates of sowing(10, 20, 30 Oct. and 9 Nov.) as main plot treatment and Brassica species (B.juncea, var. Krishna; B.campestris var.yellow sarson, PYS-841 and B.napus var. GSL-1) as sub plot treatment. A uniform basal application of 60 Kg N alongwith

TABLE 3.8 SEED YIELD (Kg/ha) AS INFLUENCED BY DEFOLIATION AT PANTNAGAR DURING 1991-92

SN.	TREATMENTS	YIELD (Kg/ha)
1.	CONTROL	1755
2.	DEFOLIATION OF 50%LOWER LEAVES AT ROSETTE STAGE	1614
3.	DEEFOLIATION OF ALL TERTIARY BRANCHES	1691
4.	DEFOLIATION OF ALL SECONDARY BRANCHES	1606
5.	DEFOLIATION OF 50% LOWER LEAVES AT 75% SILIQUAE FORMATION	1598
6.	COMPLETE DEFOLIATION OF LEAVES AT 75% SILIQUAE FORMATION	1581
SEM +		77
C.D. AT 5%		NS
C.V. %		8.13

TABLE 3.9 SEED YIELD (Kg/ha) OF ENTRIES AS INFLUENCED BY ROW SPACINGS AT FANTNAGAR DURING 1991-92

ENTRIES	ROW SPACING(cm)			MEAN
	20	30	40	
PPMS(MUSTARD)	1390	1433	1272	1365
KRISHNA(MUSTARD)	1597	1663	1735	1665
PT-303(TOPIA)	1429	1639	1543	1537
MEAN	1472	1578	1516	

	SEM	CD AT 5%	CV%
BRASSICA SPECIES(S)	67	221	13.38
ROW SPACING(R)	67	NS	-
BRASSICA SPECIESxROW SPACING	117	NS	-

40 Kg P205 and 20 Kg K20/ha was made and remained 60 Kg N/ha was top dressed at flowering stage in all the dates of sowing (Table 3.10).
The Brassica species also differed significantly among themselves and B.juncea recorded significantly higher seed yield in comparison with B.napus also gave significantly more seed yield over B.campestris var. Yellow sarson. The interaction between dates of sowing and species was non-significant. However, Brassica juncea recorded higher seed yield when sown on 10th October.

Hisar:

Performance of RH-8602 under high fertility and no thinning conditions:

The tested dose of nitrogen i.e 80 Kg/ha and 120 Kg/ha did not response significantly (Table 3.11). The tested variety RH-8602 recorded highest seed yield of 1211 Kg/ha under no thinning condition. However, it was not observed signficantly superior against RH-30 and RH-8602 under recommended spacings. The oil content and thousand seed weight did not vary because of fertilizer dose and spacing (Plant to plant). The variety RH-30 recorded highest 1000 seed weight (5.99 g) under recommended practices of thinning. The oil yield Kg/ha followed the trend of seed yield.

Ludhiana:

Effect of nitrogen application on the performance of toria and gobhi sarson intercrop:

The experiment was conducted to see the effect of nitrogen application on seed yield of toria and gobhi sarson as inter-crop. The nitrogen fertilizer was applied in two split doses, the first being applied as basal dose alongwith other recommended doses of fertilizer, while the second dose of nitrogen fertilizer was applied to G.S. after harvest of toria crop. The result of the experiment is presented in Table 3.12.

All the doses exceeding the recommended dose of N50 + N50 Kg/ha gave significantly higher seed yield of toria and gobhi sarson. The highest gross income(Rs. 20735/ha) was obtained with dose of N 62.5 + N125 but there was no appreciable difference in the total gross income between the higher doses of nitrogen. Oil content of both toria and gobhi sarson was not affected by nitrogen fertilization.

Effect of herbicide on seed yield and oil content of different strains of gobhi sarson:

To study the effect of herbicide on different strains of gobhi sarson, a field experiment was conducted in split plot design with three replications. Main plot treatments comprised of three straians viz; GSL-1, GSL-1501-T and GSL-8851 and eleven

TABLE 3.10 SEED YIELD(Kg/ha) OF BRASSICA SPECIES AS INFLUENCED BY DATES OF SOWING AT PANTNAGAR DURING 1991-92

DATES OF SOWING	BRASSICA SPECIES			
	BRASSICA JUNCEA(KRISHNA)	B.CAMPESTRIS VAR YELLOW SARSON (PYS-841)	B.NAPUS (GSL-1)	MEAN
10, OCT.	1844	1342	1723	1636
20, OCT.	1726	1131	1451	1436
30, OCT.	1343	819	1250	1137
9, NOV.	1103	690	903	898
MEAN	1504	995	1331	

	S.EM+	CD AT 5%	CV%
DATE OF SOWING(D)	51	177	12.08
BRASSICA SPECIES(S)	36	108	9.84
TO COMPARE TWO D AT SAME S	72	NS	
	93	NS	
TO COMPARE TWO S AT SAME D	0.9		

TABLE 3.11 SHOWING THE PERFORMANCE OF RH 8602 UNDER FERTILITY AND NO THINNING CONDITIONS AT HISAR DURING 1991-92

	TREATMENT	SEED YIELD (Kg/ha)	OIL CONT. (%)	OIL YIELD (Kg/ha)	1000 SEED WEIGHT(g)
	N-80	1143	43.1	492	5.24
	N-120	1159	42.5	493	5.05
CD AT 5%		NS			
	RH-30	1129	42.5	490	5.99
	RH-8602	1211	42.1	510	4.60
	(NO THINNING) RH-8602	1113	42.8	476	4.84
CD AT 5%					

TABLE 3.10 SEED YIELD AND OIL OF TORIA AND GOBHI SARSON INTERCROP AS AFFECTED BY N FERTILIZER

TREATMENT	SEED YIELD (Kg/ha)		OIL CONTENT (%)		GROSS INCOME (Rs/ha)		TOTAL GROSS INCOME BOTH THE CROPS
	TORIA	G.S.	TORIA	G.S.	TORIA	G.S.	
N50+N50	1586	1291	41.2	39.8	9516	8391	17907
N62.5+N75	1778	1400	41.5	39.6	10668	9100	19768
N62.5+N100	1810	1482	41.9	40.6	10860	9633	20493
N62.5+N125	1794	1534	41.6	40.7	10764	9971	20735
N75+N75	1702	1493	40.7	40.0	10212	9704	19916
N75+N100	1738	1569	40.8	39.3	10428	10198	20626
N75+N125	1765	1539	40.2	39.5	10590	10003	20593
CD AT 5%	47	39	-	-	-	-	-

PRICE OF TORIA Rs 600/Q AND GOBHI SARSON Rs 650/Q

TABLE 3.14 EFFECT OF ATTRAZINE ON SEED YIELD AND OIL CONTENTS
OF DIFFERENT STRAINS OF GOBHI SARSON AT LUDHIANA DURING 1991-92

TREATMENT	SEED YIELD (Kg/ha)				OIL CONTENT (%)
	GSL-1	GSL-1501	GSL-8851	MEAN	
CONTROL	1434	1340	1347	1374	39.8
TWO HAND	1855	1879	2157	1964	39.8
ATTRAZIN PRE EMG-300g	618	1910	2135	1554	38.8
ATTRAZIN PRE EMG-400g	490	1889	2252	1577	39.0
ATTRAZIN PRE EMG-500g	350	2071	2172	1531	39.0
ATTRAZIN POST EMG-300g	155	1920	2137	1404	39.1
ATTRAZIN POST EMG-400g	91	2043	2208	1447	39.3
ATTRAZIN POST EMG-400g	0	2013	2109	1374	38.7
ATTRAZIN PRE-POST EMG-300g	0	1862	2048	1303	38.1
ATTRAZIN PRE-POST EMG-400g	0	2143	2076	1406	37.0
ATTRAZIN PRE-POST EMG-500g	0	1913	2126	1346	40.2
MEAN	454	1917	2070	-	-
OIL CONTENT (%)	39.1	38.5	39.5	-	-

CD AT 5% : GENOTYPES(M)=39 Kg/ha, TREATMENT(s)=44 Kg/ha
INTERACTION(MxS)=75 Kg/ha

TABLE 3.15 EFFECT OF DIFFERENT LEVELS OF NITROGEN SEED YIELD
AND OIL CONTENTS ON G.S.HYBRIDS AT LUDHIANA DURING 1991-92

TREATMENT	SEED YIELD (Kg/ha)				MEAN	OIL CONTENT (%)
	30	40	50	60		
GSH-1	1369	1435	1663	1594	1515	38.5
GSH-2	1574	1605	1690	1782	1663	39.5
GSH-3	1590	1701	1628	1782	1675	38.2
GSH-1	1404	1412	1582	1492	1473	39.9
MEAN	1483	1538	1641	1663	-	-
OIL CONTENT(%)	39.0	38.9	39.2	38.2	-	-

CD AT 5% GENOTYPE(M):21Kg/ha
NITROGEN(S):[illegible]Kg/ha
INTERACTION(MxS):64 Kg/ha

treatments i.e. control, two hoeings, Attrazine pre-emergence dose of 300g, 400g and 500g post emergence doses of 300g,400g and 500g/ha as well as pre + post emergence doses of 300g, 400g and 500g/ha were put in sub plots. The crop was sown on Oct. 20th, 1991. Perusal of the data as presented in Table 3.13, indicated that the presently available commercial variety is highly susceptible to attrazine herbicide and hence is not amendable to chemical weed control treatment. This was evident from the sharply reduced seed yields for pre and post emergence attrazine application. The combined application of both pre and post-emergence application of Attrazine led to complete elemination of GSL-1 plants. Newly developed varieties GSL-1501 and GSL-8851 on the other hand were unaffected by the attrazine application on all the doses evaluated. Highest mean yield was reorded for GSL-8851(2070 Kg/ha). Even under hand hoeing treatment, GSL-8851 (2157 Kg/ ha) exceeded the check GSL-1(1855 Kg/ha) by a margin of 16.3% Highest seed yield of 2252 Kg/ha for GSL-8851 was recorded at pre-emergence application of attrazine at the dose of 400 gm/ ha. This was ever higher(4%) than the two hand hoeings. The yield increase for attrazaine @ 400 gm/ha) over control (no hoeing) was as much as 67 per cent. Post-emergence application (@ 400 gm/ha) also have almost similar yield (2208 Kg/ha).

Effect of nitrogen on seed yield of gobhi sarson hybrids:

To study the respone of gobhi sarson hybrid to various nitrogen levels, a field experiment was conducted in split plot design with four replications. The crop was sown on 26 Oct.1991 with four treatments(3 hybrids with GSL-1 as check) in main plot and four levels of nitrogen(30, 40,50 and 60 Kg/ha) in sub plots. Analysis of data as presented in Table 3.14 indicated significant difference for variety (hybrid) x fertilizer interaction. Higher seed yield was recorded for the hybrid GSH-2 and GSH-3(1782 Kg/ha). The check variety GSL-1 yielded 1492 Kg/ha at same dose represented an increase of 19.4 per cent in favour of hybrids at this dose. As a mean over all the doses, GSH-3 as well as GSH-2 outyielded GSL-1 by margins of 138 per cent and 12.7 per cent respectively. On mean basis over varieties, the yield of hybrids/varieties increased linearly with increased nitrogen dose upto 60 Kg/ha. Maximum mean seed yield was recorded at maximum nitrogen dose evaluated. Hybrids in general were more responsive than varieties.

Studies on the response of different mustard hybrids/varieties to nitrogen:

To study the response of mustard hybrids/varieties to nitrogen, a preliminary experiment was conducted. In this trial, 12 treatments combinaations comprising the rate of nitrogen(N40 and N50 Kg/ha) and six hybrids/varieties(PHR-2, PHR-7, YSRL-9, RLM-619, RL-1359 and Varuna) were evaluated. The data on seed yield have been given in Table 3.15. The results have shown that all the hybrids and varieties responded to higher dose(50 Kg N/ha) against the recommended dose(40 Kg N/ha). The hybrid(PHR-7) gave maximum seed yield(1540 Kg/ha) at 40 Kg N/ha whereas variety(YSR-9) gave highest seed yield(1572 Kg/ha) at 50 Kg N/ha. With regard to oil content, PHR-7, YSRL-9 and RL-1359 were superior and at par at both the nitrogen levels.

Kanpur:

Mustard crop technology for optimum production under constraints:

The experiment was conducted to find out the low cost input technology for optimum yield of mustard(Rohini). The perusal of Table 3.1 indicates that the treatment effects were found significant on seed yield equivalent of mustard during both the years. During 1990-91, the highest seed yield(3492 Kg/ha) was obtained from the treatment, line sowing(45 cm) + recommended seed rate(5 Kg/ha) + thinning at 20 days after sowing at 20 cm apart. But during 1991-92, the maximum seed yield equivalent was found in treatment No.9(line sowing with 45 cm apart + recommended seed rate(5 Kg/ha) + thinning at two stages(12-15 and 22-25 days after sowing) + border method by removing 4th row for green fodder purpose at 50 days after sowing(No thinning in 4th row).

On the basis of two years, mean line sowing with 45 cm apart + recommended seed rate(5 Kg/ha) + thinning at 20 days after sowing (20 cm) gave 16.5% higher seed yield equivalent over farmers practice.

Morena:

Seed yield of toria/mustard under different crop sequences:

The results presented in Table 3.1 reveals that in Kharif season moong yielded 9.17-9.42 q/hs whereas, different fodder crops gave 139-294 q/ha green fodder yields. In rabi season, toria produced about 12 q/ha in different sequences. Mustarad planted after kharif fallow; recorded maximum seed yield of 18.07 q/ha followed by mustard planted after Jawar fodder(16.10 q/ha) and mustarad taken after cowpea for green fodder + green pods for both the purpose.

On comparing the returns of sequence as a whole, cowpea (Pods + green fodder)-mustard sequence gave highest net returns of Rs. 14088/ha followed by Jowar(fodder)- mustard sequence(Rs. 11527/ha). Fallow - mustard(farmers practice) gave only net returns of Rs. 9322/ha under rainfed conditions in light soils of Morena.

Intercropping of mustard in gram and lentil under rainfed conditions:

TABLE 3.16 EFFECT OF DIFFERENT NITROGEN LEVELS ON SEED YIELD AND OIL CONTENT OF RAYA (HYBRIDS/VARIETIES)AT LUDHIANA DURING 1991-92

TREATMENT	SEED YIELD (Kg/ha)	OIL CONTENT (%)
N40 PHR 2	1114	36.5
N40 PHR 7	1540	39.2
N40 YSRL-9	1483	39.7
N40 RLM 619	1377	37.8
N40 RL 1359	1180	39.6
N40 VARUNA	1064	37.8
N50 PHR 2	1230	37.0
N50 PHR-7	1551	39.4
N50 YSRL-9	1572	39.3
N50 RLM 619	1441	38.1
N50 RL 1359	1196	39.4
N50 VARUNA	1279	36.9
CD AT 5%	72	-

TABLE 3.17 SEED YIELD GREEN FODDER AND SEED YIELD EQUIVATENT OF MUSTARD CROP TECHNOLOGY FOR OPTIMUM PRODUCTION AT KANPUR (1991-92)

SN.	TREATMENTS	SEED YIELD (Kg/ha) 90-91	91-92	G.FODDER YIELD (Kg/ha) 90-91	91-92	SEED YIELD EQUIVALENT (Kg/ha)	
1.	LINE SOWING 45 RECOMMENDED SEED RATE (5Kg/ha)	2772	2293			2772	2293
2.	L.S.+R.S.R.+TH 20DAS(20cm)	3492	2760			3492	2760
3.	L.S.+R.S.R.+TH ,II:22-25 DAS	3122	2769			3122	2769
4.	L.S.+R.S.R.+HOE CULTIVATER/DP 20 DAS	2963	2451			2963	2451
5.	L.S+R.S.R+SOWI NORTH-SOUTH DIRECTION	2974	2681			2974	2681
6.	L.S+R.S.R+SEED MENT WITH THIRUM	2878	2372			2878	2372
7.	L.S+R.S.R+REMO LOWER LEAVES AT 40-50DAS	2878	2390			2878	2390
8.	L.S+R.S.R+ONE AGAINST APHID IF NEED	3302	2469			3302	2469
9.	L.S+R.S.R+TH-I DAS & II :22-25 DAS+ BORDER METHOD BY REMOV- ING 4TH ROW FOR GREEN FODDER-50DAS(NO TH.IN 4TH ROW)	2339	2566	16508	14198	2669	2945

Contd...

10 L.S+R.S.R+TH.I DAS & II :22-25 DAS+ ONE IRRIGATION(PF)	3143	2813	3143	2813
11. L.S+R.S.R+HOE CULTIVATIOR/D.P.-20 DAS+TOPPING-40-50 DAS OF THE MAIN SHOT.	2751	2504	2751	2504
12. FARMERS PRACT MUSTARD SOWING BY BROAD CAST.	2751	2610	2751	2610
G.M.			2975	2587
S.EM+			149	102
C.D.(5%)			436*	293*
C.V.%			8.7	10.9

TABLE 3.18. YIELD ANDAFFECTED BY DIFFERENT CROP SEQUENCES IN RAINFED CONIDITION IN LIGHT SOIL OF MORENA (1991-92)

TREATMENT SN CORDINATON	SEED YIELD(Kg/ha) GRAM	MUSTARD	TOTAL	STRAW/STOVE YIELD(Kg/ha) GRAM	MUSTAR	TOTAL	GROSS RETURN(Rs/ha) SEED	STRAW	TOTAL	COST OF TREATMENT (Rs/ha)
CROP SEQUENCE	KHARIF	TORIA/ MUSTARD	KHARIF	TORIA/ MUSTARD	KHARIF	TORIA/ MUSTARD	KHARIF	TORIA/ MUSTARD		KHARIF+ RABI
1 COWPEA(F)-TORIA	13988	1228 (8611)	3496	9151	2681	3150	815	6000		60815
2 JOWAR(F)-TORIA	25198	1159 (8194)	5039	8647	2612	3200	2427	5547		7874
3 MOONG(S)-TORIA	917 (1131)	-	5558	-	2266	-	2892	-		2892
4 COWPIEA(F)-MUSTARD	13889 (2505)P	1558 (8383)	9598	11688	3638	3560	5960	8128		14088
5 JOWAR(F)-MUSTARD	29364	1610 (8542)	5872	12027	2612	3760	3260	8267		11527
6 MOONG(S)-MUSTARD	942 (1126)	-	5692	-	2666	3060	-	3026		-
7 COWPEA+JOWAR+GUAR (1:1:1 ROW)FODDER-TORIA	21528	1162 (1854)	6457	8718	2588	3150	3869	5568		9437
8 FALLOW-MUSTARD		1807 (9167)	-	13482	-	4160	-	9522		9322
C.D.(5%)	-	291	1292	-						

S=SEED P=POD Fig. IN PARENTHESIS ARE THE STRAW/STOVER/GRREEN PODS YIELD
*-DENOTES TORIA AND MUSTARD COULD NOT BE TAKEN DUE TO LACK OF RESIDUAL MOISTURE AFTER SEQUANCE NO 3 & 6

The data presented in Table 3.19 indicated that intercropping of gram + mustard (4:1 rows at 30 cm) recorded maximum total productivity of seed(2400 Kg/ha) and net returns (Rs.10687/ha) followed by intercropping combination of gram + mustard in 6:1 row/8:1 rows ration (total seed yield 2356/2331 Kg/ha and net returns of Rs.10031/9931/ha). Pure crop of gram and mustard gave only seed yield of 2028, and 1216 Kg/ha and net returns of Rs.7554 and Rs.4432/ha respectively. Inter cropping of lentil with mustarad also found beneficial giving returns of Rs. 8304-9997/ha as compared to pure lentil(Rs. 7561/ha) and pure mustard (Rs. 4432/ha).

Mandore:

Effect of irrigation and supersorb on the seed yield of mustard

The perusal of Table 3.20 indicates that the aplication of Supersorb through seed, soil and soil+seed increased the productivity by 6.8, 6.9 and 12.4 per cent over control (without supersorb).

Navgaon:

Technology under resources constraints fertilizer and plant protection

Data presented in Table 3.21, indicates that the seed yield of mustard increased significantly with each increasing level of nitrogen application in 1990-91 but the yield did not show significant increase beyond 20 KgN/ha application in 1991-92. Maximum yield was obtained with 30 KgN/ha in both the years. Seed yield realised with 20 KgP/ha application was at par with that obtained with 10 KgN/ha during both the years. As there was no major disease problem in 1990-91, no significant plant protection was observed but in 1990-91 yield increased significanlty with application of plant protection measures (Diathane M-45).

Berhampore:

Seed yield of mustard as influenced by Surgrow treatment

Results presented in Table 3.22 indicates that when Surgrow was imposed as soil application @ 25 Kg/ha over recommended N:P:K the crop yielded the highest (1833 Kg/ha) followed by Foliar application three sprays (1682 Kg/ha) and one spray (1638 Kg/ha), respectively. The crop receiving full dose of fertilizer only yielded 1270 Kg/ha. Thus application of Surgrow in the soil resulted 44.38% incremental yield over the control-2. In case of foliar spray the incremental yield was to the tune of 32.24% in the event of 3 foliar sprays and 28.97% in the event of single foliar spray, respectively. Considereing the cost benefit ratio soil application of Surgrow @ 25 Kg/ha proved most economic (C:B 1:9.5) over others. In case of foliar application single spray exhibited

TABLE 3.19. YIELD AND ECONOMICS AS INFLUENCED BY DIFFERENT TREATMENTS INTERCROPPING OF MUSTARD/OTHER CROPS AT MORENA DURING 1991-92

SN	TREATMENTS CORDINATION	SEED YIELD(Kg/ha) GRAM/ LENTIL	MUSTARD	TOTAL	STRAW/STOVE YIELD(Kg/ha) GRAM/ LENTIL	MUSTAR	TOTAL	GROSS RETURN(Rs/ha) SEED	STRAW STOVER	TOTAL	COST OF TREATMENT (Rs/ha)	NET RETURN (Rs/ha)
1	PURE MUSTARD	-	1216	1216	-	2088	2088	8147	445	8592	4160	4432
2	PURE GRAM	2028	-	2028	2117	-	2117	10140	1482	11622	4068	7554
3	PURE LENTIL	2134	-	2134	2261	-	2261	10243	1243	11486	3925	7561
4	GRAM+MUSTARD 4:1	1733	727	2460	1770	1844	3614	13536	1516	15052	4365	10687
5	GRAM+MUSTARD 6:1	1775	583	2356	1895	1493	3388	12781	1550	14331	4300	10031
6	GRAM+MUSTARD 8:1	1794	537	2331	1897	1371	3268	12568	1533	14101	4170	9931
7	LENTIL+MUSTARD 4:1	1150	998	2148	978	2484	3462	12207	910	13117	4230	8887
8	LENTIL+MUSTARD 6:1	1261	806	2067	1279	1984	3263	11453	1001	12454	4150	8304
9	LENTIL+MUSTARD 8:1	1351	692	2042	1654	1599	3253	11121	1149	12270	4020	8250
	CD AT 5%	279	260	222								
	CV%	11.4	23	10.9								

TABLE 3.80 EFFECT OF IRRIGATION AND SUPERSORB ON SEED YIELD OF MUSTARD AT MANDOR DURING 1989-92

SNTREATMENTS	SEED YIELD(Qtl./ha)			
	1989	1990	1991	1992
I IRRIGATION LEVELS(3)				
ONE AT 45 DAS	18.09	17.4	17.1	17.56
TWO AT 30+75 DAS	19.45	19.39	20.7	19.85
THREE AT30,45,75,DAS	21.24	23.06	22.2	22.18
SEM	0.48	0.54	0.33	
CD AT 5%	1.38	1.5	0.98	
IISUPERSORB	19.74	20.23	19.7	19.94
SEED COATING WITH 3%	19.69	19.53	20.4	19.9
SOIL APPLICATION AT 6Kg/ha	20.74	21.33	20.8	20.97
SEED+SOIL APPLICATION	18.21	18.66	19.1	18.66
WITHOUT SUPERSORB				
SEM	0.56	0.62	0.38	
CD AT 5%	1.6	1.73	1.13	
CV%	9.8	10.8	5.76	

TABLE 3.21 SHOWING THE RESULTS OF MUSTARD PRODUCTION TECHNOLOGY UNDER RESOURCE CONSTRAINS(FERT. AND PLANT PROTECTION) AT NAVGAVN DURING 1990-91 & 1991-92

TREATMENT	SEED YIELD (Kg/ha)	
	1990-91	1991-92
NITROGEN LEVELS		
10 Kg/ha	584	891
20 Kg/ha	723	1032
30 Kg/ha	805	1097
SEM	-	38
CD AT 5 %	36	111
CV%	-	13
PHOSPHORUS LEVELS		
10Kg/ha	690	974
20 Kg/ha	718	1040
SEM	-	31
CD AT 5 %	NS	NS
CV%	-	13
PLANT PROTECTION		
WITH OUT PP	687	955
WITH PP	721	1059
SEM	-	31
CD AT 5 %	NS	91
CV%	-	13

TABLE 3.22 SEED YIELD OF INDIAN MUSTARD AS INFLUENCED BY SURGROW TREATMENTS AT BERHAMPORE DURING 1991-92

SN.	TREATMENT	SEED YIELD (Kg/ha)	ADDITIONAL YIELD OVER CONTROL-2 (Kg/ha)	%INCREASED IN YIELD OVER CONTROL-2	COST: BENIFIT (Rs.)
1	CONTROL-1(W/F)	524	-	-	-
2	CONTROL-2(R/F)	1270	-	-	-
3	RF+ONE SPRAY AT 35 DAS	1638	368	28.97	1 : 6.4
4	RF+TWO SPRAYS AT 35 & 50 DAS	1529	259	20.39	1 : 1.6
5	RF+THREE SPRAYS AT 35,50 & 65 DAS	1682	412	32.24	1 : 1.7
6	RF+FOUR SPRAYS AT 35,50,65 & 80 DAS	1559	289	22.75	1 : 0.4
7	RF+SOIL APPLICATION @ 25 Kg/ha	1833	563	44.38	1 : 9.5
	SEM	29			
	CD AT 5%	86			

W/F: WITHOUT FERTILIZER
R/F: WITH RECOMMENDED FERTILIZER i.e. 80Kg N:40Kg P2O5:40Kg K2O/ha
DAS:DAYS AFTER SOWING
SELLING PRICE OF MUSTARD WAS CONSIDERED Rs.700/-PER QUINTAL

the highest Cost:Benefit ratio* (1:6.4) over others.

Yield performance of newly evolved yellow sarson cultivars as influenced by sowing dates

This is the fourth year of such trial. A perusal of Table 3.23 revealed that during 1991-92 both the varieties recorded the highest yield at 24th October sowing. The yield differences between 24th October and 4th November were at par in case of both the varieties. Delay in sowing beyond 4th November a progressive reduction in yield was observed.

Data averaged over years revealed that yield level was more or less similar in sowings between mid October to 1st week of November. There was a sharp reduction in yield when sowing is delayed beyond 1st week of November and sowing on and after 24th November yield was reported as uneconomical.

TABLE 3.23 YIELD PERFORMANCES (Kg/ha) OF NEWLY EVOLVED Y.SARSON CULTIVARS AS INFLUENCED BY SOWING DATES AT BHARAMPUR DURING 1991-92

DATE OF SOWING	1991-92		1990-91		1989-90		1988-89	MEAN OVE
	YSBNC-1	YSB-19-7-C	YSBNC-1	YSB-19-7-C	YSBNC-1	YSB-19-7-C	YSBNC-1	YSBNC-1
14th OCTOBER	-	-	-	-	1408	1092	1369	1388
24th OCTOBER	1342	1015	1164	1090	1357	939	1422	1321
4th NOVEMBER	1322	995	1070	1024	1102	837	1469	1240
14th NOVEMBER	1161	848	1046	938	704	429	1109	1027
24th NOVEMBER	626	453	512	278	275	204	1242	644
4th DECEMBER	298	215	661	558	224	122	1038	565
14th DECEMBER	270	131	506	335	153	71	347	319
24th DECEMBER	251	130	64	35	-	-	-	157
SEM FOR D/S+		37		28		83	42	
CD AT 5% FOR D/S		111		86		240	127	
SEM FOR VARIRTY+		7		22		32		
C.D. FOR VARIETY		22		67		91		
SEM FOR D/S x VARIETY+		22		18		83		
CD FOR D/S VARIETY		66		54		NS		
CV %		10.2		7.9		27.7		

4 ENTOMOLGY

4.1(A)

Name of the project : Screening of *Brassica* germplasm and the breeding material for insect-pest resistance.

Objective : To find out the resistant sources against mustard aphid, *Lipaphis erysimi* and leaf miner, *Chromatomyia horticola* in *Brassica* germplasm/breeding material.

Locations : Kangra, Ludhiana, Bathinda, Hisar, Navgaon, Junagarh, Pantnagar, Kanpur, Faizabad, Morena, Pusa/Dholi and Berhampore.

Progress of work:

A. GERMPLASM:

(a) Mustard aphid:

Ludhiana:

Two hundred ninety four genotypes were sown in aluminium trays(1 m x 0.5 m) and were subjected to heavy aphid infestation for two days at 18 days after sowing. Aphid settling response(No.of aphids per seedling, was counted at 3 and 7 days after exposure to aphid presence. The data on seedling survival(Table 4.1(A).1) indicated that 53 entries had more than 80 per cent survival at 35 days after sowing(DAS), while 31 entries had more than 50 per cent survival at 40 DAS. None of the entries could survive beyond 50 DAS. The less preferred entries in both the experiments were GSL-1509, ISN-706, RKN-90, *Tetra nigra*, SP *nigra*, *nigra*, Varuna, *carinata*, GSL-8851, PSR-5, PBM-19, Fido, Raj Raya, HNS-1, CE-4, CE-8, CE-9 and RLC-1035.

Junagarh:

Evaluation of 169 mustard entries in different trials revealed that none of them was free from the aphid attack. In 55 entries aphid infestation index (AII) ranged between2.1 and 3.0 while in 113 entries it ranged from 3.1 to 4.0. One entry had AII between 4.1 and 5.0.

Navgaon, Kanpur and Dholi:

Breeding material could not be evaluated due to low aphid incidence.

TABLE4.1(A).1: SCREEN HOUSE TESTING OF PROMISING BREEDING MATERIAL OF BRASSICA SPP.FOR APHID RESISTANCE AT LUDHIANA DURING 1991-92(TOTAL ENTRIES TESTED=294)

	GENOTYPES WITH SEEDLING SURVIVAL	
SN.	60% AND ABOVE AT 35 DAS	50% AND ABOVE AT 40 DAS
1	GSL-1509	GSL-1509
2	ISN-706	ISN-706
3	VARUNA	-
4	RKN-90	RKN-90
5	CSR-83-268	-
6	GSB-7027	-
7	RLC-1035	RLC-1035
8	-	RK-8701
9	-	DLC-2
10	FM 14	-
11	GSL 8920	GSL 8920
12	" 8965	-
13	TETRA MIGRA	TETRA MIGRA
14	SP NIGRA	SP NIGRA
15	RE 9	-
16	-	GSL 8832
17	-	CE 4
18	-	HC 1
19	-	GSL 8933
20	NIGRA	NIGRA
21	-	FM 30
22	DIC3	-
23	RE 11	-
24	VARUNA	VARUNA
25	RE 15	-
26	CARINATA	CARINATA
27	EURICAM	-
28	GSL 8853	-
29	-	GSL 8858
30	-	CE 7
31	GSL 8851	GSL 8851
32	RC CARINATA	-
33	FM 8	-
34	PBR-90	-
35	PB-19	PB-19
36	CE-8	-
37	PSR-5	PSR-5
38	DIR-457	-

Contd...

Table 3.1(A).1 contd.

SN.	GENOTYPES WITH SEEDLING SURVIVAL 60% AND ABOVE AT 35 DAS	50% AND ABOVE AT 40 DAS
39	PCR-7	-
40	-	RH-8904
41	-	RABACCA
42	RJ-15	-
43	RLC 937	-
44	RLC 1033	-
45	RLC 8635	-
46	RLC 8662	-
47	RLC 8654	-
48	RLC 812	-
49	RLC 8693	-
50	RLM 619xRLC 1031-P4	-
51	BP 1	-
52	FIDO	FIDO
53	RAJ RAYA	RAJ RAYA
54	RLM 608xRAWEL-1-P-4	-
55	RLC 1031xRL 1339-I-0-12	-
56	RLM 608 x YSR-I-P	-
57	P 3-39xKRANTI	-
58	HNS I	HNS I
59	CE 4	CE 4
60	B 85	
61	-	CE 7
62	-	HC 1
63	CE 9	CE 9

DAS DENOTES DAYS AFTER SOWING

b) Painted bug:

Bathinda:

121 entries of mustard were evaluated against the painted bug based upon damage grades(0-5) as well its population. Strains of <u>Eruca sativa</u> (T-27, TMH-9002, TMH-9001, TMH-9003) which had damage grade below 1.5 were tolerant to the pest. Three lines of mustard viz; Bathinda strains No.848,1131 and 1167 which had a mean damage grade of 1.8 were rated moderately resistant to the pest. The later two lines also harboured low population (less than one individual per plant) of the painted bug (Table 4.1(A).2).

CONCLUSION

In general, there was low aphid incidence throughout the country. A new technique has been developed at Ludhiana for testing the non-preference of working germplasm and breeding material against mustard aphid at the seedling stage. Strains of <u>Eruca sativa</u> (T-27, TMH-9002, TMH-9001, TMH-9003) were found tolerant to painted bug whereas Bathinda strain Nos. 848, 1131 and 1167 of mustard were moderately resistant.

B. Co-ordinated trials:

i) Screening of mustard strains against mustard aphid and leaf miner in IVT during 1991-92

a) Mustard aphid:

The data on the evaluation of 36 mustard entries at 8 locations viz., Kangra, Ludhiana, Bathinda, Pantnagar, Morena, Raipur, Junagarh and Dholi have been presented in Table 4.1(A).3. Perusal of the data revealed that four entries viz., DIRM-52, DLM-29, RK-919015 and RSM-9007 were found promising at three locations and five entries namely; TM-18-8, RJ-9, RJ-14, RM-9 and DIR-489 at two locations against aphid incidence.

At Pantnagar, the aphid infestation was very severe, though quite late in the season. The mean aphid population varied from 1273 to 6705 aphids per plant and none of the test entries survived the pest damage.

At Hisar, Kanpur, Navgaon and Faizabad the trial was laid out as per the AICORPO programme. The data could not be collected due to very low aphid incidence.

b) Leaf Miner:

Mustard strains under IVT were also evaluated against leaf

TABLE 4.1(A).2: INFESTATION /DAMAGE OF PAINTED BUG ON DIFFERENT VARITIES/STRAINS OF BRASSICA SPP.AT BATHINDA

		DG			PP				DG			PP	
SN.	VAR.	D1	D2	D3	D1	D2	SN.	VAR	D1	D2	D3	D1	D2
1	811	4.5	4.5	4.5	3	16.9	41	1159	3	3	4.5	11.8	14.1
2	812	3.5	4	3.5	12	2	42	1167	1.5	1.5	2.5	0.5	0
3	814	1.5	4	4.5	2.6	-	43	1169	2	2	2.5	7.4	1.2
4	823	3	3.5	0	3.6	6.4	44	1177	3	3	3.5	16.3	0.1
5	832	2	3	3	0.1	3.2	45	1179	4.5	5	4	0.2	22.3
6	843	1	1	3.5	12.3	0	46	1181	2.5	3	3.5	2.7	3.9
7	844	2.5	3	2.5	4.3	3.5	47	1191	2.5	1.5	3	2.2	0.8
8	845	2.5	3	-	19.8	14.8	48	1201	1	2	2.5	2.7	6
9	846	3	4	3	28	17.7	49	1248	2.5	3	2.5	10	0.4
10	847	3.5	3.5	3	12.3	11.7	50	1249	2	3	4	12.5	6.8
11	848	1.5	1.5	2.5	11.5	1	51	1250	4.5	3.5	0	31.5	5.3
12	849	3	4	2.5	5.4	23	52	2459	2.5	3	3.5	11.7	20.1
13	850	3.5	3.5	3.5	38.7	16.7	53	2460	2	2.5	2	25.5	1.7
14	864	2	3	2	5.1	0.4	54	2465	3	3	1.5	2.7	7.9
15	927	2.5	3.5	3	3.1	16.3	55	2466	3	3	3.5	23.5	7.9
16	957	2.5	3	3	2.5	1.2	56	2530	4.5	4.5	-	0	20.2
17	977	2	2	2.5	1.5	0	57	2532	3.5	3	2.5	0	22.5
18	978	2	3	3	2.2	0.4	58	2533	4	4.5	-	9.8	22.3
19	979	2	3	3	10.5	0.6	59	2535	2.5	3	1.5	4	16.4
20	995	4.5	4.5	3.5	3	1.5	60	2538	4.5	5	-	9.2	15.2
21	1019	2	3	2	5	19.9	61	2540	5	5	2.5	0	19.5
22	1020	5	4.5	4.5	0.9	24.2	62	2541	5	5	4	0.5	6.9
23	1025	5	4.5	4.5	0	1.4	63	2542	3	4.5	2	0	6.5
24	1026	3	3	0	24	5.5	64	2544	3.5	4.5	2	5	24
25	1028	2.5	3	4.5	12.5	24	65	2545	4	4.5	2.5	5	7
26	1030	4.5	4.5	4	0	1.6	66	2546	4	4	-	0	10.7
27	1032	5	4.5	5.5	1	11.5	67	2547	3.5	4	3	0.3	13.9
28	1042	4	4.5	4	15	13.2	68	2549	4.5	4.5	2.5	6.4	21.2
29	1043	4.5	4.5	4.5	1.3	-	69	2550	4.5	4.5	4	0.8	32.7
30	1044	1.5	2	2.5	12.4	0	70	2551	2.5	4	1.5	0	5
31	1059	4.5	4.5	3.5	3.4	19	71	2552	4	4	4	0	15.5
32	1076	4	4.5	-	1.4	2.2	72	2755	2	3.5	3.5	0	20.7
33	1086	1.5	2.5	-	11	0	73	2757	2.5	4	1.5	0	15.3
34	1096	2.5	2.5	3.5	7.5	-	74	2769	2	3.5	3	2.3	25.5
35	1103	4	5	-	0.2	34.3	75	2770	2.5	4	3.5	0	31.8
36	1131	1.5	1.5	2.5	0.3	0	76	2773	2.5	3.5	3	0.3	13.5
37	1148	3.5	4	2.5	3.4	3.2	77	2774	2.5	3	2.5	0	22.6
38	1151	2	1.5	2	14.8	0	78	2777	2	2.5	3	1.1	0.4
39	1155	1.5	2	4	0.8	0	79	2779	2.5	3.5	3	0	26.4
40	1156	2	3	3	18.3	7.8	80	2783	2.5	3.5	3	0.3	2

[illegible] SOWING

Contd....

Table 4.1(A).2 contd.

SN.	VAR	DG D1	DG D2	DG D3	PP D1	PP D2
81	2786	2	3	2.5	5.2	5
82	2791	2.5	4	3.5	0	2.2
83	2798	2	3	3	0	17.5
84	2799	2	3	2.5	0	8.8
85	2806	2	3.5	3	0.3	16.1
86	2807	2	3.5	3	0	19.8
87	2818	2	3	2.5	1.1	1.8
88	2820	2	3	2.5	0.2	20.3
89	C-6501	2.5	3.5	1	2	28.2
90	C-6502	3	4	3.5	0	25.8
91	GSL-1	3	3	2.2	0	18.5
92	HC	3.5	3.5	2.5	0.7	25.1
93	KRANTI	5	2	1.5	4	-
94	MCN-50	3	3	3.5	7.9	20
95	MCN-51	3.5	3.5	4.5	9.8	4.9
96	MCN-52	4	3.5	3	2.2	22.6
97	MCN-53	3.5	3	4.5	0.4	18.8
98	MCN-54	3	3	4.5	3.6	2.4
99	MCN-55	3.5	3	3.5	0.5	13.6
100	PBGS-89	2.5	2.5	3	0.5	6.6
101	PBT-29	2	3.5	2.5	0.8	12.4
102	PBT-33	2.5	3.5	3	0	5.6
103	PBT-34	2	3	2.5	0.5	1.2
104	PBT-35	3	4	3.5	3.2	3.6
105	PT-303	2	3	2.5	0	8.4
106	RLC-949	3	3.5	3.5	0.7	10
107	RLC-1021	3	4	4	0.5	24.3
108	RLC01327	3	3	3.5	5.9	0
109	RLC-1359	5	5	4	4.6	23.6
110	RLM-619	4	4.5	4.5	0	28.5
111	T-27	0.5	1.5	1	8	1
112	TMH-9002	0.5	1	1	1.1	0
113	TMH-9001	0.5	1.5	1	1.6	0
114	TMH-9003	0.5	0.5	1.5	0.4	0
115	T-9	3.5	4.5	3.5	2	46
116	TL-15	4	4.5	3.5	1.6	22
117	TL-16	2	3.5	3.5	0	22.5
118	TL-9001	2	3	2	1	18
119	TLC	4.5	4	4	0	24.4
120	VARUNA	5	4.5	4.5	0	16.5
121	YSRL-9	3	3	3.5	9	5.8

DG- Damage grade(0-5), PP- No.of nymphs and per plant.

D_1- D_2, D_3 - Dates of sowing.

TABLE 4.1(A).3: EVALUATION OF MUSTARD STRAINS AGAINST MUSTARD APHID
IN IVT AT VARIOUS LOCATIONS DURING 1991-92

			APHID INFESTATION INDEX (AII)					APHID POP.		
			1	2	2	1	2	2	3	4
SN	CODE	ENTRY	KNG	LDH	PANT	MOR	JUN	DOL	BTH	RAP
1	MCN-1	SJN-191	1.8	1.1-2.0	3.8	2.7	4.4	0.83	11.1	186
2	MCN-2	DIRM-52	1.9	<1.0	3.8	2.5	4.2	0.10	31.1	53
3	MCN-3	DIR-489	2.1	1.1-2.0	4.2	1.8	4.0	0.10	37.9	173
4	MCN-4	PCR-4	1.8	1.1-2.0	4.2	2.7	3.8	0.14	45.3	131
5	MCN-5	DLM-29	2.2	<1.0	3.8	2.7	5.0	0.10	16.7	156
6	MCN-6	TM-18-8	1.9	<1.0	3.2	2.6	5.0	0.16	12.6	106
7	MCN-7	BIO-246	1.9	1.1-2.0	3.5	2.1	4.2	0.29	65.5	209
8	MCN-8	BIO-94	1.6	1.1-2.0	3.6	2.1	4.6	0.10	51.1	83
9	MCN-9	RL-90-1	1.8	1.1-2.0	3.8	2.6	4.0	0.15	17.1	62
10	MCN-10	RM-9	1.8	1.1-2.0	3.6	2.7	3.8	0.29	16.5	123
11	MCN-11	SKNM-90-13	2.1	1.1-2.0	4.0	2.2	4.4	0.38	16.5	206
12	MCN-12	SKNM-90-4	2.1	1.1-2.0	3.3	2.6	4.4	0.57	16.6	74
13	MCN-13	PR-8915	2.4	1.1-2.0	3.5	2.8	3.8	0.97	50.4	127
14	MCN-14	PR-8943	1.6	1.1-2.0	3.3	2.0	3.8	0.32	29.6	231
15	MCN-15	PSR-7	2.1	1.1-2.0	3.5	2.5	4.0	0.15	27.3	114
16	MCN-16	RSR-6	1.8	1.1-2.0	3.3	2.3	4.2	0.08	42.3	243
17	MCN-17	RSM-151	0.4	1.1-2.0	3.3	2.1	5.0	0.47	27.2	61
18	MCN-18	RW-873	1.7	1.1-2.0	2.6	2.0	5.0	0.48	51.4	153
19	MCN-19	RW-872	2.1	1.1-2.0	3.5	2.2	5.0	0.38	45.3	168
20	MCN-20	RK-919015	1.4	1.1-2.0	3.5	2.4	4.8	0.33	23.2	63
21	MCN-21	RK-919003	1.5	<1.0	3.0	2.0	4.4	0.28	54.3	79
22	MCN-22	RH-8824	2.1	1.1-2.0	2.2	2.6	5.0	0.14	20.8	173
23	MCN-23	RH-8922	1.7	1.1-2.0	3.7	2.8	5.0	0.48	21.3	137
24	MCN-24	RJ-9	1.9	<1.0	2.5	2.6	5.0	0.45	36.4	137
25	MCN-25	RJ-14	1.8	<1.0	3.3	2.9	4.8	0.09	31.9	104
26	MCN-26	KBJ-24	2.2	1.1-2.0	3.6	2.8	5.0	0.44	23.3	113
27	MCN-27	KBJ-28	1.7	1.1-2.0	3.1	2.9	5.0	0.47	26.8	106
28	MCN-28	JMM-90-12	1.6	1.1-2.0	3.0	3.0	5.0	0.06	17.5	132
29	MCN-29	JMM-90-13	2.3	1.1-2.0	3.5	3.1	5.0	0.18	29.0	179
30	MCN-30	RSM-9001	1.7	1.1-2.0	3.2	3.0	4.8	0.47	43.3	35
31	MCN-31	RSM-9007	1.6	1.1-2.0	2.8	3.0	4.8	0.10	25.3	81
32	MCN-32	HJ-002	1.3	1.1-2.0	3.5	3.1	4.8	0.83	56.6	122
33	MCN-33	PCR-5	1.2	1.1-2.0	3.2	2.8	4.8	0.29	51.9	124
34	MCN-34	VARUNA	1.2	1.1-2.0	4.2	2.7	5.0	0.11	21.7	203
35	MCN-35	KRANTI	1.8	1.1-2.0	3.8	3.0	5.0	0.29	29.5	83
36	MCN-36	ZC	1.9	1.1-2.0	4.3	3.0	4.8	0.35	40.1	142

1 - AII AT FLOWERING AND POD STAGE
2 - AII AT POD STAGE
3 - POPULATION OF L. ERYSIMI WAS NEGLIGIBLE(0 - 29 APHIDS /10 CM. CENTRAL TWIG/PLANT). POPULATION OF M.PERSICAE HAS BEEN PROVIDED IN THE TABLE.
4 - MEAN APHID POPULATION /5 CM. CENTRAL TWIG/ PLANT AT FLOWERING AND POD STAGE

KNG- Kangra, LDH-Ludhiana, PANT-Pantnagar, MOR-Morena, JUN-Junagardh, DOL- Dholi,

BTH-Bathinda, RAP- Raipur.

TABLE 4.1(A).4: LEAF MINER INCIDENCE IN MUSTARD ENTRIES IN IVT AT KANGRA DURING 1991-92

SN	CODE	ENTRY	PERCENT LEAF AREA INFESTED	NO.OF LARVAE AND PUPAE PER LEAF
1	MCN-1	SJN-191	27.2	2.4
2	MCN-2	DIRM-52	29.4	3.1
3	MCN-3	DIR-489	26.9	3.1
4	MCN-4	PCR-4	25.6	3.1
5	MCN-5	DLM-29	24.9	3.0
6	MCN-6	TM-18-8	23.8	2.4
7	MCN-7	BIO-246	32.9	2.9
8	MCN-8	BIO-94	27.4	3.6
9	MCN-9	RL-90-1	32.0	3.5
10	MCN-10	RM-9	29.9	2.7
11	MCN-11	SKNM-90-13	36.5	3.4
12	MCN-12	SKNM-90-4	34.4	3.5
13	MCN-13	PR-8915	35.6	3.4
14	MCN-14	PR-8943	29.4	3.9
15	MCN-15	PSR-7	29.8	3.8
16	MCN-16	RSR-6	36.8	3.2
17	MCN-17	RSM-151	25.0	3.1
18	MCN-18	RW-873	32.1	3.4
19	MCN-19	RW-872	32.5	3.1
20	MCN-20	RK-919015	31.8	2.5
21	MCN-21	RK-919003	32.6	3.0
22	MCN-22	RH-8824	29.0	3.0
23	MCN-23	RH-8922	40.8	3.9
24	MCN-24	RJ-9	31.1	3.0
25	MCN-25	RJ-14	24.6	2.2
26	MCN-26	KBJ-24	34.5	3.5
27	MCN-27	KBJ-28	29.6	3.1
28	MCN-28	JMM-90-12	32.6	3.6
29	MCN-29	JMM-90-13	37.0	3.0
30	MCN-30	RSM-9001	26.4	3.1
31	MCN-31	RSM-9007	20.2	2.6
32	MCN-32	HJ-002	28.7	3.4
33	MCN-33	PCR-5	32.2	3.6
34	MCN-34	VARUNA	29.6	2.7
35	MCN-35	KRANTI	30.0	2.7
36	MCN-36	RH-819	36.9	3.2

miner incidence at Kangra. The data have been presented in Table 4.1(A).4. Per cent leaf area infested was lowest in RSM-9007 (20.2%) and highest in RH-8922 (40.8%). Number of larvae and pupae per leaf was lowest in RJ-14 (2.2) and highest in PR-8943 (3.9).

ii) Screening of late sown mustard entries under IVT against mustard aphid

The trial was laid out at Dholi on 18.12.91 with 25 late sown mustard entries and Varuna, Pusa bold, Kranti, BR-40 and RAURD-1001 as checks. The data on aphid infestation index was recorded at pod stage. In all the entries including checks, aphid infestation index was very low (below 0.7).

iii) Screening of toria entries under IVT for major insect-pests

Morena:

20 toria entries were sown on 18.10.91 as per programme of work. There was heavy attack of painted bug and mild infestation by flea beetle. Per cent plant infestation by painted bug ranged from 60% (TH-9102) to 83% (TH-9101) (Table 4.1(A).5). Mean number of nymphs and adults ranged from 6.6 in PT-303 to 9.5 in DT-8. Per cent mortality due to painted bug infestation ranged from 3.3 in TWB-14/86 to 23.3 in PT-8857 and PBT-37. None of the lines was considered promising against the painted bug.

Raipur:

None of the 20 toria entries survived in the later part of the season due to heavy aphid infestation.

Hisar, Pantnagar, Berhampore:

All the toria entries escaped infestation by mustard aphid due to lack of coincidence in the pest appearance and crop season.

TABLE 4.1(A).5: INCIDENCE OF PAINTED BUG AND FLEA BEETLE ON TORIA ENTRIES TESTED UNDER IVT AT MORENA DURING 1991-92

SN.	CODE	ENTRY	PERCENT PLANT AFFECTED BY PAINTED BUG	NO.OF NYMPHS AND ADULTS OF PAINTED BUG PER PLANT (AVG.OF4 OBS)	PERCENT PLANT MORTALITY DUE TO PAINTED BUG	NO.OF FLEA BEETLE/PLANT (AVG OF 4 OBS)
1	TCN-1	PT-303	71	6.6	10.0	1.0
2	TCN-2	T-9	61	7.5	6.6	1.0
3	TCN-3	TK-9101	69	8.6	6.6	1.1
4	TCN-4	TK-9102	71	7.6	13.3	1.0
5	TCN-5	TH-9101	83	7.4	10.0	1.4
6	TCN-6	TH-9102	60	7.6	20.0	1.2
7	TCN-7	TWB-876-1	73	7.3	16.6	1.5
8	TCN-8	TWB-876-2	66	7.2	6.6	1.1
9	TCN-9	TWB-14/86	75	7.1	3.3	1.4
10	TCN-10	PT-8857	75	8.5	23.3	1.4
11	TCN-11	PT-9005	66	7.7	13.3	1.2
12	TCN-12	PBT-38	65	8.0	10.0	0.8
13	TCN-13	JMT-6901	81	9.1	6.6	1.0
14	TCN-14	JMT-688-1	70	8.2	16.6	1.3
15	TCN-15	DT-8	81	9.5	16.6	1.1
16	TCN-16	DT-10	71	8.9	13.3	1.8
17	TCN-17	SEJ-2	70	8.3	16.6	1.7
18	TCN-18	PPMS	81	9.4	20.0	1.1
19	TCN-19	PBT-37	79	9.1	23.3	0.9
20	TCN-20	TL-15	78	9.1	13.3	1.1

4.1(B)

Name of the Project : Uniform pest nursery trial-mustard aphid/ leaf miner

Objectives : To test the resistance response of promising Brassica lines at different locations against mustard aphid and leaf miner infestation

Locations : Kangra, Ludhiana, Bathinda, Hisar, Navgaon, Junagadh, Pantnagar, Kanpur, Faizabad, Raipur, Morena, Dholi, Berhampore

Progress of work :

Eighty seven, Brassica genotypes (UPN-1 to 87) were evaluated against mustard aphid at nine locations viz., Kangra, Ludhiana, Bathinda, Pantnagar, Morena, Raipur, Junagadh, Berhampore and Dholi. The data are presented in Table 4.1(B).1. The following lines have been identified as promising: DLC-1, GSL-8887, JMM-926, TMH-52 and MTM-1 at five locations; DLC-2, ISN-129, RE-5, GSL-8861 and GSL-1501 at four locations and RK-8602, RW-32-2, FM-23, FM-27, RSM-8904, GSL-8858, MTM-2, MTM-3 and HC-5 at three locations.

At Hisar, Kanpur, Navgaon and Faizabad, the trial was laid out as per the AICORPO programme, but the data could not be recorded as there was no aphid infestation.

TABLE 4.1(B).1: SCREENING OF BRASSICA GENOTYPES AGAINST MUSTARD APHID UNDER UNIFORM PEST NURSERY TRIAL AT DIFFERENT LOCATIONS DURING 1991-92

SN.	CODE	ENTRY	APHID INFESTATION INDEX (AII)							APHID POP.	
			1 KNG	2 LDH	2 PANT	1 MOR	2 JUN	2 BRH	2 DHOLI	3 BTH	4 RAP
1	UPN-1	CSR-83-58	2.5	1.1-2.0	4.3	-	4.2	-	0.1	31.1	58.5
2	UPN-2	RLC-1037	2.2	1.1-2.0	4.3	-	4.1	-	0.2	40.1	106.0
3	UPN-3	GLOSSY WHITE	-	-	-	-	-	0.3	-	0.0	55.0
4	UPN-4	RK-8802	2.0	1.1-2.0	3.8	-	3.3	0.4	0.1	24.3	56.5
5	UPN-5	RK-8605	2.0	1.1-2.0	3.7	-	4.2	0.2	0.5	22.1	74.5
6	UPN-6	DIARA-337	2.1	1.1-2.0	3.5	-	3.2	0.4	0.3	19.8	74.5
7	UPN-7	RN-26	2.1	<1.0	3.7	-	4.2	0.3	0.4	32.9	169.0
8	UPN-8	RW-29-6	2.2	1.1-2.0	4.2	-	4.1	0.5	0.9	51.0	121.0
9	UPN-9	RLM-198	1.8	1.1-2.0	3.7	-	3.8	0.9	0.9	18.7	162.5
10	UPN-10	NDM-87-1	2.1	<1.0	3.2	-	3.9	0.6	0.2	24.5	101.5
11	UPN-11	KRANTI	2.2	<1.0	3.2	-	3.9	0.2	0.5	40.0	146.5
12	UPN-12	RK-8602	2.2	<1.0	3.8	-	3.4	0.1	0.6	41.1	48.0
13	UPN-13	RLC-1026	1.9	1.1-2.0	3.7	-	3.7	0.6	0.9	28.2	130.0
14	UPN-14	RN-170	1.9	<1.0	3.5	-	3.6	0.4	0.4	20.5	52.0
15	UPN-15	GSB-7027	1.5	1.1-2.0	1.7	-	3.7	0.5	0.2	4.1	-
16	UPN-16	RW-2-2	1.8	1.1-2.0	4.2	-	4.3	0.5	0.6	21.1	78.5
17	UPN-17	PR-8805	2.1	1.1-2.0	4.3	-	3.9	0.9	0.3	23.7	103.5
18	UPN-18	DLC-1	2.0	<1.0	0.0	-	3.2	0.6	0.3	0.9	50.5
19	UPN-19	R-7006	1.7	1.1-2.0	1.0	-	-	0.5	1.0	3.9	-
20	UPN-20	RK-8701	1.8	1.1-2.0	4.0	-	3.5	0.5	0.6	27.2	61.0
21	UPN-21	T-27	1.8	<1.0	1.7	-	3.0	-	3.0	39.2	-
22	UPN-22	RLC-1036	2.0	1.1-2.0	3.8	-	3.8	0.5	0.4	19.3	109.5
23	UPN-23	HC-2	1.7	1.1-2.0	3.8	-	4.2	0.7	0.5	16.8	-
24	UPN-24	DLC-2	2.1	<1.0	0.0	-	-	0.5	1.0	4.1	52.0
25	UPN-25	RH-7847	2.1	1.1-2.0	3.8	-	4.4	0.5	0.3	18.1	44.5
26	UPN-26	RW-32-2	2.3	<1.0	3.3	-	4.5	0.3	0.1	54.2	170.0
27	UPN-27	NDR-8602	2.2	1.1-2.0	3.5	-	4.4	0.1	0.3	30.5	107.5
28	UPN-28	CSR-83-155	2.0	1.1-2.0	3.4	-	3.9	0.6	0.5	32.5	75.5
29	UPN-29	RLC-1035	2.1	1.1-2.0	3.4	-	3.6	0.7	0.2	50.5	51.0
30	UPN-30	BSH-1	2.2	1.1-2.0	3.2	-	3.9	0.3	1.0	43.6	162.0
31	UPN-31	RLC-1033	2.4	1.1-2.0	3.8	-	3.7	-	0.4	31.9	89.5
32	UPN-32	VARUNA	1.9	1.1-2.0	4.0	-	3.9	0.4	1.1	11.4	126.0
33	UPN-33	GSB-7027	1.5	1.1-2.0	1.0	-	3.6	0.7	3.2	4.3	127.0
34	UPN-34	BSH-1	2.5	2.1-3.5	5.0	-	5.0	-	3.2	18.7	104.0
35	UPN-35	CSR-83-268	2.1	1.1-2.0	4.2	-	4.8	0.9	3.3	23.6	97.0
36	UPN-36	NDR-8601	2.4	1.1-2.0	3.8	-	4.0	-	2.5	47.7	125.0
37	UPN-37	NIE-2	2.2	<1.0	1.3	3.0	4.9	-	3.6	16.3	545.0
38	UPN-38	RE-21	2.8	1.1-2.0	2.8	2.5	4.6	-	1.5	10.0	93.0
39	UPN-39	DNWF-1	2.0	<1.0	3.2	2.7	5.0	-	1.4	13.8	153.5
40	UPN-40	GSL-8887	0.9	<1.0	0.3	3.0	3.6	-	3.4	8.3	49.0
41	UPN-41	ISN-129	1.2	<1.0	0.3	3.1	3.9	-	3.4	4.5	-
42	UPN-42	GSL-8876	1.6	1.1-2.0	1.7	2.4	4.1	-	-	15.3	-
43	UPN-43	RE-5	1.2	<1.0	0.0	3.1	3.8	-	3.1	4.7	133.0
44	UPN-44	GSL-8861	1.3	<1.0	0.0	3.0	4.1	-	4.1	2.8	52.5
45	UPN-45	FM-23	1.6	<1.0	0.3	3.1	3.5	-	4.0	12.3	30.5

(Contd.)

1. Mean(AII) at flowering and pod stage. 2. AII at pod stage.
3. Population of M. parsicea is given on 10 cm twig per plant.
4. Mean aphid population on 5 cm central twig/plant at flowering and pod stage.

~~Table 4.1(B).1 contd.~~

SN.	CODE	ENTRY	APHID INFESTATION INDEX (AII)							APHID POP.	
			1	2	2	1	2	2	2	3	4
			KNG	LDH	PANT	MOR	JUN	BRH	DHOLI	BTH	RAF
46	UPN-46	GSL-1509	1.9	1.1-2.0	2.3	3.0	4.5	-	4.0	4.7	78.5
47	UPN-47	FM-27	1.6	<1.0	0.0	3.1	4.4	-	-	1.9	72.0
48	UPN-48	RH-8701	2.5	1.1-2.0	3.8	1.7	4.9	-	1.7	10.9	55.5
49	UPN-49	JGM-9054	2.3	<1.0	4.0	1.3	5.0	-	1.5	18.0	116.5
50	UPN-50	RSM-8904	1.9	<1.0	4.7	1.4	5.0	-	0.3	5.2	206.0
51	UPN-51	JGM-9062	2.2	<1.0	3.7	1.7	5.0	-	1.4	13.9	-
52	UPN-52	RK-9001	2.4	<1.0	4.2	2.0	4.7	-	0.4	22.4	192.5
53	UPN-53	TM-18	1.9	1.1-2.0	3.3	2.8	5.0	-	2.9	18.6	78.0
54	UPN-54	PCR-3	2.8	<1.0	3.3	2.3	4.8	-	1.3	13.8	99.0
55	UPN-55	EAL-9	2.3	<1.0	2.2	3.4	-	-	-	10.6	133.5
56	UPN-56	PCR-7	2.5	1.1-2.0	3.7	1.5	4.3	-	0.8	17.3	95.5
57	UPN-57	GSL-1501	1.4	<1.0	0.0	3.3	4.5	-	0.4	2.3	17.5
58	UPN-58	GSL-8858	1.4	<1.0	0.7	2.8	4.4	-	-	2.4	20.5
59	UPN-59	CE-9	1.4	<1.0	0.0	2.7	4.4	-	1.3	12.7	179.0
60	UPN-60	GSB-7006	1.5	1.1-2.0	0.3	2.5	4.7	-	2.5	2.9	-
61	UPN-61	RK-8002	2.1	1.1-2.0	3.2	2.0	4.9	-	0.8	7.8	72.0
62	UPN-62	T-27	1.1	<1.0	0.8	1.8	3.1	-	0.5	23.5	76.0
63	UPN-63	RK-8903	2.7	1.1-2.0	3.0	2.1	4.9	-	0.1	15.7	80.5
64	UPN-64	RSK-64	2.4	1.1-2.0	3.3	1.7	4.9	-	0.3	24.8	96.5
65	UPN-65	JMM-926	2.2	1.1-2.0	4.0	1.9	4.9	-	-	19.6	128.0
66	UPN-66	RSK-69	2.4	1.1-2.0	3.8	2.3	5.0	-	0.9	36.0	92.5
67	UPN-67	RJ-12	1.5	1.1-2.0	4.2	1.4	-	-	0.7	9.9	87.5
68	UPN-68	BSH-1	2.3	1.1-2.0			5.0	-	1.0	17.2	-
69	UPN-69	TMH-52	0.9	1.1-2.0	0.5	1.4	3.0	-	3.6	7.7	89.0
70	UPN-70	PR-8905	2.2	1.1-2.0	3.7	1.9	4.6	-	0.1	20.6	286.5
71	UPN-71	NDR-190	2.7	2.1-3.5	4.0	2.1	4.6	-	0.2	30.0	77.5
72	UPN-72	PR-8906	2.2	1.1-2.0	3.8	1.6	4.5	-	0.5	15.5	64.0
73	UPN-73	PR-8903	2.0	1.1-2.0	3.2	2.4	4.7	-	0.5	26.6	84.5
74	UPN-74	NDYR-1	1.4	1.1-2.0	2.5	2.4	4.8	-	0.7	26.1	176.0
75	UPN-75	RSM-151	1.0	1.1-2.0	4.2	2.2	5.0	-	0.8	9.5	79.5
76	UPN-76	SSK-13	3.8	1.1-2.0	5.0	2.3	5.0	-	3.3	12.0	180.0
77	UPN-77	SKNM-90-14	1.6	1.1-2.0	4.2	1.6	5.0	-	-	11.8	77.0
78	UPN-78	SSK-6	2.4	1.1-2.0	5.0	2.1	5.0	-	0.9	16.5	156.5
79	UPN-79	RSK-69	1.8	2.1-3.5	3.5	2.1	-	-	0.3	24.6	131.5
80	UPN-80	SKNM-90-13	1.3	1.1-2.0	3.0	1.7	5.0	-	2.0	34.5	131.5
81	UPN-81	RSK-33	1.5	1.1-2.0	3.0	2.6	5.0	-	0.5	10.2	99.5
82	UPN-82	RSK-64	1.5	1.1-2.0	2.5	2.3	5.0	-	2.0	40.1	118.5
83	UPN-83	CS-52	2.0	1.1-2.0	2.5	2.7	4.9	-	0.2	19.7	4.5
84	UPN-84	MTM-2	1.7	1.1-2.0	0.3	2.7	3.0	-	2.7	12.5	24.5
85	UPN-85	MTM-3	1.1	1.1-2.0	0.0	2.6	3.0	-	4.4	12.7	-
86	UPN-86	MTM-1	1.2	1.1-2.0	0.0	2.6	3.0	-	1.8	2.5	5.5
87	UPN-87	HC-5	1.5	<1.0	0.0	3.3	4.2	-	2.1	10.4	41.0

4.2

Name of the Project : Basis of resistance against mustard aphid in Brassica crops

Objectives : To investigate the basis of resistance in promising Brassica genotypes to mustard aphid

Locations : Ludhiana, Hisar, Pantnagar, Faizabad and Kanpur

Progress of work :

Ludhiana:

This experiment included nine strains of Brassica species and one of Eruca sativa. The biological parameters like fecundity of the mother aphid, nymphal survival and nymphal period were studied on cotyledonary to 2-leaf stages on the potted plants in the screen house. Fecundity was lowest on T-27 and maximum on BSH-1, susceptible check (Table 4.2.1). Among B.carinata strains, the fecundity was much lower on DLC-2. Among B.juncea strains, T-6342 and RW-32-2 faired better than others. All the entries, however, suppressed the aphid fecundity in comparison to BSH-1. Complete nymphal mortality was observed in T-27 and lowest in BSH-1 (7.8 per cent) while it ranged from 12.2 to 24.8 per cent in other strains. No effect of various strains of Brassica species was observed on the nymphal duration of mustard aphid. Based on these parameters, T-27, DLC-2, RH-7847, T-6342, RW-32-2 were adjuged more promising against the mustard aphid.

Data on seedling survival in the screen house (Table 4.2.1) revealed that 35 days of sowing, except Rohini and BSH-1, all entries had seedling survival of more than 70 per cent. However, after 40 days of sowing, only DLC-1 had more than 60 per cent seedling survival.

The data on aphids settling response under the free choice feeding test on some promising strains (Table 4.2.2) indicated that none of the entries had less than 5 aphids/seedling after 3 days of release, while RH-7847, DLC-1, RW-2-2 and RW-32-2 harboured between 6-10 aphids/seedling. The strains T-6342, Rohini and T-27 seemed to be preferred during initial settling indicating preference of these entries by the aphid. After 7 days of release, only T-27 had the lowest number of aphids settled (6-10 aphids per seedling) indicating a resistance factor in it. Rest of the entries had more than 11 aphids per seedling.

Under field testing, observations on the per cent plant infestation, aphid population counts/plant and aphid injury grades were recorded at the full bloom stage of crop growth (Table 4.2.3.). The extent of infested plants was less than

TABLE 4.2.1: BIOLOGICAL PARAMETERS OF MUSTARD APHID AND SEEDLING SURVIVAL FOR STRAINS OF BRASSICA SPP. AND ERUCA SATIVA AT LUDHIANA DURING 1991-92

SPECIES	GENOTYPE	FECUNDITY PER FEMALE	PERCENT NYMPHAL MORTALITY	DAYS OF NYMPHAL DURATION	SEEDLING SURVIVAL(%) IN FREE CHOICE FEEDING 35 DAS	45DAS*
B.juncea	T-6342	35.4	19.7	13.5	84.6	30.7
	RH-7847	40.9	23.3	12.6	83.3	0
	RW-32-2	37	24.8	12.6	72.2	16.7
	RW-2-2	42.2	17.2	13.8	78.3	0
	ROHINI	51.9	12.9	12.6	30	0
B.carinata	DLC-1	61.8	22	12.6	88.2	64.6
	DLC-2	28.4	12.2	11.6	80	33.3
	HC-2	46	16.2	12.4	83.3	25
B.campestris	BSH-1	74.4	7.8	12.3	61.1	0
Eruca sativa	T-27	13.5	100	-	70	25

* DENOTES DAYS AFTER SOWING

TABLE 4.2.2 :FREE CHOICE FEEDING TEST FOR MUSTARD APHID ON SOME PROMISING STRAINS OF BRASSICA SPP. AND ERUCA SATIVA AT LUDHIANA DURING 1991-92

NO. OF APHIDS SETTLED/SEEDLING AFTER THREE DAYS		NO. OF APHIDS SETTLED /SEEDLING AFTER 7 DAYS	
CATEGORY (APHIDS/SEEDLING)	STRAIN	CATEOGRY (APHIDS/SEEDLING)	STRAIN
<5	NIL	<5	NIL
6-10	RH-7847,	6-10	T-27
	DLC-1,	11-15	RH-7847,
	RW-2-2,		BSH-1,
	RW-32-2		DLC-1,
11-15	HC-2,		RW-2-2,
	BSH-1,		RW-32-2
	DLC-2	>16	T-6342,
>16	T-6342,		ROHINI,
	ROHINI,		HC-2
	T-27		DLC-2

25% in T-27 and HC-2 strains while T-6342, RH-7847, RW-32-2 and DLC-2 registered 26-30% plants infestation. The remaining four entries had more than 51% infestation of plants while in BSH-1, more than 75% plants got infested. The mean aphid population/plant was below 100 aphids per plant in T-27, HC-2 and DLC-2 while the remaining seven entries harbourbd more than 200 aphids/plant. The aphid infestation index (AII) was below 1.0 in T-6342, T-27, HC-2, DLC-2 and RW-2-2, while in all others, the AII ranged from 1.1-2.0 as compared to 2.72 in BSH-1 being the highest. These results have confirmed that five strains, namely; T-27 T-6342, HC-2, DLC-2 and RW-2-2 possess high resistance to the aphid.

Hisar:

The data on morphological traits of 15 lines have been provided in Table 4.2.4. All the lines escaped aphid infestation. As already stated in the field and laboratory screening trials, most of these lines exhibited moderate to high level of resistance to the mustard aphid at different locations. However, no correlation could be established betwwen the morphological traits studied at Hisar and the resistance response of these entries.

Pantnagar:

The experiment was conducted under three conditions viz; field, laboratory and glass house. In field, five plants in each line were covered with muslin cloth and kept straight with the help of bamboo sticks. In each cage 10 freshly laid nymphs were released on 17.2.92 and weekly observations were taken on the population build up.

The same entries were also sown in the glass house and when plants grew to four-leaf stage, 10 nymphs per leaf were released on 18.3.92 and final population was taken on 31.3.92. This was replicated 5 times.

In third experiment conducted under laboratory condition, leaves of each entry were taken and their petioles were wrapped with wet cotton to keep them turgid for longer period. These leaves were kept inside the plastic petridishs having moist filter paper at the bottom. Ten first instar nymphs were released on each leaf on 21.3.92. The food was changed daily and the number of aphids counted.

Based on the results of all the three experiments conducted, entries DLC-1, RW-2-2, T-6342, GBS-7027, T-27, RH-7847 and RW-32-2 were adjudged more promising against mustard aphid whereas YST-151, B.alba, BSH-1, PT-303 and RW-29-6 were highly susceptible (Table 4.2.5).

At Faizabad and Kanpur, the experiment could not be completed becuase the crop escaped aphid incidence.

CONCLUSIONS

1. On the basis of field testing for pest resistance at different locations in IVT, following mustard lines have been identified promising against mustard aphid.

   DIRM-52, DLM-29, RK-919015 and RSM-9007 at three locations; TM-18-8, RJ-9, RJ-14, RM-9 and DIR-489 at two locations

2. The results of UPN trial revealed that following lines possessed moderate to high level of resistance to mustard aphid:

   DLC-1, GSL-8887, JMM-926, TMH-52 and MTM-1 at five locations; DLC-2, ISN-129, RE-5, GSL-8861 and GSL-1501 at four locations; RK-8602, RW-32-2, FM-23, FM-27, RSM-8904, GSL-8858, MTM-2, MTM-3 and HC-5 at three locations

   DLC-1,DLC-2 and RW-32-2 were also found promising at multilocations in UPN trial during 1990-91

3. Field and laboratory testing of five strains namely; T-6342, RW-2-2, DLC-1, DLC-2 and T-27 confirmed their high level of aphid resistance. Further it was observed that these lines possessed non-preference and antibiosis type of resistance.

TABLE 4.2.3:FIELD TESTING OF SOME PROMISING STRAINS OF BRASSICA FOR APHID RESISTANCE AT LUDHIANA DURING 1991-92

PERCENT PLANT INFESTATION		MEAN APHID POPULATION PER PLANT		APHID INFESTATION INDEX	
CATEGORY	GENOTYPE	CATEGORY	GENOTYPE	CATEGORY	GENOTYPE
<25	T-27,	<50	T-27	0-1	T-6342
	HC-2	51-100	DLC-2,		T-27,
26-50	T-6342,		HC-2		DLC-2,
	RH-7847,	101-200	NIL		RW-2-2,
	DLC-2,	>200	T-6342,		HC-2
	RW-32-2		ROHINI,	1.1-2	ROHINI,
51-75	ROHINI		BSH-1,		RH-7847,
	DLC-1		RH-7847,		RW-32-2,
	RW-2-2		DLC-1,		DLC-1
>75	BSH-1		RW-2-2,	2.1-3.5	BSH-1
			RW-32-2	3.6-5.0	NIL

TABLE 4.2.4: BASIS OF MUSTARD APHID RESTSTANCE IN ELITE BRASSICAS AT HISAR

CULTIVAR	COLOUR OF STEM	COLOUR OF FLOWER	SETTING OF FLOWERS ON INFLORESCENCE
**(RW-29-6)	-	-	-
ERUCA SATIVA (T-27)	GLOSSY	GREENISH YELLOW	SPARSE
B.JUNCEA(RW-33-2)	GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(T-6342)	NON GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(RH-7847)	NON GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(SEETA)	NON GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(B-85 GLOSSY)	GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(RH-7846)	NON GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(RW-2-2)	NON GLOSSY	YELLOW	SEMI COMPACT
B.JUNCEA(RLM-198)	NON GLOSSY	YELLOW	SEMI COMPACT
B.CARINATA(DLC-2)	NON GLOSSY	YELLOW	SEMI COMPACT
B.CARINATA	NON GLOSSY	WHITISH YELLOW	SPARSE
B.CARINATA(HC-2)	NON GLOSSY	YELLOW	SPARSE
B.CAMPESTRIS(BSH-1)	NON GLOSSY	BRIGHT YELLOW	COMPACT
B.NAPUS(GBS-7027)	NON GLOSSY	BRIGHT YELLOW	COMPACT

**DENOTES NO GERMINATION

TABLE 4.2.5: TESTING OF SOME PROMISING STRAINS/SPP. OF BRASSICA AND E. SATIVA AGAINST MUSTARD APHID AT PANTNAGAR DURING 1991-92

ENTRY	AVERAGE NO. OF APHIDS /PLANT		
	LABORATORY CONDITION (11 DAR)	GLASS HOUSE CONDITION (13 DAR)	FIELD CONDITION (33 DAR)
DLC-1	16.2	24	92
DLC-2	20.8	46	112
HC-2	20.8	40	181
B.ALBA	20.2	66	380
B.NIGRA	18	42	260
YST-151	24.2	62	296
PT-303	24.2	32	391
BSH-1	36.2	50	244
GBS-7027	18.6	30	188
RH-7847	19.4	48	162
RW-32-2	19.8	40	219
RW-2-2	12.8	32	110
RW-29-6	20.8	68	228
T-6342	19.6	18	107
T-27	20	42	100
CD AT 5%	1.04	4.32	10.54

DAR DENOTES DAYS AFTER RELEASE

4.3

Name of the Project : Population dynamics of various insect-pests of *Brassica* crops

Objectives : To study the seasonal incidence of major insect pests of *Brassica* crops in relation to biotic and abiotic environmental factors

Locations : Kangra, Ludhiana, Bathinda, Hisar, Morena, Navgaon, Pantnagar, Faizabad and Kanpur

Progress of work :

Kangra:

Population dynamics of aphid and leaf miner was studied on six strains of *Brassica* viz; yellow sarson, brown sarson, *B.juncea*, *B.napus* and *B.carinata* (Table 4.3.1). The mustard aphid appeared in February on yellow sarson, brown sarson, Varuna and *B.napus*. However, on *B.carinata* it was seen in the third week of March. *C.horticola* appeared in 3rd week of March. on all cultivars and remained active upto 3rd week of April. Rainfall had adverse effect on its population.

Ludhiana:

The seasonal fluctuations in the population and per cent plant infested by mustard aphid were studied on one strain each of *B. campestris* (BSH-1), *B.carinata* (PC-5) and *Eruca sativa* (TMLC-2), two strains of *B.napus* (GSL-1 and GSL-8851) and three strains of *B.juncea* (RLM-1359, yellow raya and S-Yn-I-J) at weekly intervals (Table 4.3.2).

The mustard aphid appeared in the begining of January, 1992 and remained at a low level throughout the season. The maximum population recorded on BSH-1, RLM-1359 and TMLC-2 strains was only 21.7, 23.9 and 18.7 aphids per plant, respectively, during the month of January. The population on all the strains declined during the month of February. There were frequent rains during January-February and this probably prevented the aphid population from increasing during this period. Heavy rainfall of more than 38.3 mm was recorded during the first week of February and eventually the aphid population declined thereafter.

On *B.napus* and *B.carinata*, the aphid appeared quite late during second fortnight of February and the peak population reached during the first week of March, maximum being 50 aphids per plant. The maximum and minimum temperature and relative humidity during the preceeding week were 24.7°C and 10.8°C and 86% and 44% respectively, which were quite favourable for aphid multiplication. All other *Brassica*

TABLE 4.3.1: POPULATION DYNAMICS OF MUSTARD APHID AND LEAF MINER ON VARIOUS BRASSICA SPP. AT KANGRA DURING 1991-92

	FEBRUARY				MARCH				APRIL			
SPECIES	I	II	III	IV	I	II	III	IV	I	II	III	IV
B.CAMPESTRIS	0*	42.8	43.5	56.3	66.3	69.3	11.9	3	0	0	0	0
VAR.Y SARSON	(-)**	(-)	(-)	(-)	(-)	(-)	(45.1)	(33.5)	(25)	(14.5)	(5.3)	(-)
B.CAMPESTRIS	0	32	37	39.2	42.5	64.7	2.5	0	0	0	0	0
(BSH-1)	(-)	(-)	(-)	(-)	(-)	(-)	(31.9)	(19.8)	(16.2)	(-)	(-)	(-)
B.JUNCEA	0	5.2	36.3	76.6	72.5	12.2	6.8	0	2.1	4	0	0
(VARUNA)	(-)	(-)	(-)	(-)	(-)	(-)	(38.3)	(6.1)	(-)	(-)	(-)	(-)
B.JUNCEA	0	0	0	48.9	27.4	48.4	17.5	5.7	0	0	0	0
(RCC-4)	(-)	(-)	(-)	(-)	(-)	(-)	(32.5)	(26.5)	(26.6)	(10.3)	(4.5)	(-)
B.NAPUS	0	0	0	2	34.3	76.4	41.9	22.4	8.8	6.7	0.7	0
	(-)	(-)	(-)	(-)	(-)	(-)	(1.2)	(4.1)	(2.8)	(4.4)	(1.9)	(-)
B.CARINATA	0	0	0	0	0	0	4.1	3.1	7.1	7.1	5.5	0.
	(-)	(-)	(-)	(-)	(-)	(-)	(0.2)	(11.9	(5.8)	(2.3)	(0.9)	(-)
RAINFALL (MM)	68.4	101.7	39.5	0	2.4	16.5	0	55.7	0	0	0	0

* NO. OF APHIDS ON 10 CM . TWIG PER PLANT.

** NO. OF LEAF MINER LARVAE AND PUPAE PER 9 LEAVES

crops had already matured by this time and, therefore, the aphid multiplied rapidly on the succulent plants of B.carinata and B.napus.
The incidence of predators viz; coccinellid beetles, syrphid flies and green lace wing remained very low upto the end of February and increased only during March.

Bathinda:

Two cultivars of B.carinata (C-6501, DLC-1) and one each of B.napus (GSL-1), B.alba (WM-6504), B.campestris (BSH-1) and B.juncea (RLM-619) were grown in a replicated trial. Observations from ten plants in each cultivar were recorded on the incidence of various pests. The population of Lipaphis erysimi was very low and never reached more than 1 individual per central shoot. Population of Myzus persicae started building up only towards the end of March and a maximum of 19.8 aphids per 10 cm central twig were recorded on B.napus (GSL-1). Leaf miner, though appeared in December but its population remained low till March when a maximum of 2.2 larvae and pupae per leaf were recorded on B.napus (GSL-1) on 21.3.92. Population of natural enemies such as coccinellid beetles and Chrysopa sp. was also very low throughout the crop season.

Hisar:

i) Toria:

The ants took away the seeds immediately after sowing as seen in good numbers near the bunds, water channels and ant burrows. The incidence of thrips was observed on the flowers, few of the plants which flowered early had, as maximum as 20-25 thrips per flower bud. The incidence resulted in flowers sterility in few cases. This is a new pest recorded on this crop. Mustard aphid incidence was very mild and only 50 colonies appeared towards the end of November on Toria' crop in 250 sqm. area. The aphids were preyed upon by Lady bird beetles i.e. Coccinella septempunctata, Menochilus sp. Hippodemia sp. and Lace wing, Chrysoperla sp. Incidence of larger moth was recorded on pod stage. The larvae tied the pods with webs and fed on pods by making holes into them. Few of the plants remained without pods due to this pest's attack. The parrots took away the pods from toria plants at maturity in unwatched fields.

ii) Brassica juncea, B.napus, B.carinata

The incidence of cutworm was more severe i.e. 1-2 cut plants/5m row in case of fields where irrigation was given at belated stage. Besides, L.erysimi, Myzus persicae (40-50 % colonies) also appeard in January. Three colour morphs i.e. pale green, red and grey appeared in the population of M.persicae, of which the first ones were predominant. There was a severe incidence of pea leaf miner on the germinating crop of *B.juncea* and *B.carinata* i.e. 2-3 mines per leaf, but the leaves of *B.napus* remained free of it in the seedling stage. The painted bug appeared on the harvested crops of mustard, karan sarson and gobhi sarson but remained very low because of low humidity in the month of March, 1992. The thrips also invaded the flowers of these crops i.e. 6-10 thrips per bud but their population declined because of predation by anthrocorid bugs. Incidence of sawfly was more on late sown (i.e. 20.11.91) mustard crop, but vanished after irrigation was applied. The aphid population appeared in low numbers i.e. maximum 350/plants in January, but it was soon overpowered by lady bird beetles and syrphids and also owing to maturity of these crops. Upto 8-10% plants were infested by mustard aphid in yellow sarson, however, the strains of *B.juncea*, *B.carinata* and *Eruca sativa* remained free of aphid infestation. The Dove' was seen eating over the developing buds of *B.napus* crop. In few of the genotypes alsmost all the buds were eaten away by the doves.

Morena:

i) Toria

Toria crop was attacked by painted bug and flea beetle at various stages of the crop growth. Flea beetle appeared at the seedling as well as vegetative stage of the crop, but did not cause the economic damage. The informations on fluctuation in insect-pests population on toria are presented in Table 4.3.3. On an average maximum of 10.3 and 12.1 nymphs and adults of painted bugs were observed on 26.10.91 on T-9 and PT-303, respectively, which declined to 0.3 and 0.5 nymphs and adults on 16.11.91 owing to crop maturity. The population of flea beetles was very low throughout the crop growth period.

ii) Mustard and Brown Sarson

These crops were attacked by painted bug, flea beetle, mustard sawfly and mustard aphid. Of these, mustard aphid was more serious (Table 4.3.4).

Populations of painted bugs, flea beetles and sawfly were confined to the seedling and vegetative stages of the crop. In GLS-1, the incidence of flea beetle again appeared at the pod stage of the corp.

The first colony of mustard aphid on brown sarson (BSH-1) was observed on 17.12.91. The aphid population declined in late December due to hailstorm on 24.12.91. Brown sarson had the higher number of aphids (32.8 nymphs and adults/plant) than Pusa bold and GLS-1. Predator, *Coccinella septempunctata* appeared late in the season.

Navgaon:

TABLE 4.3.2: SEASONAL INCIDENCE OF MUSTARD APHID ON DIFFERENT BRASSICA SPP. /STRAINS AT LUDHIANA DURING 1991-92

DATE OF OBSERVA-TION	METEOROLIGICAL PARAMETERS						SPECIES /STRAINS							
	TEMP. (°C)		MEAN RH (%)		SUN SHINE (hrs.)	RAIN-FALL (mm)	BSH-1	RLM-1359	YELLOW RAYA	S-Yn-I-J	GSL-1	GSL-8851	PC-5	TMLC-2
	MAX.	MIN.	MOR.	EVE.										
3.1.92	15.6	6.1	95	70	4.9	0	*9.6 **(35.0)	7.2 (21.7)	8.6 (18.3)	10.1 (28.3)	0 (0)	0 (0)	0 (0)	7.6 (26.7)
10.1.92	17.4	4.5	93	47	7.9	0	21.3 (36.6)	14.5 (38.3)	14.7 (36.6)	14.6 (26.6)	0 (0)	0.8 (3.3)	0 (0)	15.6 (51.6)
.8.1.92	15.6	7.6	95	78	2.6	20.8	16.8 (36.6)	17.6 (38.3)	21.8 (30.0)	15.2 (30.0)	0 (0)	0 (0)	0 (0)	17.2 (58.3)
4.1.92	18.0	3.8	98	63	6.1	0	17.1 (35.0)	15.0 (31.6)	16.5 (28.3)	17.4 (33.3)	0 (0)	0 (0)	0 (0)	18.7 (50.0)
1.1.92	19.8	9.0	95	65	3.9	6.2	21.7 (60.0)	23.9 (56.6)	20.0 (43.3)	19.9 (38.3)	0 (0)	0 (0)	0 (0)	12.8 (73.3)
.2.92	17.5	10.1	94	75	8.6	0	7.1 (13.3)	14.6 (20.0)	8.6 (13.3)	11.5 (16.6)	0 (0)	0 (0)	0 (0)	7.0 (13.3)
4.2.92	17.1	7.2	96	67	6.2	38.3	16.0 (21.6)	23.6 (30.0)	16.8 (21.6)	24.2 (33.3)	0 (0)	0 (0)	0 (0)	9.6 (41.7)
1.2.92	19.1	7.0	89	54	7.2	4.1	0 (0.0)	0 (0)	0 (0.0)	0 (0.0)	0 (0)	0 (0)	8.4 (0)	12.0 (30.0)
8.2.92	20.0	5.9	92	48	8.8	0	0 (0.0)	0 (0)	0 (0.0)	0 (0.0)	29 (13)	0 (0.0)	58.0 (20.6)	0 (0)
.3.92	24.7	10.8	86	44	8.8	0	- (0.0)	- (0)	- (0.0)	- (0.0)	- (55)	- (53.3)	- (43.3)	- (0)

DENOTES NO. OF APHIDS PER PLANT
* DENOTES PER CENT PLANTS INFESTED BY APHID

ABLE :4.3.3 INCIDENCE OF MAJOR INSECT-PESTS ON TORIA AT MORENA DURING 1991-92

ATE OF OBSERVA-TION	TEMP. (°C)		RAIN-FALL (mm)	MEAN NUMBER OF PAINTED BUG NYMPHS & ADULTS/PLANT		MEAN NO. OF FLEA BEETLE ADULTS PER PLANT	
	MAX.	MIN.		T-9	PT-303	T-9	PT-303
3-9-91	33.6	14.6	-	1.3	1.5	0.2	0.3
-10-91	31.3	16.3	-	3.7	2.9	0.5	0.3
2-10-91	28.7	12.4	7.3	4.5	5.1	0.9	1.2
9-10-91	25.1	10.9	-	6.9	6.3	1.3	1.4
5-10-91	26.7	8.5	-	10.3	12.1	1.8	1.6
-11-91	25.8	8.0	-	9.7	10.3	0.5	0.3
-11-91	24.7	6.5	-	2.5	2.2	0.1	0.0
5-11-91	24.6	7.7	-	0.3	0.5	NIL	NIL
3-11-91	21.3	9.2	2.3	NIL	NIL	-	-
0-11-91	17.8	6.1	38.2	-	-	-	-

TABLE:4.3.4 INCIDENCE OF MAJOR INSECT-PESTS ON MUSTARD AND SARSON VARIETIES AT MORENA DURING 1991-92

TIME OF OBSER-VATION	TEMP.(°C) MAX.	TEMP.(°C) MIN.	RAIN-FALL (mm)	MEAN NUMBER OF: PAINTED BUG NYMPHS & ADULTS PER PLANT			FLEA BEETLE ADULTS/PLANT			SAWFLY MAGGOTS PER PLANT			APHIDS PER PLANT			PREDATORS PER APHID COLONY		
				PUSA BOLD	BSH-1	GSL-1	PUSA BOLD	BSH-1	GSL-1	PUSA BOLD	BSH-1	GSL-1	PUSA BOLD	BSH-1	GSL-1	PUSA BOLD	BSH-1	GSL-1
5.11.91	28.7	12.4	7.3	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
12.11.91	25.1	10.9	-	0.3	0.5	0.1	0.1	0.3	0.2	-	-	-	-	-	-	-		
19.11.91	26.7	8.5	-	0.5	0.2	0.2	0.4	0.3	0.3	-	-	-	-	-	-	-		
26.11.91	25.8	8.0	-	0.3	0.3	0.4	0.1	0.0	0.2	0.1	0.0	0.2	-	-	-	-		
3.12.91	24.7	6.5	-	0.1	0.5	0.1	0.0	0.3	0.2	0.0	0.2	0.2	-	-	-	-		
10.12.91	24.6	7.7	-	-	-	-	0.1	0.0	0.1	0.2	0.3	0.5	-	-	-	-		
17.12.91	21.3	9.2	-	-	-	-	-	-	-	0.1	0.0	0.3	-	0.3	-	-		
24.12.91	17.8	6.1	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-		
31.12.91	20.9	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
7.1.92	21.3	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
14.1.92	21.3	3.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
21.1.92	25.1	6.1	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-		
28.1.92	21.5	7.6	2.5	-	-	-	-	-	-	-	-	-	0.5	1.3	-	-		
4.2.92	20.9	5.7	0.0	-	-	-	-	-	-	-	-	-	3.5	12.3	0.1	-		
11.2.92	22.9	5.4	-	-	-	-	-	-	-	-	-	-	20.3	32.8	3.1	-		
18.2.92	24.6	7.1	-	-	-	-	-	-	-	-	-	-	23.4	29.9	8.5	-		
25.2.92	29.3	9.1	-	-	-	-	-	-	-	-	-	-	25.0	12.3	10.5	-		
3.3.92	29.4	10.8	-	-	-	-	-	-	-	-	-	-	8.3	0.3	15.3	0.2		0.3
10.3.92	31.4	12.1	-	-	-	-	-	-	-	-	-	-	3.1	0.0	17.0	0.3		0.7
17.3.92	32.4	15.8	-	-	-	-	-	-	0.5	-	-	-	-	-	9.7	0.0		0.4
24.3.92	31.9	16.1	-	-	-	-	-	-	0.2	-	-	-	-	-	3.3	-		0.8
31.3.92	33.0	16.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-

All the Brassica species escaped the aphid infestation. Red vented Bulbul (Picnortus cafer L.) was found damaging the siliquae of B.napus. The per cent damaged siliquae ranged between 16.07 to 71.42 with a mean 36.97 per cent. Almost all siliqua bearing twigs were damaged. Young stem/twigs of plants were badly peeled off and eaten, while in case of siliqua only stalks were left. Other Brassica species adjacent to B.napus were not at all touched. Regarding the incidence of bird, it was found that the birds were most active during 9.00 to 11.00 AM and 3.00 to 5.30 PM. In single plot of 3 x 5 m about 4-6 Bulbul could be observed at a time.

Pantnagar:

This experiment was laid-out by using six species of Brassica, namely; B.juncea, B.campestris Var. yellow sarson and brown sarson, B.nigra, B.alba and B.carinata. Observations on aphid population (10 cm central twig/plant) were recorded at weekly intervals starting from 27th of January 1992 till maturing of these crops.

It is apparent from the Table 4.3.5 that aphid appeared in the 5th standard week on brown sarson. On B.napus, it appeared in the 7th week and in 8th week all the remaining species had aphid infestation. B.alba harboured higher aphid population followed by yellow sarson, B.napus and mustard.

Maximum aphid population was noticed in 9th standard week on all the seven varieties. The aphid population became zero in 10th week on brown sarson, mustard and B.nigra and in 14th week on Karan rai and B.alba.

Kanpur, Faizabad:

The experiment could not be completed due to low insect-pest incidence.

4.4

Name of the Project : Economic threshold of mustard aphid

Objectives : To find out the critical level of aphid population for economic control of mustard aphid (Lipaphis erysimi) on rapeseed-mustard

Locations : Morena, Hisar, Navgaon and Pantnagar

Progress of work :

Morena:

Experiment was laid-out in a randomized block design using variety Pusa bold on 11.11.1991. Different levels of the exposure to aphid attack were maintained by spraying oxydemeton methyl 0.025 per cent. Data presented in Table 4.4.1 indicated that aphid population was very low nevertheless the calculations for cost benefit ratio for complete protection, one, two and three weeks exposure to aphid infestation were 1:4.72, 1:5.96, 1:3.70 and 1:1.57. The spraying in case of four weeks exposure period was not economical.

At Hisar, Pantnagar and Navgaon, the experiment was laid-out as per the technical programme. However, it could not be completed due to low aphid incidence.

TABLE 4.3.5: POPULATION DYNAMICS OF MUSTARD APHID ON VARIOUS BRASSICA SPECIES AT PANTNAGAR

STD. WEEK	TEMP. (°C) MAX.	TEMP. (°C) MIN.	RAIN-FALL (MM)	RH (%) MAX	RH (%) MIN	SUN SHINE (hrs)	WIND VELO-CITY (KPH)	MEAN NO. OF APHIDS/10cm CENTRAL TWIG: BROWN SARSON	MUS-TARD	B.NIGRA	YELLOW SARSON	GOBHI SARSON	KARAN RAI	B.ALB
5	23.1	9.3	0.0	91	51	6.5	5.3	43.3	0	0	0	0	0	0
6	19.3	9.8	9.0	92	66	3.6	5.7	24.0	0	0	0	0	0	0
7	19.9	7.1	16.4	91	65	5.2	4.8	13.0	0	0	0	4.6	0	0
8	20.1	7.6	0.4	90	53	6.6	5.1	38.0	29.3	26.0	75.6	48.6	14.9	777
9	22.8	5.9	0.0	87	33	8.2	4.7	7.2	13.8	11.4	26.2	96.4	29.8	1642.
10	25.8	10.2	0.0	86	33	7.6	6.3	0	0	0	0.4	147.3	72.6	1387.
11	27.3	8.9	0.0	87	23	8.6	8.8	0	0	0	0	1462.5	136.0	164.
12	28.9	11.1	0.0	84	32	6.0	6.3	0	0	0	0	319.8	67.3	59.
13	29.5	14.7	0.0	80	37	4.3	4.4	0	0	0	0	114.4	9.3	9.
14	30.9	15.1	0.0	76	24	5.9	8.7	0	0	0	0	2.6	0	0

DATE OF SOWING 21.11.91

TABLE 4.4.1: ECONOMIC THRESHOLD OF MUSTARD APHID AT MORENA DURING 1991-92

TREATMENT	NO.OF SPRAY	NO. OF APHIDS ON 5cm TWIG PER PLANT	YIELD (Kg/ha)	INCREASE IN YIELD OVER CON-TROL (Kg/ha)	COST OF SPRAY-ING (Rs)	COST OF INCREASED YIELD (Rs/ha)	NET PROFIT (Rs/ha)	COST BENEFI RATIO
COMPLETE PROTECTION	3	2.2	1996	531	900	4248	3348	1:4.72
ONE WEEK EXPOSURE	2	6.9	1912	447	600	3576	2976	1:5.96
TWO WEEKS EXPOSURE	2	11.8	1743	278	600	2224	1624	1: 3.7
THREE WEEKS EXPOSURE	1	15.2	1524	59	300	472	172	1:1.57
FOUR WEEKS EXPOSURE	1	16.3	1473	8	300	[illegible]	-[illegible]	-
CONTROL(NO SPRAY)	-	18.3	1465	-	-	-	-	-
…Em ±		0.56	62.93					
…D AT 5%		1.69	188.35					

PRICE OF SEED @ Rs.800/100 Kg

…'BETWEEN AVERAGE APHIDS/PLANT AND YIELD QTL/ha:-0.978

GAIN THRESHOLD:0.375

4.5

Name of the Project : Assessment of yield losses in various *Brassica* crops caused by mustard aphid

Objectives : To find out the available yield losses caused by mustard aphid, *Lipaphis* erysimi infestation on *Brassica* genotypes throughout India

Locations : Kangra, Ludhiana, Bathinda, Hisar, Navgaon, Pantnagar, Kanpur, Faizabad, Pusa, Bhubaneswar, Berhampore and Khudwani

Progress of work :

The experiment was laid out at Kangra, Bathinda and Pantnagar by growing different *Brassica* species under protected and unprotected conditions. The results presented in Table 4.5.1 revealed that losses in yield due to mustard aphid infestation ranged from 22.1% (*B.alba*) to 45% (*B.campestris* var. yellow sarson) at Kangra, 17.4% (*B.juncea*) to 64.9% (*B.alba*) at Bathinda and 2.8% (*B.carinata*) to 38.7% (*B.nigra*) at Pantnagar. At Bathinda the losses in yield were mainly due to *Myzus persicae*.

At Ludhiana, Hisar, Navgaon, Kanpur, Faizabad and Berhampore, the experiment was laid-out as per the programme but could not be completed due to low insect-pest incidence.

4.6

Name of the Project : Studies on the off-season biology and migration of mustard aphid

Objectives : To find out the survival of mustard aphid, *Lipaphis erysimi* throughout the year at various centres

Locations : Kangra, Hisar, Kanpur, Faizabad and Pantnagar

Progress of work :

Kangra:

Mustard aphid appeared first time on toria on 25.10.1991 and remained active upto 4.5.1992 on *Brassica napus* and *B.carinata*. Later on, it was found surviving on stray plants of *B.juncea* and *B.campestris* upto 10.6.1992. Mustard aphid was also recorded from other plants viz; *Sylena coloidea* and *Raphanus* spp. It survived well at 35°C and 68 per cent relative humidity under natural conditions.

Hisar:

First aphid colony at Hisar was seen on 20.11.1991 on toria which was predated upon by *Coccinella septempunctata* and *Hippodemia* sp by 4.12.1991.

The aphid appeared in quite high numbers over the late sown mustard crop towards the end of February, 1992 which started to decline after middle of March. Very high populations of *Coccinella septempunctata* (10 adults and 15 grubs/aphid infested plant of mustard and *Hippodemia* sp. were seen towards the end of March, 1992. Mustard aphid survived upto middle of May on *B.napus*, cauliflower heads, radish grown for seed, Haryana Saag and *B.carinata* plants at Hisar.

Kanpur, Faizabad:

There was no incidence of mustard aphid throughout the crop season.

Pantnagar:

No incidence of mustard aphid was noticed after 15th of April, 1992.

4.7

Name of the Project : Emperical approach in mustard aphid management

Objectives : To study the possibilities of mustard aphid management through manual removal of aphid infested twigs in mustard crop

Locations : Morena, Ludhiana, Hisar, Navgaon, Pantnagar, Faizabad and Kanpur

Progress of work :

Morena:

The experiment was laid-out in a randomized block design using variety Pusa bold on 11.11.91. In the treatment, (insecticidal control) crop was protected by using oxydemeton methyl @ 0.025 per cent and two sprays were required to control the aphid. In the second treatment(manual control) all aphid infested twigs were removed at an interval of 15 days (Table 4.7.1). Perusal of data revealed that aphid population was significantly lower in the plots with insecticidal treatment and manual removal of aphid infested twigs than control (untreated). Net profit was estimated to be Rs.5400/- per ha in insecticidal treatment and Rs. 2904/- per ha in manual treatment. The cost benefit ratio was found to be 1:10 in insecticidal treatment and 1:8.6 in manual control.

At Ludhiana, Hisar, Navgaon, Pantnagar, Faizabad and Kanpur, the experiment was laid-out as per the technical programme. However, it could not be completed due to low or lack of aphid incidence.

TABLE 4.6.1:ASSESSMENT OF YIELD LOSSES CAUSED BY MUSTARD APHID IN DIFFERENT BRASSICA GENOTYPES AT VARIOUS LOCATIONS DURING 1991-92

SPECIES	TREAT-MENT	KANGRA			BATHINDA*			PANTNAGAR		
		VARIETY	YIELD (Kg/ha)	% LOSS IN YIELD	VARIETY	YIELD (Kg/ha)	% LOSS IN YIELD	VARIETY	YIELD (Kg/ha)	% LOSS IN YIELD
B. JUNCEA	1	VARUNA	1776	31.3	RLM-619	1184	17.4	VARUNA	895	16.0
	2		1220			978			752	
B.ALBA	1	-	438	22.1	WM-6504	151	64.9	-	438	22.1
	2		341			53			341	
B.CAMPESTRIS VAR. YS	1	YSP-842	636	45.0	-	-	-	YST-151	279	29.8
	2		350						195	
B.CARINATA	1	-	-	-	C-650	1411	19.7	-	196	2.6
	2					1153			191	
B.NAPUS	1	-	1043	31.9	GSL-1	1422	27.0	-	160	16.4
	2		710			1038			134	
B.NIGRA	1	-	-	-	-	-	-	-	922	38.7
	2								565	
B.CAMPESTRIS VAR. BS	1	BSH-1	643	44.0	-	-	-	BSH-1	236	18.6
	2		360						191	

* DAMAGE WAS MAINLY DUE TO M. PERSICAE
DATE OF SOWING KANGRA-21.11.91;BATHINDA-13.11.91;PANTNAGAR-26.10.91
1-PROTECTED ; 2- UNPROTECTED : YS- YELLOW SARSON : BS- BROWN SARSON

TABLE 4.7.1 EMPERICAL CONTROL OF MUSTARD APHID AT MORENA DURING 1991-92

TREATMENTS	AVERAGE* APHID POPULATION	YIELD (Kg/ha)	INCREASE IN YIELD OVER CONTROL(Kg/ha)	COST OF TREATMENT (Kg/na)	COST OF INCREASED YIELD (Rs/ha)	NET PROFIT (Rs/ha)	COST BENEFIT RATIO
INSECTICIDAL CONTROL	7.5	2583	750	600 (2SPRAYS)	6000	5400	1:10
MANUAL TWIGS REMOVAL	9.5	2246	413	400 (2TIMES)	3304	[illegible]304	1:8.26
UNTREATED	19.2	1833	-	-	-	-	-
SEm ±	1.2	91.28					
CD AT 5%	3.64	276.38					

COST OF PRODUCE 800/Qtl
* MEAN OF TWO OBSERVATIONS.

4.8
STATION TRIAL

(A).

Name ofthe Project : Screening of *Brassica* against aphid infes- tation at Hisar

Objectives : To rear the mustard aphid on a single leaf of a host variety without disturbing its continous feeding under laboratory conditions

Progress of work :

In laboratory studies, for screening germplasm/breeding material for aphid resistance, either we use potted palnts or the excised fresh leaves are to be provided every day. Both the methods have flaws: in first case lot of space is required for keeping the pots and in second the leaf dries up within 24 hours affecting the normal feeding of the aphids. So a technique developed by BARC, Trombay was tested under Hisar conditions. The 3rd leaf from the top of 60 days old *B.juncea* and *B.campestris* plants were brought in the laboratory and kept in test tubes (15cm long with 1.25cm diameter) filled with water. The base/petiole of leaf was wrapped in cotton plug to fit in the mouth of test tube. In another set the leaves were kept in 15cm diameter petridishes. The petiole of leaf was wrapped in moist cotton (Table 4.8.1).

Table 4.8.1:

Survival of *Brassica* leaves under laboratory conditions

Host	Life of leaves in (days)	
	Test tube	Petridish
B.juncea		
JMG-221	30	15
JMG-219	36	20
JMG-217	37	25
JMG-214	36	20
JMG-212	30	20
JMG-211	34	20
RH-30	32	19
B.campestris		
BSH-1	15	8

In *B.juncea* roots initiation on leaves kept in test tubes took place in an average of 9.7 days (range 9-11 days) and the tubes were completely filled with roots on 25th day (24-26 days). The leaves in tubes started to dry up by 30th day and completely dried in maximum of 37 days. The survival period of leaves kept in petriplate was comparatively low and on an average the leaves dried in 20 days (range 15-25 days). The freshness of *B.campestris* leaf remained only upto 15 days.

It is, therefore, suggested that the comparative biology of mustard aphid can be studied on a single leaf of the host. This method can be used to find out the relative susceptibility of *Brassica* lines to mustard aphid under laboratory conditions.

(B).

Name of the Project : Biology of mustard sawfly, *Athalia proxima* at Hisar under laboratory conditions

The female adults of sawfly laid most of the eggs inside the leaf margins and few in the base of mid rib of leaves of *Brassica juncea*. The microscopic studies of eggs taken from the leaf tissues revealed that these were minute, creamy white and barrel shaped. The small raised spots in lower lamina of the leaf near margins gave the indication of the presence of eggs. The details of various life stages are given in Table 4.8.2.

Table 4.8.2: Biology of mustard sawfly

Stage of insect	Duration in days
1. Adult longevity	
Male :	12.2
Female :	18.8
2. Pupal period	
i) Dec-Jan	22.20
ii) Feb-March	4.10
3. Larval period	
1st instar	3.8
2nd instar	3.2
3rd instar	2.2
4th instar	2.7
5th instar	7.3
6th instar	4.1
4. Total larval period	23.3

5 PLANT PATHOLOGY

5.1

Name of the Project : Screening of Brassica material against different diseases

Objectives : To identify the resistant sources under natural and epiphytotic conditions

Locations : (A) Hisar, Kanpur, Pusa (Dholi), Pantnagar, Navgaon, Morena, Junagadh, Ludhiana,

(B) Shillongani, Berhampore, Pusa, Faizabad, Kanpur, Pantnagar, Hisar, Ludhiana, Kangra, Junagadh, Morena, Navgaon, Sriganganagar, Diggi/Jobner (Taramira), Khudwani, Ghaziabad, S.K.Nagar, Bathinda

Progress of work :

Data have been presented in Table 5.1.1.

Kangra:

None of the entry was found resistant against Alternaria blight and white rust, however, RH-8824 showed tolerant reaction against white rust under natural condition. RH-8824 and Varuna were free from downey mildew. 8 strains showed staghead formation in traces whereas, DIR-489 was completely free from staghead formation.

Ludhiana:

All the tested lines were susceptible to highly susceptible against both the foliar diseases (Alternaria blight and white rust). However, TM-8-8 was found free from white rust at leaf stage, but had 22.5% staghead formation. All the B.napus lines of GSL series were free from white rust. WRG-15 was free from white rust and showed resistant reaction against alternaria blight.

Bathinda:

Under UDN trial, lines; PC-5, C-6-YS-7B and HC-1 (B.carinata) were scored as one against alternaria blight on leaves as well as on pods and were categorised as resistant against white rust and alternaria blight.

Hisar:

None of the line was observed free from alternaria blight, however, the B.napus, B.carianata and B.alba were scored in

grade one. The lines; TM-18-8, Norin, Regent, BEC-152, EC-174239, HNS-335 and RH-8693 were free from white rust infestation.
A number of lines viz., PYS-841, PYS-843, GSL-1501, SSK-1, RH-8539, PYS-842, Zem-1, Zem-2, SSK-13, DIRA-313-7, DIRA-313-6, GSB-7006, GSB-7027, YSK-8502, MIDAS, HC-1, SPAN, BJ-1, Trawase, HNS-3, EC-129126-1 and Domo-4 were observed free from white rust incidence.

Sriganganagar:

The strain, SJN-191 was observed resistant against alternaria blight under natural conditions. The strain, TM-18-8 was observed highly resistant against white rust at leaf stage and it was also free from staghead formation.

The lines; PYS-843, GSL-1501, SSK-1, WRR-3-1, Zem-2, RSK-33, DIRA-373-6, RSK-10, HC-1, Trawase and Domo-4 were free from white rust infection both at leaves as well as staghead formation.

IARI, New Delhi:

The lines; DIR-489, PCR-4, TM-18-8 and RK-919015 graded as one against alternaria blight and lines; SJN-191, PCR-4, TM-18-8, BIO-246, SKNM-9-19-4, RW-873 and RSM-9001 were graded as one or less than one against white rust infection.

Navgaon:

Under artificial condition, the lines; TM-18-8, PR-8915 and PSR-6 had minimum incidence of alternaria blight. All the tested entries were susceptible to powdery mildew.

The strain, PBR-91 which was tested in AVT-1 had least white rust and downey mildew reaction.

In hybrid trial, all the entries were observed susceptible to white rust, alternaria and downey mildew. The disease score ranged 2-3 for white rust, 3-4 for alternaria blight and 1-3 for downy mildew. In B.napus IVT, Semu 249/24, GSL-8914, WW-1507 and GSL-334 possessed alternaria blight disease score one on leaf as well as on pod stage.

Merena:

In pot experiment, the entry, TK-9101, SEJ-2, PPMS and T-9 recorded moderate infection against white rust. Lines; TWB-14/86, PT-8857, PT-9005 and PPMS showed minimum infection against alternaria blight.

In IVT mustard minimum white rust infection was observed for a strain TM-18-8. In AVT-1, a strain YSRL-9 had shown minimum alternaria blight infection and graded as one. The entry YSRL-9, RSK-33 and Varuna were graded one against downy mildew. Staghead formation varied from 0.7-3.4%, but it was minimum in RSM-8904.

In UDN trial, lines; GSL-1501, PC-5, GSL-1, HNS-5, C6-YS-7B, Tower, DIRA-313-7, DIRA-313-6, GSB-7006, GSB-7027, YSK-8502, MIDAS, HC-1 and EC-129126-1 were completely free from foliar infection of white rust and staghead formation. None of the line was observed resistant against alternaria blight, the disease varied in grade 2-4. Out of 76, 65 lines were free from downy mildew.

Pantnagar:

All the tested toria strains were susceptible to white rust. However, DIRA-489 was resistant to white rust at leaf stage. The strains, GSL-1501, PC-5, GSL-1, NDYS-2, C6-YS-7B, Zem-1 and DIRA-326 were free from white rust and rated as resistant against white rust.

B.carianta lines were free from white rust infection. However, none of the line was observed resistant to alternaria blight. In addition to this, it was observed that 14 B.carinata lines possessed less degree of incidence against alternaria blight under natural condition.

All the lines tested under UDN were free from staghead formation due to white rust except the strains; DIRA-247, RWARB-3, RSK-10, CSR-448 and CSR-416, which were susceptible to staghead infection.

Kanpur:

Under UDN trial, strains namely; culture-1 and KRV-Tall were rated as resistant against alternaria blight. Out of 76, 49 lines were free from white rust infection and 10 were reported to be resistant to alternaria blight. 13 lines were resistant against powdery mildew.

Faizabad:

In IVT mustard, none of the tested strain was observed resistant against alternaria blight. A strain, DLM-29 was found resistant to white rust. Out of 36 tested lines in above said trial, 14 lines were free from staghead formation.

In UDN trial, none of the line was found resistant to leaf infection of alternaria blight. However, the strains; NDR-873 and WRR-3-1 were found free from alternaria blight infection on siliquae. Out of 78, 20 lines were found free from downy mildew infection. All the tested entries were free from staghead formation except Jatai rai which was kept as susceptible check.

38 mustrad strains were screened against alternaria blight under artificial innoculation condition. None of the tested line was found resistant to alternaria blight at leaf stage. However, 20 of them were scored as one at pod stage infection. No symptoms of downy mildew and staghead formation were observed in any of the entry at cotyledonary stage.

Out of 76 UDN entries, 13 entries namely; GSL-1501, PC-5, C6-YS-7B, GSB-7006, GSB-7027, MIDAS, PHR-2, HC-1, SPAN, BJ-2, BJ-1, Trawase and Domo-4 were found resistant to alternaria blight at both the stages i.e. leaf as well as the pod stage.

Berhampore:

Amongst 67 entries tested, none of the entry was found resistant against Alternaria blight at leaf and pod stage. A mild attack of Downy mildew was observed at seedling stage in all the entries. Incidence of white rust was observed as negligible. However, it occur on some entries at leaf stage. All the entries were free from downy mildew at leaf stage and stag head formation due to white rust and downy mildew at siliquae stage.

In UDN trial, 80 entries were evaluated and it was found that none of the tested entry was observed resistant against Alternaria blight. However, some late maturing strains were observed as moderately resistant at flowering as well as pod maturity stage. All the tested entries were free from white rust and downy mildew incidence at siliaquae maturity.

TABLE 5.1.1 SCREENING OF DIFFERENT LINES OF BRASSICA AGAINST DIFFERENT DISEASES
(UNDER NATURAL AND ARTIFICIAL INOCULATION CONDITIONS) DURING 1991-92
ALTERNARIA BLIGHT 0 - 5 SCALE (LEAF)

SN	CODE	DECODE	KNG	BATH	SGN	* HSR	* NAV	* DLH	* MOR	* KAN	* PNT	FZB	DHL	BRH
1	MCN-1	SJN-191	3	3	1	3	3	2.0	3	4	4	3	2	3
2	MCN-2	DIRM-52	3	3	2	-	4	2.0	4	4	4	3	2	3
3	MCN-3	DIR-489	3	4	2	3	3	1.0	3	4	5	3	3	3
4	MCN-4	PCR-4	3	4	2	3	4	1.0	4	4	4	4	3	3
5	MCN-5	DLM-29	3	4	2	3	4	2.0	3	4	5	3	2	3
6	MCN-6	TM-18-8	3	4	2	3	4	1.0	3	3	5	-	3	3
7	MCN-7	BIO-246	3	4	1	5	4	2.0	3	4	5	4	2	3
8	MCN-8	BIO-94	2	1	2	3	3	2.0	3	4	4	3	3	3
9	MCN-9	RL-90-1	2	4	1	4	3	1.5	3	4	4	2	2	3
10	MCN-10	RH-9	3	3	2	3	4	2.5	3	5	4	3	3	3
11	MCN-11	SKNM-90-13	3	4	2	3	4	1.5	3	5	4	-	3	4
12	MCN-12	SKNM-90-4	3	4	3	4	3	1.5	3	5	4	4	2	3
13	MCN-13	PR-8915	3	4	2	5	3	2.0	4	4	5	2	2	3
14	MCN-14	PR-8343	2	4	2	-	3	2.5	4	4	5	2	2	3
15	MCN-15	PSR-7	2	4	2	5	4	1.5	3	5	4	-	3	3
16	MCN-16	PSR-6	3	4	2	4	2	1.0	3	4	4	4	3	3
17	MCN-17	RSM-151	2	4	2	4	3	2.0	3	5	4	3	3	3
18	MCN-18	RW-873	3	3	3	4	4	1.5	3	4	4	4	2	3
19	MCN-19	RW-872	2	4	2	4	3	2.0	3	4	4	4	2	4
20	MCN-20	RK-919015	3	4	3	4	3	1.0	3	4	4	4	2	3
21	MCN-21	RK-919003	3	3	3	3	4	1.5	4	5	5	4	3	3
22	MCN-22	RH-8824	3	4	3	3	4	1.5	4	5	5	-	2	3
23	MCN-23	RH-8922	3	4	3	4	3	2.0	3	4	4	3	2	3
24	MCN-24	RJ-9	2	3	3	4	3	2.0	3	4	4	4	2	3
25	MCN-25	RJ-14	2	4	3	4	3	2.0	3	4	5	4	2	4
26	MCN-26	KBJ-24	2	4	3	5	4	2.0	4	4	4	4	2	3
27	MCN-27	KBJ-28	3	4	3	3	3	1.5	3	4	5	3	2	3
28	MCN-28	JMM-90-12	3	4	3	5	4	1.5	3	5	5	2	2	3
29	MCN-29	JMM-90-13	2	4	2	3	3	1.5	4	4	5	3	2	3
30	MCN-30	RSM-9001	3	4	3	4	3	2.5	3	4	4	4	2	4
31	MCN-31	RSM-9007	2	4	2	4	4	2.0	3	4	4	4	3	4
32	MCN-32	HJ-002	2	4	2	3	3	2.5	3	4	5	4	2	4
33	MCN-33	PCR-5	3	4	3	4	4	2.0	3	4	5	3	2	3
34	MCN-34	VARUNA(NC)	2	4	3	4	3	2.5	3	4	5	5	3	4
35	MCN-35	KRANTI(NC)	3	4	3	3	3	2.5	3	4	4	4	2	3
36	MCN-36	RH-1359(ZC	3	4	3	5	3	3.0	3	4	4	3	4	3
37		CHECK 1	-	-	3	4	3	-	3	-	-	5	-	3
38		CHECK 2	-	-	3	-	-	-	3	-	5	4	-	3

* UNDER ARTIFICIAL INNOCULATION CONDITIONS

TABLE 5.1.1 SCREENING OF DIFFERENT LINES OF BRASSICA AGAINST DIFFERENT DISEASES (UNDER NATURAL AND ARTIFICIAL INOCULATION CONDITIONS) DURING 1991-92
WHITE RUST 0-5 SCALE (LEAF)

SN	CODE	DECODE	KNG	BTH	SGN	HSR	* NVG	DLH	* KAN	* PNT	FZB	BRH
1	MCN-1	SJN-191	3	2	3	2	3	0.8	0	5	2	0
2	MCN-2	DIRM-52	3	2	4	-	3	1.5	0	5	2	0
3	MCN-3	DIR-489	3	2	3	1	3	2.0	0	1	3	0
4	MCN-4	PCR-4	3	2	4	2	3	1.0	0	4	2	0
5	MCN-5	DLM-29	3	2	3	2	3	1.5	0	4	1	0
6	MCN-6	TM-18-8	3	1	1	0	2	0.5	0	4	-	0
7	MCN-7	BIO-246	4	2	3	2	3	0.8	0	4	3	0
8	MCN-8	BIO-94	4	1	3	3	3	1.5	0	5	3	0
9	MCN-9	RL-90-1	3	1	3	3	3	1.5	0	4	4	1
10	MCN-10	RM-9	3	3	3	2	2	2.0	0	4	3	1
11	MCN-11	SKNM-90-13	3	4	2	3	3	2.0	0	3	-	0
12	MCN-12	SKNM-90-4	3	3	3	[illegible]	3	1.0	0	4	3	0
13	MCN-13	PR-8915	4	1	3	3	2	3.5	1	-	3	0
14	MCN-14	PR-8943	3	2	2	-	3	2.5	1	5	4	0
15	MCN-15	PSR-7	4	2	2	3	3	2.0	2	5	-	1
16	MCN-16	PSR-6	3	4	3	3	2	1.5	2	5	3	1
17	MCN-17	RSM-151	4	2	2	3	4	4.0	1	5	2	1
18	MCN-18	RW-873	-	3	2	2	2	1.0	0	5	3	0
19	MCN-19	RW-872	4	2	3	3	3	1.5	0	5	2	0
20	MCN-20	RK-919015	4	1	3	3	3	2.0	0	5	2	0
21	MCN-21	RK-919003	4	2	3	2	3	3.5	0	5	4	0
22	MCN-22	RH-8824	1	2	3	3	3	3.0	0	4	-	0
23	MCN-23	RH-8922	2	2	3	2	4	4.0	1	5	3	0
24	MCN-24	RJ-9	3	2	3	2	3	1.5	1	5	3	1
25	MCN-25	RJ-14	2	1	3	3	4	1.5	0	5	2	0
26	MCN-26	KBJ-24	3	1	2	3	4	3.5	0	5	3	0
27	MCN-27	KBJ-28	3	1	3	2	3	2.5	2	5	3	0
28	MCN-28	JMM-90-12	3	2	3	3	4	2.5	0	5	3	1
29	MCN-29	JMM-90-13	3	1	3	2	4	2.0	0	5	2	0
30	MCN-30	RSM-9001	3	2	3	2	3	1.0	0	5	3	0
31	MCN-31	RSM-9007	3	1	3	2	3	2.5	0	4	2	1
32	MCN-32	HJ-002	3	2	3	2	3	3.0	0	4	2	0
33	MCN-33	PCR-5	3	2	3	3	3	2.0	0	5	3	0
34	MCN-34	VARUNA(NC)	3	2	3	4	3	2.5	0	5	2	0
35	MCN-35	KRANTI(NC)	3	2	3	3	3	2.5	0	5	4	0
36	MCN-36	RH-1359(ZC	2	2	4	2	3	5.0	1	5	2	0
37		CHECK 1	4	-	3	2	2	-	-	5	2	1
38		CHECK 2	-	-	3	-	-	-	-	-	4	-

: * UNDER ARTIFICIAL INNOCULATION CONDITIONS

TABLE 5.1.1 SCREENING OF DIFFERENT LINES OF BRASSICA AGAINST DIFFERENT DISEASES (UNDER NATURAL AND ARTIFICIAL INOCULATION CONDITIONS) DURING 1991-92

			'ALTERNARIA BLIG HT ON SILIQUA 0-5 SCALE						POWDERY MILDEEW (0-5 SCALE)		
SN	CODE	DECODE	NGN	KAN	PNT	FZB	DHL	BRH	* JUN	JUN	SKN
1	MCN-1	SJN-191	1	4	2	2	1	3	4	4	2
2	MCN-2	DIRM-52	2	4	2	1	1	3	4	4	2
3	MCN-3	DIR-489	1	4	2	3	1	3	5	5	2
4	MCN-4	PCR-4	2	3	2	3	1	3	4	4	2
5	MCN-5	DLM-29	3	5	2	1	1	2	4	4	1
6	MCN-6	TM-18-8	2	4	2	-	2	3	3	3	1
7	MCN-7	BIO-246	3	5	2	2	1	3	4	4	2
8	MCN-8	BIO-94	2	5	2	1	1	3	4	4	2
9	MCN-9	RL-90-1	1	3	2	1	1	3	5	4	2
10	MCN-10	RM-9	1	4	2	1	2	3	5	4	2
11	MCN-11	SKNM-90-13	2	5	2	-	1	3	5	5	1
12	MCN-12	SKNM-90-4	1	5	1	2	1	3	4	4	1
13	MCN-13	PR-8915	1	4	2	1	1	3	5	5	1
14	MCN-14	PR-8943	2	4	2	1	1	2	5	5	2
15	MCN-15	PSR-7	2	4	2	-	2	3	5	5	2
16	MCN-16	PSR-6	2	5	2	2	1	3	5	5	2
17	MCN-17	RSM-151	2	4	2	1	2	2	5	5	2
18	MCN-18	RW-873	2	4	2	3	1	3	5	5	2
19	MCN-19	RW-872	2	5	2	3	1	3	4	4	1
20	MCN-20	RK-919015	2	5	2	2	1	3	3	3	2
21	MCN-21	RK-919003	3	4	2	2	1	3	5	5	2
22	MCN-22	RH-8824	3	5	2	-	1	3	5	5	2
23	MCN-23	RH-8922	1	4	2	1	1	2	5	5	2
24	MCN-24	RJ-9	1	5	2	2	1	3	3	3	2
25	MCN-25	RJ-14	3	5	2	3	1	3	3	3	2
26	MCN-26	KBJ-24	2	4	2	2	1	3	4	4	2
27	MCN-27	KBJ-28	1	4	2	2	1	2	4	4	2
28	MCN-28	JMM-90-12	2	4	2	1	1	3	4	4	2
29	MCN-29	JMM-90-13	1	5	-	1	1	2	3	3	2
30	MCN-30	RSM-9001	2	4	2	2	1	3	3	3	2
31	MCN-31	RSM-9007	2	4	2	2	1	3	4	4	2
32	MCN-32	HJ-002	1	4	2	3	1	3	4	4	2
33	MCN-33	PCR-5	3	5	2	2	1	3	4	4	2
34	MCN-34	VARUNA(NC)	2	4	2	3	1	3	5	5	2
35	MCN-35	KRANTI(NC)	1	4	2	2	1	3	3	3	2
36	MCN-36	RH-1359(ZC)	2	4	2	1	1	3	3	3	2
37		CHECK 1	2	-	2	3	1	4	3	3	-
38		CHECK 2	0	-	2	3	2	2	4	4	-

' * UNDER ARTIFICIAL INNOCULATION CONDITIONS

TABLE 5.1.1 SCREENING OF DIFFERENT LINES OF BRASSICA AGAINST DIFFERENT DISEASES (UNDER NATURAL AND ARTIFICIAL INOCULATION CONDITIONS) DURING 1991-92

			STAG HEAD %						DOWNY MILDEW 0-5 SCALE				
SN	CODE	DECODE	KNG	SGN	* NVG	* MOR	* PNT	FZB	KNG	* MOR	* KAN	FZB	BRH
1	MCN-1	SJN-191	3.0	50.0	5.0	2.4	8.7	0.0	2	2	0	0	0
2	MCN-2	DIRM-52	1.6	30.8	6.0	3.6	8.7	0.0	2	2	0	3	0
3	MCN-3	DIR-489	0.0	60.0	6.0	1.7	16.6	0.0	2	2	0	2	0
4	MCN-4	PCR-4	1.4	56.2	5.0	2.8	-	0.0	2	2	0	4	0
5	MCN-5	DLM-29	2.4	80.0	6.0	2.2	-	0.0	3	0	0	4	0
6	MCN-6	TM-18-8	0.2	0.0	1.0	0.5	-	-	2	2	2	-	0
7	MCN-7	BIO-246	1.8	40.0	7.0	1.8	-	10.0	2	1	1	3	0
8	MCN-8	BIO-94	2.6	11.5	5.0	1.8	6.5	5.0	3	1	0	2	0
9	MCN-9	RL-90-1	2.7	56.0	10.0	3.2	-	8.0	3	3	0	2	0
10	MCN-10	RW-9	1.9	77.8	2.0	1.2	-	5.0	2	0	3	0	0
11	MCN-11	SKNM-90-13	2.4	62.9	12.0	3.4	-	-	2	0	0	2	0
12	MCN-12	SKNM-90-4	1.6	25.9	6.0	2.1	5.7	0.0	2	0	0	2	0
13	MCN-13	PR-8915	1.6	81.8	2.0	4.3	7.7	20.0	2	1	1	1	0
14	MCN-14	PR-8943	1.6	91.3	9.0	2.8	-	10.0	2	0	3	-	0
15	MCN-15	PBR-7	0.2	82.3	6.0	2.3	-	-	2	0	2	1	0
16	MCN-16	RSR-6	1.5	92.0	2.0	2.6	-	8.0	2	1	0	3	0
17	MCN-17	RSM-151	1.6	65.5	13.0	1.5	-	0.0	1	2	2	0	0
18	MCN-18	RW-872	1.3	9.5	3.0	2.2	-	5.0	2	0	0	1	0
19	MCN-19	RW-872	0.2	66.7	7.0	3.3	-	5.0	2	0	0	2	0
20	MCN-20	RK-919015	1.8	90.9	10.0	1.3	9.0	5.0	2	3	0	0	0
21	MCN-21	RK-919003	0.2	53.8	9.0	4.9	-	0.0	3	2	2	-	0
22	MCN-22	RH-8824	0.2	76.0	12.0	4.5	9.9	-	0	2	0	2	0
23	MCN-23	RH-8922	1.6	48.1	11.0	3.9	-	5.0	1	3	0	3	0
24	MCN-24	RJ-9	1.4	27.2	13.0	2.5	-	0.0	2	3	0	2	0
25	MCN-25	RJ-14	1.4	21.7	11.0	2.3	-	10.0	2	0	2	1	0
26	MCN-26	KBJ-24	1.6	40.0	1.0	2.6	-	5.0	1	0	2	1	0
27	MCN-27	KBJ-28	2.3	37.5	7.0	2.8	-	5.0	2	0	0	1	0
28	MCN-28	JMM-90-12	3.3	52.6	7.0	3.1	-	0.0	2	0	2	3	0
29	MCN-29	JMM-90-13	1.6	35.3	14.0	1.9	-	0.0	1	0	2	3	0
30	MCN-30	RSM-9001	1.8	44.1	11.0	1.9	-	0.0	2	3	0	2	0
31	MCN-31	RSM-9007	1.4	10.0	4.0	2.6	7.1	10.0	2	2	0	2	0
32	MCN-32	HJ-002	2.3	32.0	5.0	2.6	-	0.0	2	1	2	2	0
33	MCN-33	PCR-5	2.6	74.1	2.0	4.8	-	0.0	3	0	2	3	0
34	MCN-34	VARUNA(NC)	0.2	31.2	2.0	2.1	-	5.0	0	0	0	4	0
35	MCN-35	KRANTI(NC)	0.2	91.3	2.0	2.7	10.00	5.0	3	3	0	2	0
36	MCN-36	RH-1359(ZC)	1.8	58.7	7.0	3.9	-	10.0	1	0	2	2	0
37		CHECK 1	1.6	6.0	3.0	2.1	5.0	5.0	-	0	-	2	0
38		CHECK 2	-	56.0	-	3.3	_	20.0	-	3	-	2	0

* UNDER ARTIFICIAL INNOCULATION CONDITIONS

TABLE 5.1.2 UNIFORM DISEASE NURSERY TRIAL UNDER ARTIFICIAL CONDITIONS AT DIFFERENT LOCATIONS DURING 1991-92

			ALTERNARIA BLIGHT 0-5 SCALE (LEAF)												ALTERNARIA BLIGHT 0-5 SCALE (SILQUAE)				
SN	CODE	DECODE	KNG	LDH	SGN	HSR	GZB	NGN	MOR	PNT	KAN	FZB	DHL	BRH	LDH	NGN	PNT	FZB	DHL
1	UDN-1	NDR-873	3	4	2	3	4	3	2	4	4	2	2	3	4	2	4	0	1
2	UDN-2	RWARS-9	3	3	3	3	4	3	3	4	4	3	2	3	4	1	2	1	1
3	UDN-3	DIR-247	3	4	3	3	4	3	3	4	4	3	2	3	4	2	2	2	2
4	UDN-4	RWARB-3	3	4	3	4	4	3	3	4	4	2	2	3	4	1	2	1	1
5	UDN-5	PR-8805	3	3	3	4	3	3	3	4	4	2	2	4	3	1	2	1	1
6	UDN-6	PYS-841	3	4	3	4	5	3	4	4	4	4	3	3	4	2	4	2	3
7	UDN-7	RHC-9005	3	4	4	3	4	3	4	4	4	3	3	3	4	1	2	2	1
8	UDN-8	NDR-871	4	4	3	4	3	3	3	4	4	4	2	4	4	2	2	2	1
9	UDN-9	PYS-843	3	4	3	4	5	3	4	4	4	4	3	2	3	1	3	3	2
10	UDN-10	GSL-1501	3	3	3	4	1	2	3	3	4	3	1	4	3	1	2	1	1
11	UDN-11	NDR-872	3	3	3	3	2	3	4	4	5	4	2	4	4	1	2	3	1
12	UDN-12	SSK-1	2	4	4	4	5	3	4	5	4	5	4	4	3	2	3	4	3
13	UDN-13	PT-303	4	4	4	3	5	4	3	3	4	4	3	2	3	4	3	3	2
14	UDN-14	RN-356	4	4	3	3	3	3	4	4	2	3	2	3	3	2	3	2	1
15	UDN-15	RN-248	3	3	3	3	3	3	4	4	4	4	3	3	4	1	1	3	1
16	UDN-16	RN-253	3	3	3	3	3	4	3	3	4	4	2	3	4	2	2	3	1
17	UDN-17	RN-248	2	3	3	3	3	4	4	4	4	3	3	3	4	2	2	2	1
18	UDN-18	RN-293	3	4	3	4	2	3	3	4	4	3	3	3	4	2	2	2	1
19	UDN-19	RN-100	3	4	3	3	2	3	3	4	4	2	2	3	3	2	2	1	1
20	UDN-20	RN-345	4	3	3	3	3	3	2	4	4	3	3	3	4	2	1	2	1
21	UDN-21	RN-263	2	4	3	4	2	3	2	4	4	3	3	3	3	2	2	2	1
22	UDN-22	RN-249	2	3*	3	4	1	3	3	4	4	3	2	3	1	2	2	1	1
23	UDN-23	PC-5	2	1	3	2	0	3	4	3	2	3	1	2	2	2	2	2	0
24	UDN-24	GSL-1	2	2	4	3	1	3	4	4	2	2	2	2	4	2	2	1	1
25	UDN-25	HNS-8	3	4	4	3	5	3	4	4	4	3	2	4	3	2	2	3	2
26	UDN-26	WRR-3-1	2	3	4	4	1	3	3	3	2	2	2	3	4	2	2	0	1
27	UDN-27	NDYS-2	3	4	4	4	5	3	4	4	4	5	3	4	1	2	3	4	2
28	UDN-28	C6YS-7B	1	1	5	3	0	4	4	4	3	2	1	2	3	3	2	1	0
29	UDN-29	TOWER	1	3	4	2	4	2	3	5	4	2	2	2	4	2	2	1	1
30	UDN-30	RH-8688	3	4	3	3	2	2	4	4	4	3	3	4	4	2	1	2	2
31	UDN-31	RH-8539	2	3	4	3	0	3	2	4	4	2	3	3	4	2	2	2	1
32	UDN-32	RH-8546	2	3	4	4	1	2	2	5	4	2	3	3	4	1	1	1	1
33	UDN-33	RH-8691	2	4	3	4	1	4	2	4	3	3	2	3	4	3	2	2	1
34	UDN-34	RH-8689	2	4	3	3	1	3	2	4	4	2	2	4	4	2	2	1	1
35	UDN-35	NDR-8601	3	4	4	4	3	3	2	4	4	3	2	3	4	3	1	2	1
36	UDN-36	PYS-842	4	4	4	4	5	3	4	4	2	4	3	4	4	2	3	2	2
37	UDN-37	ZEM-1	1	-	3	4	4	3	3	5	3	-	-	-	-	2	2	-	-
38	UDN-38	ZEM-2	1	-	4	2	3	-	3	4	4	-	-	-	-	2	-	-	-
39	UDN-39	RSK-89	3	3	-	4	3	3	2	4	4	4	2	4	3	2	-	3	2

SN	CODE	DECODE	KNG	LDH	SGN	HSR	GZB	NGN	MOR	PNT	KAN	FZB	DHL	BRH	LDH	NAV	PNT	FZB	DHL
40	UDN-40	SSK-6	4	4	-	4	5	3	4	4	4	5	3	4	3	2	3	5	2
41	UDN-41	SSK-13	4	4	3	4	5	3	4	4	4	4	2	3	3	2	2	4	2
42	UDN-42	RSK=33	3	4	4	3	3	3	2	4	4	3	3	3	4	2	3	2	2
43	UDN-43	SKNM-90-13	3	4	4	3	3	3	2	3	2	3	2	3	3	2	1	2	1
44	UDN-44	RSK-64	3	4	3	4	3	3	2	4	2	4	3	3	4	2	1	2	2
45	UDN-45	SKNM-90-4	3	3	3	3	3	3	3	4	4	4	3	3	4	2	2	2	2
46	UDN-46	DIRA-313-7	2	4	4	3	2	3	4	4	4	3	2	3	4	2	2	2	1
47	UDN-47	DIRA-313-6	2	3	4	4	3	2	3	5	2	3	2	3	3	2	2	2	1
48	UDN-48	DIRA-326	3	4	4	4	3	3	3	5	4	3	2	3	4	2	1	2	1
49	UDN-49	GSB-7006	1	4	3	3	3	3	4	5	3	2	1	2	3	2	2	1	1
50	UDN-50	YRT-3	2	3	3	4	3	3	2	4	2	3	2	3	4	2	2	2	1
51	UDN-51	RSK-10	3	3	4	3	3	3	3	3	4	4	2	3	3	3	2	2	1
52	UDN-52	CULTURE-1	3	3	4	3	2	3	4	3	1	3	2	3	3	2	1	2	1
53	UDN-53	KRV-TALL	3	3	3	4	3	3	3	5	1	3	3	3	3	2	2	2	1
54	UDN-54	RH-8544	2	4	3	4	1	3	4	3	2	3	3	3	3	2	-	1	1
55	UDN-55	RH-8545	3	2	3	4	2	3	3	3	4	3	3	3	3	2	3	1	1
56	UDN-56	CSR-142	3	3	4	3	4	3	2	3	4	3	2	2	4	2	2	1	1
57	UDN-57	GSB-7027	3	4	3	3	3	3	2	5	3	3	1	2	2	1	2	2	1
58	UDN-58	RC-781	2	3	3	3	2	3	2	4	3	3	2	3	4	2	3	1	1
59	UDN-59	CSR-448	3	4	4	3	2	3	3	4	2	3	2	3	4	2	1	1	1
60	UDN-60	HNS-4	3	3	3	3	4	3	2	3	4	4	3	2	4	2	1	3	1
61	UDN-61	YSK-8502	4	4	3	4	5	3	4	5	5	4	3	4	4	2	3	4	2
62	UDN-62	CSR-416	4	4	3	3	2	3	3	4	3	4	3	3	4	2	2	3	2
63	UDN-63	GULIVER -1	1	4	4	4	2	3	2	4	4	4	-	3	4	2	2	3	2
64	UDN-64	PHR-1	3	3	4	4	0	3	2	3	4	3	2	2	3	2	2	2	1
65	UDN-65	MIDAS	2	3	3	1	3	3	3	5	2	3	1	2	3	2	2	1	1
66	UDN-66	PHR-2	2	3	3	3	1	3	2	5	4	3	1	2	3	1	2	1	0
67	UDN-67	HC-1	2	1	3	2	0	3	3	5	4	2	1	2	1	2	2	1	1
68	UDN-68	SPAN	2	3	3	3	2	2	3	5	3	2	1	3	3	2	2	1	1
69	UDN-69	BT-2	3	3	3	4	2	3	2	5	2	3	1	3	4	2	2	2	1
70	UDN-70	BJ-1	2	2	3	3	2	3	2	5	4	3	1	2	2	2	2	3	0
71	UDN-71	PYSR-3	3	4	3	4	3	3	2	3	4	4	3	3	4	2	2	3	2
72	UDN-72	TRANABE	3	3	3	3	0	3	2	5	4	3	1	2	3	2	2	3	0
73	UDN-73	HNS-3	-	4	-	2	-	3	-	4	4	2	-	-	3	2	3	-	-
74	UDN-74	EC-129126-1	-	2	-	2	-	2	3	4	3	-	-	2	2	1	2	1	-
75	UDN-75	CB-50	3	4	3	3	2	3	2	5	2	3	3	3	3	2	1	3	1
76	UDN-76	DOMO-4	2	2	3	4	0	3	4	5	-	3	1	3	2	2	2	3	0
77	CHECK-IVARUNA		-	4	3	-	4	3	3	5	-	4	3	3	4	3	3	2	2
78	CHECK-2YST-151		-	4	3	-	-	3	3	2	4	5	3	3	4	4	3	2	3

TABLE 5.1.2 UNIFORM DISEASE NURSERY TRIAL UNDER ARTIFICIAL CONDITIONS AT DIFFERENT LOCATIONS DURING 1991-92

SN	CODE	DECODE	WHITE RUST 0-5 SCALE (LEAF)											DOWNY MILDEW 0-5 SCALE(LEAF)			
			KNG	LDH	SGN	HSR	GZB	NGN	MOR	PNT	KAN	FZB	BRH	KNG	MOR	FZB	BRH
1	UDN-1	NDR-873	3	3	3	3	3	2	4	4	3	2	0	2	2	1	1
2	UDN-2	RWARS-9	3	3	3	3	3	3	3	5	0	3	0	2	2	3	1
3	UDN-3	DIR-247	2	3	3	4	4	3	3	5	0	3	0	3	3	2	1
4	UDN-4	RWARB-3	2	3	3	2	3	3	4	4	2	3	0	2	0.	2	1
5	UDN-5	PR-8805	3	3	3	4	4	5	3	5	2	4	1	2	0	4	1
6	UDN-6	PYS-641	3	3	0	0	1	3	2	5	3	0	0	2	0	1	2
7	UDN-7	RHC-9005	3	4	2	2	2	4	3	5	2	3	0	2	0	4	1
8	UDN-8	NDR-871	3	3	3	3	3	3	4	5	2	4	0	3	3	2	1
9	UDN-9	PYS-843	2	3	0	0	1	2	2	4	1	0	0	2	0	0	1
10	UDN-10	GSL-1501	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
11	UDN-11	NDR-872	3	3	3	4	3	3	2	5	0	3	0	2	0	2	1
12	UDN-12	SSK-1	2	0	0	0	1	2	1	4	2	0	0	1	0	3	1
13	UDN-13	PT-303	2	3	0	0	0	2	1	5	2	0	0	2	0	1	2
14	UDN-14	RN-356	3	3	3	3	3	4	4	5	0	2	0	3	2	4	2
15	UDN-15	RN-246	3	3	3	3	4	4	3	5	0	2	0	2	3	3	2
16	UDN-16	RN-253	3	3	2	2	4	3	3	4	2	1	1	2	0	3	1
17	UDN-17	RN-248	2	3	3	3	3	3	4	4	2	2	0	1	2	3	1
18	UDN-18	RN-293	3	4	3	2	3	4	4	5	0	3	0	2	0	3	1
19	UDN-19	RN-100	3	3	3	3	4	2	3	5	2	2	1	2	0	3	1
20	UDN-20	RN-345	3	3	3	4	3	4	3	5	2	1	0	2	0	4	1
21	UDN-21	RN-263	3	3	3	3	4	4	4	5	0	2	0	2	0	3	1
22	UDN-22	RN-249	3	3	3	2	3	5	4	3	1	3	1	2	0	3	2
23	UDN-23	PC-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	UDN-24	GSL-1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
25	UDN-25	HNS-8	3	3	0	0	0	2	0	4	0	1	1	2	0	1	1
26	UDN-26	WRR-3-1	0	0	0	1	0	3	2	4	0	0	1	0	0	2	1
27	UDN-27	NDYS-2	3	3	0	0	0	2	1	5	0	0	0	2	0	1	2
28	UDN-28	C6YS-7B	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
29	UDN-29	TOWER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	UDN-30	RH-8688	3	3	0	1	3	3	4	5	0	3	0	2	2	0	1
31	UDN-31	RH-8539	1	0	0	0	2	3	2	5	0	1	0	0	0	2	1
32	UDN-32	RH-8546	1	0	3	1	3	3	3	5	0	1	0	0	0	3	1
33	UDN-33	RH-8691	2	3	2	2	2	2	2	5	0	2	0	1	0	2	1
34	UDN-34	RH-8689	2	3	2	1	2	3	2	5	0	3	0	1	0	2	1
35	UDN-35	NDR-8601	3	3	2	4	4	3	4	5	0	3	0	2	2	2	1
36	UDN-36	PYS-842	2	3	2	0	1	3	3	5	0	0	0	2	0	3	1
37	UDN-37	ZEM-1	3	-	3	0	2	2	4	0	0	-	-	2	0	-	-
38	UDN-38	ZEM-2	2	-	0	0	3	-	2	4	0	-	-	1	0	-	-
39	UDN-39	RSK-69	3	3	-	4	4	3	4	4	0	2	0	2	.0	0	1

SN	CODE	DECODE	KNG	LDH	SGN	HSR	GZB	NGN	MOR	PNT	KAN	FZB	BRH	KNG	MOR	FZB	BRH
40	UDN-40	SSK-6	1	3	-	1	0	3	2	5	0	0	0	2	0	4	2
41	UDN-41	SSK-13	1	3	4	0	4	3	2	5	0	0	0	2	4	3	2
42	UDN-42	RSK=33	2	3	0	4	4	3	4	5	0	2	0	0	4	1	1
43	UDN-43	SKNM-90-13	3	3	0	3	3	3	4	4	1	3	0	2	4	1	1
44	UDN-44	RSK-64	3	3	3	3	3	3	4	4	0	3	0	2	3	2	1
45	UDN-45	SKNM-90-4	3	3	3	1	3	3	3	5	1	1	0	1	0	3	1
46	UDN-46	DIRA-313-7	0	3	0	0	3	2	0	5	1	0	0	2	0	2	1
47	UDN-47	DIRA-313-6	2	3	3	0	3	2	0	5	0	0	0	0	0	3	1
48	UDN-48	DIRA-326	3	3	1	1	0	3	2	0	0	3	0	0	0	3	1
49	UDN-49	GSB-7006	0	0	1	0	3	0	0	4	0	0	0	2	0	0	1
50	UDN-50	YRT-3	2	3	2	1	4	4	2	4	0	0	0	0	0	0	0
51	UDN-51	RSK-10	3	3	0	4	2	3	4	4	0	3	1	1	0	1	1
52	UDN-52	CULTURE-1	0	0	2	1	3	0	2	4	0	0	0	2	2	1	1
53	UDN-53	KRV-TALL	3	3	3	4	3	4	4	4	0	3	0	0	0	1	1
54	UDN-54	RH-8544	1	1	0	2	2	2	1	4	2	2	0	2	0	3	1
55	UDN-55	RH-8545	0	0	3	2	1	2	2	4	0	2	0	1	0	2	1
56	UDN-56	CSR-142	3	2	1	2	2	3	4	4	1	2	0	0	0	2	1
57	UDN-57	GSB-7027	0	0	0	0	0	2	0	5	0	1	0	2	0	0	1
58	UDN-58	RC-781	2	1	3	1	2	2	2	5	0	0	0	0	0	0	0
59	UDN-59	CSB-148	3	3	0	2	4	3	3	3	0	1	1	2	0	2	1
60	UDN-60	HNS-4	3	3	1	3	4	3	4	4	0	4	1	2	0	2	1
61	UDN-61	YSK-8502	1	2	3	0	0	0	0	5	0	3	0	2	0	2	1
62	UDN-62	CSR-416	3	3	3	3	4	3	4	4	0	0	0	0	0	0	2
63	UDN-63	GULIVER -1	0	3	0	2	4	3	4	5	1	3	0	3	0	3	1
64	UDN-64	PHR-1	0	2	3	1	1	2	3	4	0	1	0	0	0	0	1
65	UDN-65	MIDAS	0	0	3	0	0	0	0	4	0	1	0	0	0	0	1
66	UDN-66	PHR-2	2	2	1	1	0	2	2	5	2	0	0	0	0	0	1
67	UDN-67	HC-1	0	0	0	0	0	2	0	5	1	1	0	1	0	0	1
68	UDN-68	SPAN	0	0	2	0	2	0	2	5	0	0	0	0	0	0	1
69	UDN-69	BT-2	1	2	0	2	3	3	2	5	0	0	0	0	0	2	1
70	UDN-70	BJ-1	1	0	1	0	4	2	1	5	0	2	0	0	0	0	1
71	UDN-71	PYSR-3	2	3	1	2	4	3	3	5	0	1	0	0	0	0	1
72	UDN-72	TRAWASE	2	2	0	0	1	3	3	5	2	2	0	2	1	2	1
73	UDN-73	HNS-3	-	0	-	0	-	0	-	5	0	1	0	2	0	-	1
74	UDN-74	EC-129126-1	-	0	-	0	-	3	0	5	0	0	0	-	-	1	-
75	UDN-75	CS-52	3	2	3	2	3	3	4	4	0	2	0	-	0	0	1
76	UDN-76	DOMO-4	0	0	0	0	0	0	3	4	1	2	0	2	1	1	1
77	CHECK-1	VARUNA	-	3	3	-	3	4	4	4	1	2	0	-	2	2	2
78	CHECK-2	YST-151	-	3	3	-	3	0	2	1	-	0	0	-	2	3	-

TABLE 5.1.2 UNIFORM DISEASE NURSERY TRIAL UNDER ARTIFICIAL CONDITIONS AT DIFFERENT LOCATIONS DURING 1991-92

			STAG HEAD %					PM 0-5 SCALE	
SN	CODE	DECODE	KNG	LDH	NGN	MOR	PNT	SKN	KAN
1	UDN-1	NDR-873	1.1	40.9	2	2.3	-	2	3
2	UDN-2	RWARS-9	1.4	30.2	3	2.3	-	2	2
3	UDN-3	DIR-247	1.6	30.5	-	4.7	10.5	2	4
4	UDN-4	RWARB-3	1.6	30.1	-	1.4	5	2	3
5	UDN-5	PR-8805	4.0	41.0	4	2.7	-	1	2
6	UDN-6	PYS-841	2.3	20.8	-	0.3	-	1	3
7	UDN-7	RHC-9005	5.0	31.4	3	1.2	-	2	3
8	UDN-8	NDR-871	2.5	40.7	-	0.8	-	2	1
9	UDN-9	PYS-843	1.3	25.0	-	0.0	-	2	1
10	UDN-10	GSL-1501	0.0	0.0	-	0.0	-	2	2
11	UDN-11	NDR-872	3.0	36.2	1	0.3	-	1	3
12	UDN-12	SSK-1	0.0	17.6	-	0.5	-	1	4
13	UDN-13	PT-303	0.0	11.7	-	0.0	-	1	4
14	UDN-14	RN-356	1.5	52.2	3	2.5	-	2	3
15	UDN-15	RN-246	0.0	35.7	2	1.9	-	2	2
16	UDN-16	RN-253	0.0	19.2	-	2.4	-	2	1
17	UDN-17	RN-248	1.3	27.9	-	3.4	-	2	3
18	UDN-18	RN-293	2.5	52.8	3	1.4	-	2	3
19	UDN-19	RN-100	3.3	38.2	-	2.2	-	1	3
20	UDN-20	RN-345	1.3	26.5	-	1.7	-	2	3
21	UDN-21	RN-263	0.0	47.5	4	1.3	-	2	4
22	UDN-22	RN-249	3.3	35.0	5	1.4	-	2	4
23	UDN-23	PC-5	0.0	0.0	-	0.0	-	2	3
24	UDN-24	GSL-1	0.0	0.0	-	0.0	-	2	5
25	UDN-25	HNS-8	1.0	12.5	-	0.0	-	2	3
26	UDN-26	WRR-3-1	0.0	0.0	1	0.0	-	2	3
27	UDN-27	NDYS-2	3.0	11.4	-	0.0	-	2	1
28	UDN-28	C6YS-7B	0.0	0.0	-	0.0	-	2	4
29	UDN-29	TOWER	0.0	0.0	-	0.0	-	2	1
30	UDN-30	RH-8688	0.0	17.9	-	1.7	-	2	1
31	UDN-31	RH-8539	0.0	0.0	2	0.0	-	2	3
32	UDN-32	RH-8546	0.0	0.0	-	0.3	-	2	2
33	UDN-33	RH-8691	1.5	13.1	-	1.2	-	2	3
34	UDN-34	RH-8689	0.0	1.7	1	1.7	-	2	1
35	UDN-35	NDR-8601	1.6	19.7	2	2.9	-	2	2
36	UDN-36	PYS-842	1.3	9.8	2	0.0	-	2	2
37	UDN-37	ZEM-1	0.0	-	-	3.2	-	-	3
38	UDN-38	ZEM-2	-	-	-	0.0	-	-	1
39	UDN-39	RSK-69	2.5	50	3	4.1	-	-	1

TABLE 5.1.2 UNIFORM DISEASE NURSERY TRIAL UNDER ARTIFICIAL CONDITIONS AT DIFFERENT LOCATIONS DURING 1991-92

			STAG HEAD %					PM 0-5 SCALE	
SN	CODE	DECODES	KNG	LDH	NAV	MOR	PNT	SKN	KNG
40	UDN-40	SSK-6	0.0	12.1	-	1.3	-	3	2
41	UDN-41	SSK-13	0.0	11.1	-	0.6	-	2	2
42	UDN-42	RSK=33	1.3	34.2	-	4.0	-	2	3
43	UDN-43	SKNM-90-13	0.0	57.1	-	7.3	-	2	3
44	UDN-44	RSK-64	3.3	39.4	-	4.3	-	2	2
45	UDN-45	SKNM-90-4	0.0	25.4	2	1.5	-	2	4
46	UDN-46	DIRA-313-7	0.0	0.0	-	0.0	-	1	3
47	UDN-47	DIRA-313-6	0.0	0.0	1	0.0	-	2	3
48	UDN-48	DIRA-326	2.0	50.0	-	1.7	-	2	3
49	UDN-49	GSB-7006	0.0	0.0	2	0.0	-	2	4
50	UDN-50	YRT-3	0.0	46.2	-	1.2	-	1	3
51	UDN-51	RSK-10	1.4	20.0	3	1.2	2.6	1	2
52	UDN-52	CULTURE-1	0.0	0.0	-	0.0	-	2	3
53	UDN-53	KRV-TALL	1.6	11.9	-	2.2	-	2	3
54	UDN-54	RH-8544	0.0	2.6	3	0.0	-	2	1
55	UDN-55	RH-8545	0.0	0.0	-	0.0	-	1	1
56	UDN-56	CSR-142	2.3	17.9	-	1.5	-	1	2
57	UDN-57	GSB-7027	0.0	0.0	1	0.0	-	2	2
58	UDN-58	RC-781	1.4	0.0	-	0.0	-	1	3
59	UDN-59	CSR-448	1.6	51.4	-	2.3	8.3	2	3
60	UDN-60	HNS-4	1.4	0.0	2	0.5	-	2	4
61	UDN-61	YSK-8502	0.0	0.0	-	0.0	-	2	2
62	UDN-62	CSR-416	2.6	38.2	-	1.8	7.6	2	2
63	UDN-63	GULIVER -1	0.0	57.1	2	2.0	-	2	1
64	UDN-64	PHR-1	0.0	0.0	1	0.0	-	2	3
65	UDN-65	MIDAS	0.0	0.0	1	0.0	-	2	2
66	UDN-66	PHR-2	1.0	0.0	-	0.0	-	2	4
67	UDN-67	HC-1	0.0	0.0	-	0.0	-	2	3
68	UDN-68	SPAN	0.0	0.0	-	0.0	-	1	3
69	UDN-69	BT-2	0.0	34.0	-	0.1	-	1	3
70	UDN-70	BJ-1	0.0	0.0	-	0.0	-	1	2
71	UDN-71	PYSR-3	0.0	55.5	-	0.0	-	1	3
72	UDN-72	TRAWASE	1.3	0.0	2	0.0	-	1	1
73	UDN-73	HNS-3	-	0.0	1	-	-	2	2
74	UDN-74	EC-129126-1	-	0.0	-	0.0	-	2	3
75	UDN-75	CS-52	1.6	1.3	2	1.6	-	2	4
76	UDN-76	DOMO-4	0.0	0.0	2	0.0	-	2	3
77	CHECK-1	VARUNA	-	30.0	-	3.7	7.7	2	-
	CHECK-2	YST-151	-	2.3	0	2.0	14.	-	-

TABLE 5.1.3. SCREENING OF B.CAMPESTRIS CV TORIA GERMPLASM AGAINST WHITERUST, ALTERNIRA BLIGHT AND PHYLLODY DURING 1991-92

			AB 0-5 SCALE(LEAF)					-POD INF.0-5 SCALE			WR (0-5 LEAF			PH(%)	DM(0-5) SCALE
SN.	CODE	DECODE	MOR	PANT	KAN	FZB	BRH	PNT	FZB	BRH	MOR	PNT	BRH	MOR	BRH
1	TCN-1	PT-303	2.0	5	4	3	4	2	2	4	1	4	0	0.0	1
2	TCN-2	T-9	2.0	5	5	3	3	2	3	4	1	4	0	0.0	2
3	TCN-3	TK-9101	2.0	5	4	4	4	2	3	4	2	4	0	0.0	2
4	TCN-4	TK-9102	1.5	4	4	4	3	3	4	4	1	5	0	0.0	2
5	TCN-5	TH-9101	1.5	5	4	5	4	2	4	4	1	5	0	0.0	2
6	TCN-6	TH-9102	2.0	5	4	3	4	3	2	4	1	4	0	0.0	1
7	TCN-7	TWB-876-1	1.5	4	5	3	4	4	2	4	1	4	0	0.0	1
8	TCN-8	TWB-876-2	2.0	5	4	3	4	3	2	4	1	4	0	0.0	2
9	TCN-9	TWB-14/86	1.0	5	5	3	3	3	3	4	1	4	0	0.0	1
10	TCN-10	PT-8857	1.0	5	4	4	4	3	3	4	1	4	0	0.0	2
11	TCN-11	PT-9005	1.0	5	3	3	4	3	3	4	1	4	0	0.0	2
12	TCN-12	PBT-38	2.0	5	5	4	4	3	3	4	1	4	0	4.7	1
13	TCN-13	JMT-6901	3.0	5	3	4	4	3	4	4	1	4	0	0.0	1
14	TCN-14	JMT-688-14	3.0	4	3	3	4	3	2	4	1	4	0	0.0	1
15	TCN-15	DT-8	1.5	4	3	4	4	3	3	4	1	4	0	6.8	2
16	TCN-16	DT-10	1.5	4	3	4	3	3	4	4	1	4	0	6.2	2
17	TCN-17	SEJ-2	1.0	3	2	3	4	2	3	3	2	2	0	0.0	1
18	TCN-18	PPMS	1.0	2	3	3	3	2	2	3	2	1	0	0.0	1
19	TCN-19	PBT-37	2.0	3	2	4	4	2	4	4	1	5	0	0.0	2
20	TCN-20	TL-15	2.0	5	-	4	-	3	3	-	1	4	-	0.0	2
21	CHECK 1	TH-68	2.0	5	-	-	-	4	-	-	2	5	-	5.8	-
22	CHECK 2	PANCHALI-TWC-3	-	5	-	-	-	2	-	-	-	-	-	-	-
23	YSCN-1	YSBW-877	-	-	-	-	4	-	-	4	-	-	0	-	2
24	YSCN-2	YSBW-881	-	-	-	-	4	-	-	4	-	-	0	-	2
25	YSCN-3	YS-6	-	-	-	-	4	-	-	4	-	-	0	-	2
26	YSCN-4	YS-7	-	-	-	-	4	-	-	4	-	-	0	-	2
27	YSCN-5	YS-8	-	-	-	-	4	-	-	4	-	-	0	-	2
28	YSCN-6	YST-151	-	-	-	-	4	-	-	4	-	-	0	-	2
29	YSCN-7	SUBENOY(45-19-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	YSCN-8	YSBW-9	-	-	-	-	4	-	-	4	-	-	0	-	1
31	YSCN-9	SSK-6	-	-	-	-	4	-	-	4	-	-	0	-	2
32	YSCN-10	SSK-13	-	-	-	-	4	-	-	4	-	-	0	-	2

PH DENOTES PHYLLODY, DM DENOTES DOWNY MILDEW , AB DENOTES ALTERNARIA BLIGHT AND WR DENOTES WHITE RUST

TABLE 5.1.4A. REACTION OF BRASSICA LINES TO AB,WR AND PM UNDER LATE SOWN CONDITIONS DURING 1991-92

SN.	CODE	DECODE	AB(0-5) SCALE HSR	AB(0-5) SCALE KAN	WR (0-5) HSR	STAG-HEAD (%) HSR	PM(0-5) SCALE HSR	PM(0-5) SCALE KAN
1	MLS-1	RL-4/66	1	5	4	23	2	3
2	MLS-2	RW-4C-6-3/II	1	4	4	23	2	4
3	MLS-3	RH-8812	1	5	3	45	2	3
4	MLS-4	PCR-3	1	4	3	89	1	4
5	MLS-5	RLC-962	1	5	3	37	2	3
6	MLS-6	PUSA BAHAR	1	5	4	66	1	4
7	MLS-7	PUSA BASANT	1	5	4	35	0	3
8	MLS-8	RN-100	1	5	4	21	1	3
9	MLS-9	RK-9082	1	5	4	21	2	4
10	MLS-10	RK-9046	1	4	4	56	1	4
11	MLS-11	TM-21	1	5	4	49	0	4
12	MLS-12	TM-17	1	5	3	13	1	3
13	MLS-13	RW-873	1	5	5	46	0	3
14	MLS-14	RW-8716	1	5	5	98	0	4
15	MLS-15	VARDAN	1	5	3	33	0	3
16	MLS-16	RLM-619	1	4	3	43	0	3
17	MLS-17	RK-918502	1	4	4	50	0	4
18	MLS-18	RK-911256	2	5	4	62	0	5
19	MLS-19	PMSS	1	5	5	96	0	3
20	MLS-20	NDR-8602	2	5	4	50	1	2
21	MLS-21	NDR-889	2	5	3	16	0	1
22	MLS-22	VARUNA(NC)	2	4	5	28	1	3
23	MLS-23	KRANTI(NC)	2	5	4	50	2	4
24	MLS-24	RH-7859	2	4	3	24	2	3
25	MLS-25	SEJ-2	2	5	3	32	0	2
26	CHECK	RH-30	3	-	4	49	0	-

TABLE 5.1.4B. REACTION OFBRASSICA LINES TO AB AND WR AT HISAR DURING 91-92

SN.	ENTRY	AB HSR	WR HSR	SN	ENTRY	AB HSR	WR HSR
1	PAHARI RAI	5	2	14	REGENT	2	0
2	B.CHINENSIS	5	3	15	BEC-152	3	0
3	B.NAPUS	2	0	16	MIDAS	2	0
4	B.NIGRA	3	2	17	HNS-4	3	1
5	RH-8695	4	1	18	BEC-108	4	1
6	H-1101A	4	2	19	BEC-125	4	3
7	SSK-1	5	1	20	EC-174239	3	0
8	GULIVAR-1	2	0	21	HNS-5	3	0
9	BEC-148	5	1	22	RH-8693	4	0
10	BEC-147	5	1	23	RH-8687	5	1
11	BEC-135	3	1	24	HNS-3	3	0
12	NORIN	3	0	25	RSH-3	4	2
13	CSR-142	4	3	26	BEC-111	2	1
				27	RH-8689	3	1

AB DENOTES ALTERNARIA BLIGHT, WR DENOTES WHITE RUST AND PM DENOTES POWDERY MILDEW

TABLE 5.1.5. SCREENING OF HIGH OIL CONTENT STRANS TEREATMENTS
AT KANPUR DURING 1991-92

SN.	CODE	DECODE	AB	WR	POD	DM	PHYLLODY
			SCALE USED 0-5				
1	HOCN-1	RW-7/86	5	0	5	0	S
2	HOCN-2	RW-3/86	4	0	5	0	0
3	HOCN-3	RW-9469B	4	0	4	0	0
4	HOCN-4	RK-8605	5	0	4	2	0
5	HOCN-5	RK-8604	4	0	5	2	0
6	HOCN-6	NDYR-8	4	0	3	3	0
7	HOCN-7	RC-891	4	1	4	3	0
8	HOCN-8	CSR-1110	4	0	5	3	S
9	HOCN-9	RC-915	4	0	4	3	0
10	HOCN-10	PRG-908	4	0	3	2	0
11	HOCN-11	DYS-27-9	4	0	3	2	S
12	HOCN-12	PRG-909	4	0	4	2	0
13	HOCN-13	PRG-914	5	0	4	3	0
14	HOCN-14	PRG-925	4	0	3	2	S
15	HOCN-15	SRM-45	4	0	3	3	S
16	HOCN-16	SRM-147	4	2	3	3	S
17	HOCN-17	SRM-148	5	3	4	4	S
18	HOCN-18	SRM-156	3	0	3	3	0
19	HOCN-19	JGM-38	4	0	3	2	S
20	HOCN-20	JGM-28	5	0	4	2	S
21	HOCN-21	JGM-21	5	0	4	3	S
22	HOCN-22	JGM-881	5	2	4	3	S
23	HOCN-23	KRANTI	4	2	4	3	HS
24	HOCN-24	VARUNA	4	1	3	2	0
25	HOCN-25	NDYR-10	-	-	-	-	-

AB DENOTES ALTERNARIA BLIGHT, WR DENOTES WHITE RUST AND
DM DENOTES DOWNY MILDEW

5.2

Name of the Project : National screening nursery trial for Alternaria blight and White rust resistance

Objectives : To confirm the level of true resistance for Alternaria blight and White rust at national level

Locations : (A) Alternaria:

Hisar, Pantnagar, IARI, New Delhi, Ludhiana, Bathinda, Navgaon, Kanpur

(B) White rust:

Ludhiana, Pusa, Kanpur, Sriganganagar, Berhampore, Pantnagar, Bathinda

Progress of work:

The strains reported as resistant/tolerant at different cooperating research stations in previous years were evaluated against Alternaria blight and White rust in National screening nursery trial for Alternaria blight and White rust. The results reported from different centres have been discussed (Table 5.2.1).

Ludhiana:

A strain PB (ABRNT)-6 was observed as resistant against Alternaria blight at leaf as well as at siliquae stage. Whereas, other tested strains were observed as susceptible.

Strain PB (WRRNT)-13 was found immune against White rust incidence at leaf and siliquae stage, while, strains PB(WRRNT)-1, PB(WRRNT)-3, PB(WRRNT)-4, PB(WRRNT)-5 and PB(WRRNT)-12 were found resistant against staghead formation.

Bathinda:

None of the tested strain was rated as resistant against Alternaria blight at leaf stage. However, strains PB(ABRNT)-7,8 and 10 were observed as resistant/tolerant at siliquae stage.

The strains viz; PB(WRRNT)-3, PB(WRRNT)-9 and PB(WRRNT)-13 were found resistant against White rust incidence at leaf and siliquae stage.

Hisar:

At this centre, line PB(ABRNT)-5 showed tolerance against

Alternaria blight at leaf and siliquae stage whereas, line PB(ABRNT)-6 was moderately resistant to Alternaria blight at siliquae stage.

Navgaon:

A strain PB(ABRNT)-6 was observed as tolerant against Alternaria blight at both the stages i.e leaf and siliquae.

Pantnagar:

None of the tested strain was found resistant against Alternaria blight. However, strains PB(ABRNT)-1 and PB(ABRNT)-5 showed resistant reaction against white rust.

The strains, PB(WRRNT)-1, 3, 5, 8 and 12 showed resistant reaction against White rust whereas, a strain PB(WRRNT)-13 possessed moderate degree of resistance under artificial inoculated conditions.

Kanpur:

None of the line under test was found resistant against Alternaria blight.

The strains namely, PB(WRRNT)-1, 3, 5, 10, 11 and 13 were found free from white rust incidence whereas, strains PB(WRRNT)-2,6, 7, 9 and 14 were found resistant for this disease.

Dholi:

At this centre, a strain PB(ABRNT)-7 was rated as resistant against Alternaria blight at leaf and siliquae stage.

IARI, New Delhi:

The strains namely, PB(WRRNT)-1, PB(WRRNT)-3, PB(WRRNT)-5 and PB(WRRNT)-8 were free from White rust infection and strain PB(WRRNT)-13 was found resistant against White rust.

Sriganganagar:

A strain PB(WRRNT)-5 was found resistant against White rust at leaf and siliquae stage whereas, strain PB(WRRNT)-14 showed resistance at leaf stage but was found susceptible at siliquae stage(Stag head formation was observed).

CONCLUSION

It was concluded that strains PB(ABRNT)-5 and PB(ABRNT)-6 showed resistant/tolerant reaction at more than one location.

TABLE 5.2.1 NATIONAL SCREENING NURSERY TRIAL FOR ALTERNARIA BLIGHT RESISTANCE DUR

TABLE 5.2.1 NATIONAL SCREENING NURSERY TRIAL FOR ALTERNARIA BLIGHT RESISTANCE DURING 199

ALTERNARIA BLIGHT 0-5 SCALE ALTERNARIA BLIGWR 0-5 STAG PM

TABLE 5.2.1 NATIONAL SCREENING NURSERY TRIAL FOR ALTERNARIA BLIGHT RESISTANCE DURING 1991-92

SN	STRAIN	ALTERNARIA BLIGHT 0-5 SCALE (LEAF)							ALTERNARIA BLIGWR 0-5 0-5 SCALE (PODSCAL						(LEAF)			STAG HEAD (%)	PM 0-5 SCALE
		LDH	BTH	HSR	NAV	PNT	KAN	DOL	LDH	BTH	HSR	NAV	PNT	DOL	HSR	NAV	PNT	NAV	HSR
1	PB(ABRNT)-1	4	4	3	3	4	4.5	4	3	2	3	2	2	2	0	1	0	2	0
2	PB(ABRNT)-2	4	4	3	2	3	4.5	3	3	2	2	2	2	1	1	3	4	4	0
3	PB(ABRNT)-3	4	4	3	3	3	4.2	2	4	3	2	3	2	1	2	3	4	4	0
4	PB(ABRNT)-4	4	4	3	3	3	4.2	0	4	3	2	2	1	1	2	2	3	6	0
5	PB(ABRNT)-5	4	4	2	3	3	4.7	4	4	2	1	2	2	2	0	2	1	2	0
6	PB(ABRNT)-6	3	4	3	2	3	4.0	3	2	2	1	1	2	1	2	3	4	4	0
7	PB(ABRNT)-7	2	4	3	3	3	5.0	1	1	1	3	1	1	1	1	2	5	0	2
8	PB(ABRNT)-8	3	4	3	3	5	4.5	2	3	1	2	2	2	1	2	3	5	4	0
9	PB(ABRNT)-9	4	4	3	3	4	4.5	2	3	2	3	3	2	2	3	3	5	3	0
10	PB(ABRNT)-10	3	4	3	3	4	4.2	2	3	1	2	2	2	1	2	3	3	5	2
11	CHECK	-	-	-	3	5	-	4	-	3	-	3	2	3	-	3	5	5	-

TABLE 5.2.2 NATIONAL SCREENING NURSERY TRIAL FOR WHITE RUST RESISTANCE DURING 1991-92

SN	STRAIN	WHITE RUST 0-5 SCALE (LEAF)						STAG HEAD %				AB 0-5 SCALE	
		LDH	BTH	DLH	SGN	PNT	KAN	LDH	BTH	SGN	PNT	SGN	PNT
1	PB-(WRRNT)-1	1	2	0	2	1	0.0	0.0	17.0	1.3	8.3	3	2
2	PB-(WRRNT)-2	3	2	4	3	5	1.0	13.3	20.4	52.7	-	2	2
3	PB-(WRRNT)-3	2	1	0	2	0	0.0	0.0	0.0	24.5	-	3	2
4	PB-(WRRNT)-4	3	2	4	2	5	2.7	7.4	18.0	34.0	-	3	2
5	PB-(WRRNT)-5	2	1	0	1	1	0.0	0.0	0.0	0.0	-	3	2
6	PB-(WRRNT)-6	3	2	4	3	3	1.0	11.1	20.2	41.9	1.6	2	2
7	PB-(WRRNT)-7	3	2	3	4	3	1.0	36.6	25.0	49.5	-	3	2
8	PB-(WRRNT)-8	1	2	0	2	1	1.5	7.7	8.5	2.8	-	3	2
9	PB-(WRRNT)-9	3	1	3	3	4	1.0	26.5	0.0	20.0	1.3	3	2
10	PB-(WRRNT)-10	3	2	4	3	4	0.0	6.4	18.2	42.6	-	2	2
11	PB-(WRRNT)-11	3	1	5	3	4	0.0	7.8	0.0	17.2	-	2	2
12	PB-(WRRNT)-12	2	1	2	2	0	1.2	0.0	0.0	11.0	2.2	3	2
13	PB-(WRRNT)-13	0	1	1	3	5	0.0	0.0	0.0	70.2	-	[illegible]	[illegible]
14	PB-(WRRNT)-14	3	3	3	0	5	0.2	4.3	15.3	16.0	2.5	3	2
15	CHECK	-	3	4	3	5	-	-	18.7	62.7	4.5	2	3

5.3

Name of the Project : Chemical control of Alternaria blight, white rust and Powdery mildew (Junagarh)

Objectives : To control Alternaria, White rust and Powdery mildew diseases through chemical spray in an integrated way

Locations : Kangra, Ludhiana, Hisar, Navgaon, Morena, Pantnagar, Kanpur, Faizabad and Dholi

Progress of work :

Data have been presented in Table 5.3.1. The experiment was planned to assess the efficacy of different chemicals against major diseases of rapeseed-mustard. The results obtained have been discussed below:

Kangra:

Three sprays of Rovral significantly reduced Alternaria blight over control. Ridomil MZ also reduced white rust disease. The yield was significantly higher in Rovral treatment.

Ludhiana:

The application of fungicide (Rovral) reduced Alternaria blight from leaves and pods and white rust from leaves significantly compared to unsprayed check. Staghead formation was also reduced by all the fungicides. The reduction in Alternaria blight was maximum with Rovral spray and white rust with Ridomil MZ. Rovral spray significantly increased the yield. Rovral (Iprodione) has been found the best fungicide for the control of Alternaria blight and subsequent increase in yield.

Hisar:

All the fungicides reduced Alternaria blight and white rust significantly. These fungicides were at par but highest yield was obtained from Foltaf treated plots followed by Ridomil MZ. The net profit was also high in Foltaf treataed plots followed by Dithane-M-45.

Navgaon:

White rust was effectively controlled by all the fungicides as compared to control but Ridomil Mz. had given maximum control of the disease. Stagheads were also not formed where the crop was sprayed with Ridomil MZ, Mancozeb and Foltaf. Iprodione could not control white rust but Alternaria blight was effectively controlled as the disease severity of blight on leaf and siliquae was minimum in this treatment. Increase in yield was significantly higher and at par in all the treatments compared to control.

Morena:

Ridomil MZ was found most effective. Though, the results were statistically at par with Foltaf. These treatments were also superior to Dithane M-45 and Rovral. Rovral was most effective in controlling Alternatia blight. The highest yield was recorded with Rovral tretment though it was statistically at par with Foltaf which was superior to Ridomil, Dithane M-45 and control.

Pantnagar:

Iprodione gave maximum disease control and was significantly superior to Mancozeb, Foltaf and Ridomil MZ. Ridomil MZ gave significant reduction in severity of white rust at leaf and staghead phase of the disease. Mancozeb, Foltaf and Iprodione did not check white rust infection on leaf though some reduction in the severity of the staghead phase was observed as a result of spray of these fungicides. Iprodione was the only fungicide which gave significantly higher yield as compared to check.

Kanpur:

All the fungicides were significantly superior over control in reducing the intensity of disease. Iprodione proved to be the most effective in controlling Alternaria blight except Ridomil MZ. All the fungicides were superior over control in increasing the yield. Iprodione gave maximum yield (2750 kg/ha) followed by Mancozeb which gave 2683 kg/ha.

Faizabad:

Iprodione was most effective against Alternaria blight followed by Dithane M-45 and Foltaf. Ridomil MZ was found better in controlling white rust followed by Foltaf and Dithane M-45. The highest yield(1083.33 kg/ha) was recorded in Rovral(Iprodione) treated plots. The average test weight was also recorded significantly higher in Rovral treated plots over control.

Dholi:

Spray of Iprodione was found superior than all other treatments in minimising the disease intensity of Alternaria blight upto 3.4 per cent and that of white rust upto 6.6 per cent with respect to uonsprayed control having disease intensity 45.0% and 13.0%, respectively. The maximum yield was also obtained in the same treatment i.e. Iprodione followed by Ridomil MZ. It was minimum in unsprayed control.

CONCLUSION:

Of the 9 centres, 7 centres reported maximising the seed yield by Iprodione spray whereas only two centres reported highest seed yield with Ridomil spray. The data indicated that the disease pressure due to staghead formation was very low which is the most damaging stage of white rust or combination of white rust with downey mildew in causing heavier losses. Further, it was also observed that none of the chemical were effective in controlling all the three diseases of rapeseed-mustard. However, out of 9 centres, 7 have reported that Iprodione was quite effective in controlling alternaria blight disease.

Powdery Mildew:

Junagarh:

Table 5.3.2 indicate that all the treatments were significantly superior in controlling powdery mildew. Lowest disease intensity observed in Dinocap(0.05%) and wettable sulphur. Maximum seed yield was obtained in Dinocap (0.05%, 1388 kg/ha) followed by Calixin (0.05%, 1254 kg/ha).

Table 5.3.2: Chemical control of mustard Powdery mildew at Junagadh during 1991-92

Treatments	Concn. (%)	Powdery mildew (Average intensity)	Av.Yield (Kg/ha)	Plant stand (ha.)
Dinocap	0.05	41.50* (40.10)	1338	248609
Tridomorph	0.04	62.04 (51.94)	1254	252082
Phytoalexin	0.10	68.50 (55.86)	1157	251040
Wettable sulphur	0.20	62.50 (52.24)	1208	249304
Carbendazim	0.50	73.00 (58.71)	1122	249651
Control	-	89.00 (70.72)	1104	249998
SEm ±		0.40	1527	1927.68
CD at 5%		1.22	47.22	NS
CV%		2.95	5.19	3.08

'*' Figures in Parenthesis are angular transformation values

TABLE 5.3.1 CHEMICAL CONTROL OF ALTERNARIA BLIGHT AND WHITE RUST DURING 1991-92

ALTERNARIA BLIGHT (%) ON LEAVES

SN.	FUNGICIDE	%	KNG VARUNA	LDH RL-1359	LDH GSL-1	HSR VARUNA	NAV VARUNA	MOR	PNT	KAN	FZB	DOL
1	MANCOZEB	0.2	34.6	60.4	53.9	24.6	20.1	38.7	42.2	15.1	41.2	34.0
	(DITNOMEM-45)		(32.2)			(29.7)		(38.4)		(22.8)	(39.9)	
2	FALTAF		32.3	55.8	43.9	20.8	17.7	42.1	40.80	24.2	45.7	28.0
	(DIFOLATA	0.2	(28.6)			(27.1)		(40.3)		(29.4)	(42.5)	-
3	RIDONIL	0.3	34.3	67.1	60.6	26.8	21.2	39.3	33.8	29.5	50.9	22.0
	MZ		(32.1)			(31.5)		(38.8)		(32.8)	(45.5)	
4	IPRODIONE	0.2	8.1	29.3	27.3	23.0	9.8	36.3	28.3	11.6	26.3	3.4
	(ROVRAL)		(1.90)			(28.6)		(37.0)		(19.8)	(30.8)	
5	BITOX	0.2	-	62.7	61.3	-	-	-	-	-	-	
6	CHECK	-	47.2	76.3	74.2	50.1	30.5	52.2	51.4	43.9	76.3	45.0
			(53.1)			(46.1)		(46.2)		(41.9)	(60.9)	
	CD AT 5 %		2.02	5.9	8.2	4.3	4.9	2.2	11.3	2.9	2.1	9.4
	CV%	UNDE	4.42	-	-	-	6.2	3.9	-	6.4	3.6	26.7

SN.	FUNGICIDE	%	ALTERNARIA BLIGHT ON PODS KNG	LDH RL-1359	LDH GSL-1	NAV	PNT	FZB	1000 SEED WEIGHT KNG	NAV	FZB
1	MANCOZEB	0.2	34.6	39.8	52.7	12.1	5.4	25.8	3.0	5.2	4.3
	(DITNOMEM-45)		(32.0)					(30.4)			
2	FALTAF		33.4	30.6	50.7	12.5	3.2	29.2	3.00	5.2	4.10
	(DIFOLATA	0.2	(30.4)					(32.6)			
3	RIDONIL	0.3	35.2	47.3	70.7	11.6	5.6	36.3	3.00	5.1	3.8
	MZ		(33.0)					(36.6)			
4	IPRODIONE	0.2	15.0	6.5	14.6	3.2	1.6	14.6	3.6	5.3	4.5
	(ROVRAL)		(6.0)					(22.3)			
5	BITOX	0.2		41.1	62.2	-	-	-	-	-	-
6	CHECK	-	49.2	66.1	79.5	18.0	20.0	43.10	2.8	4.6	3.7
			(57.0)					(41.0)			
	CD AT 5%		2.7	6.8	7.9	2.8	3.4	2.4	0.1	0.2	0.4
	CV %		6.0	-	-	8.1	-	2.5	2.0	10.8	6.5

		WHITE RUST ON LEAF (%)								
SN. FUNGICIDE	%	KNG	LDH	HSR	NAV	MOR	PANT	FZB	DOL	KAN
1 MANCOZEB (DITNOMEM-45)	0.2	17.6	36.6	18.9 (25.1)	18.2	22.0 (27.8)	28.8	38.3 (38.2)	4.2	0.9
2 FALTAF (DIFOLATA	0.2	15.8	39.3	16.5 (23.9)	19.4	12.6 (20.6)	23.2	33.1 (35.1)	6.2	0.6
3 RIDONIL MZ	0.3	2.5	34.1	19.5 (26.1)	12.5	10.2 (18.5)	16.0	16.1 (23.5)	8.0	0.1
4 IPRODIONE (ROVRAL)	0.2	23.6	47.8	30.4 (33.4)	29.5	38.8 (38.4)	24.6	56.9 (48.9)	6.6	1.1
5 BITOX	0.2	-	38.5	-	-	-	-	-	-	-
6 CHECK	-	27.8	56.0	40.4 (39.5)	37.3	45.8 (42.5)	28.0	65.5 (51.4)	13.0	1.4
CD AT 5 %		2.0	5.7	4.1	3.2	3.5	6.0	2.2	4.1	0.3
CV %		8.4	-	-	4.4	8.7	-	4.1	40.0	7.7

		WHITE RUST ON LEAF (%)					SEED YIELD (Kg/ha)			
SN. FUNGICIDE	%	LDH	NAV	MOR	PNT	FZB	LDH GSL-1	HSR	NAV	MOR
1 MANCOZEB (DITNOMEM-45)	0.2	2.3	0.0	0.7 (1.3)	8.1	22.5	2120	1840	1570	1962
2 FALTAF (DIFOLATA	0.2	2.6	0.0	0.3 (1.1)	7.5	16.9	2160	2020	1572	2198
3 RIDONIL MZ	0.3	0.0	0.0	0.0 (0.0)	6.9	14.8	2160	1930	1557	2039
4 IPRODIONE (ROVRAL)	0.2	5.8	6.0	1.9 (7.3)	9.4	29.6	2680	1830	1491	2379
5 BITOX	0.2	4.6	-	-	-	-	2180	-	-	-
6 CHECK	-	8.0	8.3	2.0 (8.3)	15.7	34.4	1460	1670	1181	1766
CD AT 5 %	120	NS	-	1.2	6.0	12.2	73	270	126	232
CV 5	6.7	-	-	-	-	4.8	-	-	11.4	8.8

SN. FUNGICIDE	%	PNT	KAN	FZB	DOL	KNG
1 MANCOZEB (DITNOMEM-45)	0.2	1170	2683	1042	1220	1286
2 FALTAF (DIFOLATA	0.2	1140	2533	979	1270	1330
3 RIDONIL MZ	0.3	1130	2483	885	1535	1350
4 IPRODIONE (ROVRAL)	0.2	1400	2750	1083	1805	1641
5 BITOX	0.2	-	-	-	-	-
6 CHECK	-	1100	230	645	1075	1015
CD AT 5 %		127	204	111	164	120
CV %		4.2	-	9.1	8.9	6.8

5.4

Name of the Project : Integrated disease management trial

Objectives : To find out suitable combination of fungicidal spray in controlling white rust and Alternaria blight of mustard simultaneously

Locations : Kangra, Ludhiana, Bathinda, Hisar, Navgaon, Morena, Dholi and Faizabad

Progress of work :
The data have been presented in Table 5.4.1.

Kangra:

Ist spray of Ridomil MZ followed by two subsequent sprays of Rovral on mustard sown on Oct.30th have been observed very effective for the control of Alternaria blight at leaf as well as siliquae stage and white rust at staghead stage. In early sown crop i.e. 15th & Ist Oct., white rust(Staghead) does not become the problem. Only Alternaria blight occurs in serious form. In normal and early sown crop, two sprays of Rovral were sufficient to check Alternaria blight.

Ludhiana:

First spray of Ridomil MZ with subsequent two sprays of Rovral sown on Ist week of November have been found very effective for white rust(Staghead stage). In early sown crop staghead does not become the problem, only alternaria developed in severe form which can be controlled by 2-3 sprays of Rovral alone at 20 days interval.

Bathinda:

Rovral and Difolatan(Foltaf) alongwith first spray of Ridomil MZ were at par in reducing Alternaria blight in all dates of sowing but where first spray of Ridomil MZ was followed by two sprays of Difolatan(Foltaf), the white rust disease control was more than where Ridomil MZ was followed by two sprays of Rovral.

Navgaon:

White rust severity on leaves increased with advancement in date of sowing till 31st October. However, stagheads increased with advancement in sowing date till 15th Nov. Blight disease in early sown crop was less as compared to crop sown at later dates. Treatment Ridomil MZ followed by Rovral sprays found to control white rust least than where Ridomil MZ spray followed by 2 spray of Foltaf were given. Blight inensity was least in treatment Ridomil MZ + Rovral

Morena:

Spraying with Ridomil + Foltaf was found superior to control white rust disease intensity. The staghead results were statistically non-significant. Spraying with Ridomil followed by Rovral was found superior to Ridomil + Foltaf in reducing Alternaria blight disease resistance. Both schedules were superior to control in relation to increase in yield. Among the spray schedule Ridomil followed by Rovral spray was superior to Ridomil + Foltaf spray.

Pantnagar:

Ridomil MZ spray followed by Iprodione sprays was significantly superior in all the planting dates. Ist and 15th Oct. sown crop suffered with lodging due to heavy rains and the yield was effected. Ridomil MZ spray followed by two sprays of Rovral gave excellent control of white rust and Alternaria blight with increase in yield under all the planting dates despite the lodging.

Kanpur:

October Ist, 15th, 30th and Nov.15th differed significantly among themselves. 15th Oct. sowing proved best in increasing the yield. Ist spray of Ridomil MZ followed by 2nd and 3rd spray with Iprodione at 15 days interval gave maximum yield(2694 kg/ha) and reduced Alternaria blight to minimum.

Faizabad:

Both combinations decreased the severity of Alternaria blight and white rust infections on leaves as well as pods. They also increased yield and 1000 seed weight significantly. Maximum seed yield was recorded in the crop sown on 15th Oct. 1991. The fungicide Rovral was found significantly superior in controlling the Alternaria blight and increasing the seed yield and 1000 seed weight in comparison to Foltaf.

Dholi:

Ist spray of Ridomil MZ followed by 2nd and 3rd spray of Rovral @ 0.2% at 15 days interval on 30th Oct. sown crop were found significantly most effective in maximising the yield and minimising the intensity of Alternaria blight and white rust.

CONCLUSION:

Combination of Ist spray of Ridomil followed by 2nd and 3rd spray of Rovral at an interval of 15 days on 30th October sown crop have been reported to be most effective in maximising the yield and reducing the intensity of white rust and Alternaria blight at most of the stations.

TABLE 5.4.1 INTEGRATED DISEASE MANAGEMENT TRIAL ON MUSTARD CONDUCTED DURING 1991-92

		ALTERNARIA BLIGHT ON LEAF (%)									AB ON PODS (%)				
SN	TREAT.	KNG	LDH	HSR	NVG	MOR	PNT	KAN	FZB	DOL	KNG	LDH	NAV	PNT	FZB
1	D1S0	29.4	79.8	54.3	16.9	36.0	55.0	41.9	57.3	55.0	28.8	68.4	9.0	20.0	45.1
2	D1S1	9.6	43.2	25.0	6.4	11.9	14.0	20.3	31.9	7.3	12.9	15.2	3.1	11.0	25.3
3	D1S2	18.2	63.2	27.0	12.5	17.5	19.0	28.5	39.5	25.0	17.1	36.9	5.2	12.0	30.3
4	D1S3	-	36.4	-	-	-	-	-	-	-	-	16.4	-	-	-
5	D2S0	34.5	80.1	44.1	19.8	42.3	58.0	41.7	65.3	55.0	44.6	65.5	13.4	20.0	48.1
6	D2S1	5.5	43.0	25.6	6.8	4.4	19.0	20.4	38.1	6.0	19.5	17.6	4.9	10.0	20.9
7	D2S2	18.9	69.2	23.0	12.2	25.0	29.0	27.7	44.7	31.7	29.7	36.2	7.4	12.0	25.0
8	D2S3	-	38.2	-	-	-	-	-	-	-	-	15.2	-	-	-
9	D3S0	45.2	70.1	46.3	28.8	53.5	46.0	40.2	57.0	58.3	48.1	61.6	19.2	17.0	40.9
10	D3S1	4.7	44.1	22.3	8.4	12.4	20.0	20.8	27.5	11.6	24.4	17.5	5.5	11.0	18.6
11	D3S2	27.7	55.4	25.4	16.3	18.4	26.0	27.1	35.6	28.3	32.8	30.0	8.3	11.0	23.4
12	D3S3	-	37.9	-	-	-	-	-	-	-	-	13.8	-	-	-
13	D4S0	47.9	85.9	24.9	31.6	37.7	37.0	38.5	49.9	-	47.3	49.1	25.3	17.0	36.6
14	D4S1	14.7	38.4	9.4	9.9	25.3	20.0	19.8	27.8	-	25.5	14.6	8.4	9.0	16.5
15	D4S2	29.1	54.0	11.3	17.5	38.2	27.0	26.9	30.1	-	32.4	25.5	14.7	11.0	25.1
16	D4S3	-	32.2	-	-	-	-	-	-	-	-	11.8	-	-	-

		WHITE RUST ON LEAF (%)									STAG HEAD (%)					
SN	TREAT.	KNG	LDH	BTH	HSR	NAV	MOR	PNT	FZB	DOL	KNG	LDH	BTH	NAV	MOR	PNT
1	D1S0	11.9	60.4	53.1	14.6	18.3	41.5	23.0	-	9.3	0.0	4.5	17.1	3.7	4.9	13
2	D1S1	0.0	43.0	34.2	8.4	12.0	26.0	6.0	-	4.3	0.0	4.6	8.7	1.8	3.7	7
3	D1S2	1.7	34.9	30.8	5.9	6.9	10.9	15.0	-	9.3	0.0	3.8	9.9	0.1	0.3	7
4	D1S3	-	45.2	-	-	-	-	-	-	-	-	2.1	-	-	-	-
5	D2S0	26.4	63.4	58.8	28.8	26.9	44.3	19.0	30.1	8.0	0.4	5.2	26.3	5.9	3.1	16
6	D2S1	10.8	49.2	28.3	19.8	15.7	26.8	12.0	18.9	8.6	0.0	7.2	10.6	3.4	1.2	9
7	D2S2	9.3	38.7	32.4	12.6	11.5	12.6	12.0	22.7	7.7	0.0	8.7	13.7	0.2	0	10
8	D2S3	-	47.2	-	-	-	-	-	-	-	-	3.6	-	-	-	-
9	D3S0	36.4	68.8	50.3	36.0	35.4	42.3	25.0	33.3	20.0	2.3	19.1	8.2	9.7	3.1	28
10	D3S1	19.2	54.0	28.9	20.3	26.7	8.2	16.0	22.5	9.3	0.4	6.6	15.3	6.3	1.2	13
11	D3S2	17.2	38.6	27.7	13.0	15.9	6.3	19.0	22.9	15.0	0.4	8.2	14.0	0.3	0.6	10
12	D3S3	-	48.6	-	-	-	-	-	-	-	-	16.7	-	-	-	-
13	D4S0	31.1	69.1	55.1	44.6	25.2	31.8	35.0	55.3	-	4.7	24.0	29.0	13.6	2.8	25
14	D4S1	13.6	57.2	28.9	26.0	13.8	18.9	15.0	39.5	-	0.6	9.7	20.3	8.3	1.6	13
15	D4S2	12.6	43.7	35.9	15.2	10.3	9.1	23.0	33.5	-	0.5	8.5	21.3	3.6	0.9	14
16	D4S3	-	48.8	-	-	-	-	-	-	-	-	16.0	-	-	-	-

		YIELD (Kg/ha)									1000 SEED WT.(g)		
SN	TREAT.	KNG	LDH	HSR	NAV	MOR	PNT	KAN	FZB	DOL	KNG	NAV	FZB
1	D1S0	807	1560	1720	1255	1659	733	2083	1343	619	3.8	3.7	6.6
2	D1S1	782	2180	1910	1392	2316	1156	2444	1942	127	4.1	5.4	7.1
3	D1S2	693	1670	1940	1370	2229	1058	2305	1018	1124	4.0	4.9	6.6
4	D1S3	-	2170	-	-	-	-	-	-	-	-	-	-
5	D2S0	852	1350	1790	1316	1645	719	2319	1142	46	4.0	5.3	5.1
6	D2S1	1187	1560	2040	2010	2129	1213	2694	1843	939	4.1	5.7	6.7
7	D2S2	1141	1460	2080	1871	1916	952	2513	1571	728	4.0	5.7	5.7
8	D2S3	-	1460	-	-	-	-	-	-	-	-	-	-
9	D3S0	1678	730	1710	723	1727	1221	2027	978	225	3.6	4.7	4.7
10	D3S1	2560	1560	1850	975	2049	1624	2350	1451	569	4.3	5.2	5.7
11	D3S2	2167	1150	1940	961	1629	1397	2319	1299	521	4.0	5.1	5.6
12	D3S3	-	1250	-	-	-	-	-	-	-	-	-	-
13	D4S0	1092	520	1530	600	1124	740	1500	593	-	3.6	3.5	4.5
14	D4S1	1634	1250	1830	855	1597	880	1903	1034	-	4.0	4.0	5.5
15	D4S2	1334	1050	1920	803	1330	755	1805	927	-	3.7	4.1	5.0
16	D4S3	-	1150	-	-	-	-	-	-	-	-	-	-

5.5

Name of the Project : Studies on epidemiology of Alternaria blight and white rust

Objectives : To develop systematised weather forecasting system

Locations : Pusa, Morena and Pantnagar

Progress of work :

Alternaria appears more on early and timely sown crop. White rust appears more on late sown crop.

Alternaria is high temperature disease where white rust and downy mildew are low temperature diseaases.

Alternaria blight, White rust and Downy mildew require high humidity but Powdery Mildew require low humidity.

Morena:

In toria, white rust did not appear even after inoculation of oosporic powder in the soil before sowing in timely sown crop on Sept. 15th. But the disease appeared in Toria crop. Variety Bhawani sown in last week of Oct. The first symptoms of white rust appeared in first week of Dec. Simultaneously, that on Mustard sown in Oct. This shows that the symptoms of white rust do not appear on leaves unless the mean temp. of the day does not touch 15°C (Max. 22 and Min.7.3) which is most favourable for germination of oospores.

In certain cultivars sown in disease nursery, only staghead formation was noticed even after they remained free from leaf infection throughout crop season. This shows beyond doubt that secondary infection does take place. Previously, it was thought that the disease is systematic. As such it is necessary to screen the plants both against leaf infection as well as stagheads.

Low temperature (4.0 to 22°C) with RH 75% and above coupled with slight rains (40 mm) in last week of December favoured the development of white rust and stagheads.

Pantnagar:

As in the last year, effect of weather factors on development of white rust and alternaria blight disease was studied using mustard variety "Krishna" in different planting dates. For this purpose, six planting dates viz; October 10, 25, Nov. 5, 15, 25 and Dec. 5, 1991 were selected and each sowing date was replicated four times in randomised block design. Plot size was 4 x 3. The sowing was done in rows maintained at 30 cm distance and plant to plant distance was kept 10-15 cm. Observations on the first appearance of white rust and alternaria blight and the disease severity were recorded as given in Table 5.5.1.

White rust:

The first appearance of symptoms of white rust on true leaves took only 30 days after sowing when the sowing was done on Nov.25, 1991 as compared to longer period of time i.e. 45-60 days after sowing for the first appearance of symptoms in respect of oct. 15, 25 and Nov.5, plantings (Table 5.5.1). Analysis of weather data revealed that maximum temperature(19-20oC), minimum temperature(6-8oC) with high relative humidity in the range of 92-98% and less hours(4-6th/day) of bright sunshine period favoured early appearance of the first white rust symptoms on leaf in respect of late planted crop.

In contrast to this higher range of maximum temperature(25-32oC), higher minimum temperature(13-19oc), low relative humidity(76-87%) and longer period of bright sunshine(7-9h/day) did not favour the occurrence of white rust symptoms and subsequently delayed the first appearance of white rust symptoms on leaf. Occurrence of rainfall to the extent of 18-19 mm in the last week of Dec. favoured the development of white rust leaf as well as the formation of staghead phase in Nov. 5-25 plantings(Table 5.5.1).

Alternaria blight:

The first symptom of alternaria blight appeared in about 35-39 days after sowing in late planted crop(Nov. 25, Dec.5) as compared to comoparatively longer duration of time i.e. 51-60 days after sowing for the first appearance of symptoms in the case of Oct. 15th to 25th planted crop. The alternaria blight index on leaf was maximum i.e 85 to 86% in the case of 5-25th Nov. planting. The severe development of leaf infection of alternaria blight was associated with the similar weather conditions as mentioned for development of white rust in the preceding paragraphs. The alternaria blight infection on pod was observed to be quite low in the range of 20-25% in all the plantings. The low severity of pod infection was perhaps because of absence of rainfall during the pod formation and development stages. The rainfall during the pod development stages has otherwise been found to favour infection of alternaria blight on pods.

Dholi:

The first appearance of alternaria blight and white rust diseases was observed after 67 and 78 days of sowing respectively during Jan.,1992 in normal sown (28th Oct.91) pathological trial on mustard (Varuna) crop. The weather reports indicate the most suitable weather conditions for the infection and development of these diseases during the month of Dec.1991 and Jan.1992 when there was highest relative humidity (100%) and winter shower (5.2mm) too. Again, the disease development was observed more during Feb. 1992 when the temperature ranged between 8.6 to 24.0^{o}C having two rainy days (with 3.2 mm rainfall). These weather conditions also favoured the incidence and development of stem rot (*Sclerotinia sclerotiorum*) which incidence was recorded as high as 9.87% in the experimental plots of mustard (Var. Kranti) at Dholi.

Table 5.5.1: Effect of different planting dates on occurrence and severity of white rust (WR) and alternaria blight (AB) of mustard at Pantnagar during 1991-92

Planting date	WR	AB	AB*	WR ind. (%) leaf	AB index(%) leaf	AB index(%) pod	Staghead(%) Inc.	Staghead(%) Sev.	**
Oct.15	51	51	88	13.33	62.66	20.00	7.38	10.51	112
Oct.25	60	60	86	40.00	49.33	24.13	7.60	6.01	102
Nov.5	50	50	75	30.66	86.33	20.96	11.33	16.20	92
Nov.15	45	51	74	28.00	85.33	25.53	22.18	13.95	82
Nov.25	30	35	72	22.66	62.66	24.13	23.31	12.03	72
Dec.5	39	39	61	14.00	41.33	24.90	18.06	16.73	61
CD at 5%				2.62	4.85	5.82	6.42	NS	

\`WR´ denotes 1st appearance of white rust (days after sowing)
\`AB´ denotes 1st appearance of alternaria blight (days after sowing)
\`AB*´ denotes 1st appearance of AB on pods (days after sowing)
\`**´ denotes appearance of staghead (days after sowing)

5.6

Name of the Project : Testing variability in *Alternaria brassicae* and *Albugo candida*

Objectives : A) To identify the raceas of the pathogen

B) To develop differentials for identification of races

Location : Pantnagar

Progress of work :

On the basis of symptomatology, reports from abroad and prelim experimental evidence in India, it is found that there is existence of races of *Alternaria brassicae* and *Albugo candida*.

The experiments were conducted separately under IDRC Inter Institutional Collaborative Project for Pantnagar Centre.

5.7

Name of the Project : Diseases of Local Importance

Objectives : To combat with the diseases before they becomes national problem to cause economic losses

Locations : All the centres engaged in Pathological work

In West Bengal, club root disease of crucifers, Rajasthan Sclerotinia rot and Orobanche and Gujarat Powdery mildew have started in taking heavy toll.

Morena:

The incidence of Phyllody in B.campestris var. Toria is increasing every year. Hence the screening of varieties against phyllody is initiated.

The others new important diseases in this region are Sclerotinia stem rot and powdery mildew particularly in late sown crop.

Screening of B.juncea lines against white rust, alternaria and downy mildew:-

Entries: 26

Date of sowing: 20.11.91

Observations:

Results are summarised in table 5.7.1. Out of 26 entries of mustard (B.juncea) BIO YSR, PYM-7 and ZEM-1 were found resistant to white rust. No staghead formation was noticed in above varieties. The maximum disease intensity was recorded in Varuna (Score:4) and staghead in RA-9 (13.1%).

The disease intensity of alternaria blight varied from 2 to 5 score. BIO YSR, Pusa barani, Vaibhav and RLM-619 were scored two. The incidence of downy mildew varied from 0 to 4, maximum being in Seeta and Krishna.

Screening of toria germplasm/varieties against alternaria and phyllody:

Entries: 27

Date of sowing: 14.9.91

Observation:

The incidence of alternaria varied from 1-3. Tobin, Parkland x T-9 & TL-9001 were graded as 1. The incidence of phyllody varied from 0-16.7%. It was maximum in Torch.

Pantnagar:

Bacterial blight caused by *Xanthomonas campestris* pv *campestris* and Sclerotinia rot caused by *Sclerotinia sclerotiorum* were observed taking heavy toll of the crop in the Tarai area of Uttar Pradesh. The occurrence of Sclerotinia rot was observed to the extent of 5 to 10 per cent particularly in the month of January. Late sown crop showed severe development of powdery mildew attack but it was not considered to be serious enough reducing the crop yield. A new unidentified virus disease was observed on No. 16 line included in the quality breeding trial. About 10-20 per cent plants were infected and all the plants of this line were destroyed by burning as precautionary measure to prevent further spread of the disease in subsequent crop season.

Kanpur:

Alternaria blight is one of the most destructive disease of this area. The disease appeared on 26.11.91 whereas it was observed on 1.12.91 in mustard. The disease broke up in severe form in the month of Jan. 1992 when the temperature went down to 8.69 oC and relative humidity was as high as 68.84%. Both these factors prove to be the most conducive for the development of the disease. The infection of disease was also seen on pods resulting poor yield. 45 to 50% intensity was recorded.

Next important diseases are downy mildew and white rust. Downy mildew was noted on 15.10.91. 10-15% disease intensity was recorded. White rust appeared on 20.12.91 and its intensity was 5-10%.

Stem rot appeared in the last week of Jan. 1992. 40-60% intensity was recorded on toria whereas in mustard its intensity was 30-40%.

Powdery mildew was recorded in the second week of Feb. 1992. All the aerial parts of plants were covered with white chalky powder of powdery mildew. The disease was also seen on pods resulting in poor yield. All the entries of late sown trials were found highly susceptible to disease. Bacterial stalk rot was also seen on some varieties/cultures of Laha and Toria.

Assessment of losses caused by Alternaria blight of rapeseed-mustard:

An experiment was also laid out in randomised block design with four replications. Varuna was sown in plot-size of 4 x 3M. The spray with Mancozeb @ 0.25% were given according to the schedule.

A regression line was fitted in disease intensity and yield and expected yield loss in percentage were calculated.

The results indicated that yield decreased from 2-2.24% with 5% increase in disease intensity of Alternaria bight.

Table 5.7.1: Screening of *Brassica juncea* lines against white rust (artificial), downey mildew & alternaria blight at Morena during 1991-92

Entry	White rust: Leaf infection (0-5) scale	White rust: Staghead (%)	Alternaria leaf infection (0-5) scale	Downy mildew (0-5) scale
Pusa bold	2	3.9	5	2
Varuna	4	7.6	4	4
Krishna	3	1.9	3	4
Seeta	2	3.5	3	3
Rohini	3	1.9	4	0
BIOYSR	0	0.0	2	-
PYM-7	0	0.0	3	-
ZEM-1	0	0.0	4	0
RA-9	3	13.1	5	3
MT-12	2	0.0	5	0
PR-8301	2	2.2	4	0
PR-8601	3	1.7	5	3
PR-48	2	3.9	5	2
RK-8503	2	0.0	5	2
RN-8559	3	1.9	4	2
RLC-1105	3	8.3	4	0
RH-30	3	4.1	4	0
RSK-5	3	0.0	5	0
RH-848	3	0.0	5	0
NDR-875	3	3.2	4	0
NDR-8503	2	2.2	4	0
RH-7369	3	7.2	4	2
Pusa barani	3	1.8	2	1
Vaibhav	3	1.7	2	2
RLM-619	2	0.0	2	0
Kranti	3	4.0	4	2

5.8

Name of the Project : Plant growth responses to VA Mycorrhiza

Objectives : To improve yield of mustard using VA-Mycorrhiza

Location : PC Unit

Symbiotic association between Mycorrhiza and plant root has been shown to have significant effect in terms of efficient phosphate uptake as well as biological suppression of potential soil borne pathogens. Based upon above information, biological suppression of *Sclerotinia sclerotiorum* causing Sclerotinia rot in mustard was undertaken.

Interaction studies between Vesicular arbuscular mycorrhizal fungus *Glomus mosse* and *Sclerotinia sclerotiorum* in mustard (Varuna) revealed that mycorrhizal inoculation significantly restricted the spread of the pathogen in host root tissue. Disease incidence was reduced in pathogen + mycorrhizal inoculated plants. It also increased total dry matter production.

6 PLANT PHYSIOLOGY:

6.1

Name of the Project : Screening of genotypes for frost tolerance

Objectives : To identify frost tolerant genotypes

Locations : Hisar, Ludhiana, Navgaon
Hisar centre only reported data

Progress of work:

Hisar:

Each experiment plot had a size of 1.2 m x 1m consisting of 5 rows of 10 plants each with row to row distance of 22.5 cm and plant to plant distance of 10cm. Such plots were arranged in rows 5m apart. Plot to plot distance was 1m. One border row of RH-30 was grown on either side as non-experimental line. Freezing could not be achieved by Movable Freezing Chamber becauase of non-functioning of generator. Therefore, twig test was applied and these twigs were given freezing treatment in the deep freezer adopting following procedure:-

Main shoot twigs bearing siliqua were cut 30-35 days after sowing from differnt genotypes and planted in pots containing soil maintained at field capacity. A fixed temperature of 3.5°C was given to the potted twigs for 2 hrs. and the lid of the deep freezer was opened after 30 minutes. After another 30 minutes twigs were removed and kept alongwith unfrozen control twigs. The twigs were normal irrigated every day and high humidity was maintained. After about 10-12 days, the difference in living and killed seeds became apparent. The data was recorded on per cent killed and unkilled seeds. Lower the per cent unkilled seeds in a genotype more tolerant will be.

From the data available, (Table 6.1(I).1), it is aparent that strains RH-9001, RH-8814 and RH-8904 were relatively frost tolerant.

Table 6.1(I).1 Effect of freezing treatment on number of normal undamaged seeds/siliqua.

Genotypes	No.of normal undamaged seeds/siliqua in frozen and unfrozen plants.		% reduction in number of undamaged seeds/siliqua by freezing.
	Frozen	Unfrozen	
RH-30	8.8	12.3	28.5
RH-781	9.4	12.3	23.2
Varuna	8.6	11.0	21.6
RH-819	7.7	11.3	32.1
RH-9001	11.9	14.3	32.1
RH-8812	11.3	18.4	26.8
RH-8904	11.2	14.0	19.8
RH-8821	10.2	14.7	30.6
RH-8816	13.6	18.0	24.6
RH-8315	11.4	15.6	26.9
RH-8689	8.2	12.4	34.0
RH-8113	9.9	14.6	32.3
RH-8602	9.4	13.0	40.2
RH-8605	7.4	12.3	39.8
RH-8693	10.0	14.2	29.6
RH-8814	10.5	13.0	19.3
RH-839	9.9	14.2	30.1

6.1(II)

Name of the Project : To assess the cryoprotective role of various chemicals

Objectives : To assess the possible cryoprotective which can partially mitigate frost damage

Locations : Hisar, Ludhiana, Navgaon
Hisar centre only reported the data

Progress of work:

Hisar:

The variety RH-30 was grown in the field and 35 days after its sowing 100 ppm concentration write this each of Cycocel, Etheral and Nephthyl acetic acid(NAA) were sprayed. Next morning, main shoot twig were taken and freezing treatment was given adopting same procedure as in experiment 6.1(I). Data was recorded on No. of killed seeds/siliquae in control unfrozen plants and various treatments. The data presented in table 6.1(II).1 revealed that NAA had a positive cryoprotective role whereas cycocel offers very little protection. The Etheral did not have any effect. Almost, similar observations were recorded last year except crop that CCC did not prove effective in this regard.

Table 6.1(II).1: Effect of chemical spray on number of unkilled seeds/siliqua in frozen and unfrozen plants and per cent reduction in unkilled seeds/siliqua

Chemical (conc.)	Unkilled seeds/ siliqua		% reduction in unkilled seeds/ siliqua over control
	F	UF	
Control (unsprayed)	9.6	12.8	25.0
Control (water sprayed)	9.7	12.9	24.8
CCC (100 ppm.)	10.9	13.0	16.1
Etheral (100 ppm.)	9.9	12.8	22.7
NAA (100 ppm.)	11.8	13.1	9.9

6.2.

Name of the Project : To study partitioning index in Brassica genotypes

Objectives : To examine per cent transfer of assimilates from source to sink

Locations : Hisar, Kanpur
Kanpur centre only reported data

Progress of work:

Hisar:

The strains; RH-781, RH-8812, RH-9001, RH-8701, RH-8954, RH-819, RLM-198, RLM-514, RLM-1457, Varuna, RH-30 and Kranti were grown in two rows of 6 m length each in RBD. All the senescising leaves were plucked. Leaves were sun-dried. Due to rains in mid Jan., the sun-dried leaves got rotten and hence reliable data could not be obtained.

Kanpur:

Ten genotypes were grown for this experiment. Seed yield per plant, No. of siliquae per plant, No.of seeds per siliquae, test weight(gm), dry weight of leaves per plant, partitioning index and harvest index were recorded (Table 6.2.1). The characterwise results have been given below:

No. of siliquae per plant:

Maximum No. of siliquae were recorded in RLM-198, RH-8001, Varuna whereas genotypes RH-8812, RH-8904 had lowest number of siliquae per plant (Table 6.2.1).

No.of seeds per siliqua:

Genotypes Varuna, RH-30, RH-819, RH-8701 had relatively higher number of seeds per siliquae while genotypes RH-8812 had lowest seed number per siliqua (Table 6.2.1).

1000 seed weight:

Genotypes RH-8701, RH-30, Varuna, RH-8904 recorded boldest seed size followed by RH-9001, whereas RLM-198 had average small seed size by showing lowest test weight.

Partitioning index:

Genotypes Varuna, RH-8701 and RH-781 recorded relatively higher value of partitioning index while genotypes RLM-198 had lowest value of partitioning index.

Harvest index:

TABLE 6.2.1 SEED YIELD (g/PLANT),NO.OF SILIQUA, NO.OF SEEDS/SILLIQUA, 1000 SEED WEIGHT(g), Wt. OF LEAVES(g) /PLANT,PARTITIONING INDEX AND HARVEST(%) INDEX PER CENT IN 10 BRASSICA GENOTYPES

VARIETY	SEED YIELD (g)/PLANT	SILLIQUAE/ PLANT	SEEDS/ SILLIQUA	1000 SEED WT.(g)	WT. OF LEAVES/ PLANT(g)	P.I	H.I
RH-781	18.7	473.5	12.3	3.2	14.4	56.4	17.9
RH-8812	12.8	322.2	10.7	3.5	12.2	51.3	18.1
RH-9001	16.8	415.6	12.2	4.2	18.3	47.9	18.3
RH-8701	19.7	493.3	12.6	4.5	14.9	56.8	21.3
RH-8904	16.3	382.4	11.6	4.3	13.2	55.2	20.3
RH-819	14.0	419.3	12.7	4.0	11.5	54.8	19.0
RLM-198	18.6	664.0	11.8	2.5	22.7	44.8	18.6
VARUNA	18.6	488.9	12.8	4.3	13.9	57.7	21.5
RH-30	18.3	454.9	12.7	4.4	14.4	55.8	21.2
KRANTI	13.5	481.6	12.1	3.2	12.7	51.4	14.2

TABLE 6.3.1 PERCENT SEED GERMINATION AS AFFECTED BY 3 SALINITY LEVELS AND % REDUCTION IN SALINITY OVER THEIR RESPECTIVE CONTROLS

SPECIES/VARIETY	% SEED GERMINATION CO	C1	C2	C3	% REDUCTION IN SALINITY OVER CONTROL
B.JUNCEA					
RH-30	95	85	80	55	42.11
RH-781	100	100	100	80	20.00
RH-819	100	100	90	60	40.00
RH-8113	100	100	85	85	15.00
RH-8812	100	100	95	85	15.00
B.CARINATA					
HC-2	100	95	95	90	10.00
CAR-5	90	95	80	25	72.22
CAR-6	100	90	90	30	70.00
C-6-YS7B	100	90	95	60	40.00
HC-9003	85	70	50	75	11.76
B.NAPUS					
N-20-7-1	95	90	95	75	21.05
N-20-23-1	85	90	100	75	11.76
N-20-12-1	90	90	70	40	55.56
N-20-26-1	90	100	90	80	11.11
HNS-8902	100	85	75	50	50.00

Maximum value of harvest index was recorded in Varuna, RH-8701 followed by in RH-30 while Kranti had the lowest value of haravest index.

Dry waeight of leaves:

Maximum dry weight of leaves per plant was recorded in genotypes RLM-198 while RH-8812 had the minimum dry weight of leaves per plant.

Seed yield per plant:

Genotypes RH-8701 was found to produce maximum seed yield per plant followed by RH-781, Varuna, RLM-198 and RH-30.

The high yield in RH-8701, Varuna and RH-30 was attributed due to large number of siliquae per plant, number of seeds per siliquae, bold seed size, high value of partitioning index and harvest index, whereas in RLM-198, high yield was due to the production of maximum number of siliquae per plant.

6.3

Name of the Project : Studies on salinity tolerance in *Brassica* species

Objectives : To identify varieties tolerant to salinity at germination stage

Locations : Hisar, Kanpur

Progress of work:

Hisar:

Five varieties each belonging to B.juncea (Var. RH-30, RH-781, RH-819, RH-8113 and RH-8812), B.carinata (HC-2, CAR-5, CAR-6, C6YS7B and HC-9003), B.napus (N-20-7-1, N-20-23-1, N-20-20-1, N-20-26-1 and HNS-8902) were sown in petriplates using 3 concentrations of chloride predominating salinity (150, 225 and 300 meq.) referred to as C1, C2 and C3 alongwith control (distilled water referred to as C0). Daily record of seed germination was recorded upto 20 days after sowing. In the end, observations were recorded on the root and shoot length, fresh and dry weight of the seedlings. The salient findings were:

Per cent seed germination:

In control almost 85-100 per cent seeds germinated. In general, significant and progressive reduction in the seed germination was observed with the increasing order of salinity (Table 6.3.1). The reduction in seed germination over control was much leser in C1 and C2 than C3 when a drastic reduction was noticed. On the basis of mean of all the five genotypes belonging to a particular species, in highest salinity level, the percent reduction in the seed germination was maximum in B.carinata (47.4%), followed by in B.napus (31.2%) and B.juncea (26.3%). The genotypes which were promising in this regard were RH-781, RH-8113, RH-8812 of B.juncea genotype HC-2 of B.carinata and genotype N-20-7-1, N-20-23-1, N-20-26-1 of B.napus. In highest salinity solution (300 meq), the seed germination was in general lesser in B.carinata.

Coefficient of velocity (C.V.):

Coefficient of velocity was calculated by the following formula:

$$\frac{100 \times A1 + A2 + A3 \text{---------------------------} An}{A1T1 + A2T2 \text{-----------------------------} AnTn}$$

Where A1 = No. of seeds germinated on first day after sowing

& likewise.

T1 = Time i.e one day after sowing and likewise.

Data (Table 6.3.2) reveal that in control, coefficient of velocity ranged between 30-50 per cent. The cv. 50 indicates that all the 10 seeds germinated one day after sowing. In control, the mean C.V. (mean of all genotypes in a particular species) was maximum in B.juncea (45.0%) followed by in B.carinata (40.6%) and B.napus (39.0%), respectively.

The coefficient of velocity in general reduced remarkably with increasing level of salinity and resulting thereby it was minimum in C3 where it ranged between 14 to 25. In C3 the mean, C.V. (mean of all genotypes of each species) was maximum in B.juncea (23) followed by in B.napus(22) and B.carinata (19), respectively. But the per cent mean of reduction in cv. in all salinity treatment (mean of C1 to C3) over its control was maximum in B.napus(37.4%) followed by in B.juncea(33.6%) and B.carinata(31.2%), respectively. The coefficient of velocity in B.juncea var. RH-8812 and B.napus vars. N-20-7-1 and N-20-23-1(in saline solutions) showed less than 25 per cent reduction over their respective controls thereby indicating a characteristic of relative salinity tolerance. None of the genotype belonging to B.carinata showed less than 29.5% reduction in coefficient of velocity over control thereby suggesting that the carinata is relatively susceptible to salinity at germination stage. Thereby, keeping in view coefficient of velocity as criterion of screening genotypes, B.napus has as edge over B.juncea whereas B.carinata is relatively susceptible.

Speed of germination:

It was calculated using following formula:

$$\frac{\text{No. of normal seedlings}}{\text{Days to first count.}} + \text{----------} \frac{\text{No. of normal seedling}}{\text{Days to final count.}}$$

In non-saline solutions(Table 6.3.2), the speed of germination ranged between 2.54 (var.HC-9003) to 5.00(var. HC-2). Almost similar observation was recorded in coefficient of velocity. The highest mean speed of germination was amongst different species was observed in B.juncea (4.50) followed by in B.carinata (4.01) and B.napus(3.80) which were almost at par.

The speed of germination in general reduced with the increasing level of salinity resulting thereby attaining a minimum value in 300 meq. (highest salinity level). The mean speed of germination in 3 salinity levels was computed and per cent reduction calculated over their respective controls. The per cent reduction ranged between 44.99 (var. RH-8812) to 68.22(var. HNS-8902). The per cent reduction was in general

TABLE 6.3.2 COEFFICIENT OF VELOCITY AND SPEED OF GERMINATION AS AFFECTED BY 3 SALINITY LEVELS

VARIETY	COEFFICIENT OF VELOCITY				TREATMENT MEAN	%REDUCTION	SPEED OF GERMINATION				TREATMENT MEAN	% RED. IN SALI.OVER CON
	C0	C1	C2	C3			C0	C1	C2	C3		
B.JUNCEA												
RH-30	45	33	26	20	26	41.5	4.30	3.11	2.77	1.28	2.39	44.42
RH-781	44	35	30	23	29	33.4	4.50	3.60	3.13	1.99	2.92	35.11
RH-819	48	43	29	23	32	34.1	4.92	4.50	2.59	1.46	2.85	42.07
RH-8113	49	41	31	25	32	34.1	4.92	4.25	2.71	2.23	3.06	37.8
RH-8812	39	34	28	29	29	24.8	3.89	3.30	3.08	2.25	2.86	26.48
B.CARINATA												
HC-2	50	44	33	22	33	34.0	5.00	4.10	3.42	2.23	3.25	35.0
CAR-5	30	22	23	14	20	34.4	3.40	3.04	2.10	0.42	1.85	45.59
CAR-6	46	36	24	17	25	44.3	4.59	3.73	2.68	1.44	2.61	43.14
C-6-YS7B	43	33	33	25	30	29.5	4.54	3.45	2.92	1.65	2.67	41.19
HC-9003	34	20	17	18	19	44.1	2.54	2.01	0.92	0.67	1.12	55.91
B.NAPUS												
N-20-7-1	32	31	25	23	26	17.7	3.27	2.91	2.55	1.90	2.46	24.77
N-20-23-1	36	33	28	23	28	22.3	3.33	2.81	3.00	1.82	2.42	27.33
N-20-12-1	40	28	22	22	24	40.0	3.92	2.90	1.98	0.92	1.93	50.77
N-20-26-1	40	37	28	24	29	25.8	3.92	3.16	2.73	2.11	2.65	32.00
HNS-8902	47	29	22	19	23	30.4	4.50	2.81	1.87	1.05	1.90	54.29

lower in *B. juncea* and *B. napus* than *B. carinata* which again supportas over earlier contention that *B. napus* and *B. juncea* are superior in saline conditions to *B. carinata*.

Root length:

In control, the root length ranged between 2.81 cm(HC-9003) to 7.27(HNS-8902) (Table 6.3.3). It deserves a special emphasis that var. HNS-8902 in control solution has high per cent germination, high coefficient of velocity and high speed of germination but it did not perform well in salinity solution i.e. germination was relatively poor and speed of germination over their respective controls was maximum.

The root length reduced with increasing level of salinity. The mean per cent reduction(mean of C1, C2 and C3) in root length in salinity over its respective controls ranged between 41.05 per cent(var. car-5) to 64.92 per cent (var. HNS-8902). Therefore, variety(HNS-8902) again proves to be very susceptible to salinity.

Shoot length:

Similar to root length, the mean shoot length(mean of all genotypes belonging to each species) was maximum in *B. napus* followed by in *B. carinata* and *B. juncea*(Table 6.3.3). In control, the shoot length was in general equal to or lesser than that of root length except in var. HC-9003 which had consistantly higher shoot length than its root length either in control or in various concentration of saline solutions. The shoot growth seems to be at the expense of root growth because root growth in this particular variety was lowest among the genotypes belonging to this species whereas the shoot length was the highest.

Root:Shoot Ratio(R:S):

In control, roots were usually longer than shoots hence. Root: Shoot ratio values usualy ranked above one except in varieties CAR-5, HC-9003, N-20-26-1(Table 6.3.3). The root: ratio in general ranged between 0.65 to 1.67. The ratio in C1 and C2 showed no consistant observation. It increased, decreased or remained same as of their respective controls depending upon the genotypes, but this ratio consistantly reduced in C3 except in N-20-26-1 which showed a marginal increase. It is, however, safe to be stated that mean of 3 salinity concentrations viz; C1, C2 & C3 reduced in all cases except var. HC-9003 and N-20 -26-1. The per cent reduction in this ratio over their respective controls ranged between 11.00 (var. CAR-5) to 47.39(var. HNS-8902).

In control, the mean R:S ratio in control (mean of all genotypes of a species) was maximum in *B. napus* (1.66)

Table 6.3.3: Root length and shoot length(cm) as affected by 3 salinity leve

VARIETY	ROOT LENGTH				TREATMENT MEAN	% REDUCTION
	C0	C1	C2	C3		
B.JUNCEA						
RH-30	4.86	4.29	2.22	1.08	2.53	47.94
RH-781	4.97	4.05	2.6	0.83	2.49	49.84
RH-819	4.44	3.6	2.34	0.46	2.13	51.95
RH-8113	4.43	3.3	1.8	0.63	1.91	56.88
RH-8812	6.41	5.46	2.98	1.58	3.34	47.89
B.CARINATA						
HC-2	4.83	3.44	1.86	2.02	2.44	49.48
CAR-5	3.02	3.24	1.81	0.3	1.78	41.05
CAR-6	4.09	3.24	1.73	0.44	1.8	55.9
C-6-YS7B	3.9	3.04	1.67	0.57	1.76	54.8
HC-9003	2.81	2.36	1.93	0.26	1.51	46.26
B.NAPUS						
N-20-7-1	5.6	4.03	1.16	0.98	2.05	63.39
N-20-23-1	4.84	4.29	1.24	0.93	2.15	55.58
N-20-12-1	4.48	4.48	1.85	0.98	2.44	45.53
N-20-26-1	4.45	4.3	1.77	1.1	2.39	46.29
HNS-8902	7.27	4.83	2.09	0.75	2.55	64.98

	SHOOT LENGTH				TREATMENT MEAN	% REDUCTION
	C0	C1	C2	C3		
B.JUNCEA	3.6	2.8	2.23	1.71	2.24	37.5
RH-30	3.47	2.88	1.76	1.15	1.93	44.38
RH-781	3.8	3.09	1.96	1.09	2.04	46.14
RH-819	3.95	3.07	1.71	1.3	2.03	48.6
RH-8113	3.84	2.87	2.18	1.29	2.11	44.96
RH-8812						
B.CARINAT						
HC-2	3.96	2.88	2.02	1.07	1.99	49.74
CAR-5	3.32	2.52	2.08	1.1	1.9	42.77
CAR-6	3.84	3.43	2.12	0.84	2.13	44.59
C-6-YS7B	3.42	2.59	1.75	0.98	1.77	48.15
HC-9003	4.31	2.13	1.71	0.8	1.88	56.38
B.NAPUS						
N-20-7-1	4.24	3.27	1.63	1.06	1.98	53.14
N-20-23-1	4.14	3.61	1.92	0.91	2.14	48.15
N-20-12-1	4.09	3.53	2.4	1.33	2.42	40.83
N-20-26-1	4.54	3.43	2.02	1.18	2.21	52.03
HNS-8902	4.39	4.64	2.35	1.09	2.69	46.74

Table 6.3.3 Contd.....

	ROOT : SHOOT RATIO				TREATEMENT MEAN	% REDUCTION
	C0	C1	C2	C3		
B.JUNCEA						
RH-30	1.35	1.53	1.00	0.63	1.05	22.00
RH-781	1.43	1.41	1.48	0.72	1.2	16.08
RH-819	1.17	1.17	1.19	0.42	0.93	21.00
RH-8113	1.1	1.96	1.37	1.22	1.52	35.71
RH-8812	1.67	1.9	0.92	1.22	1.35	19.16
B.CARINAT						
HC-2	1.22	1.19	0.92	1.08	1.06	13.0
CAR-5	0.91	1.29	0.87	0.27	0.81	11.0
CAR-6	1.07	1.25	0.82	0.52	0.86	19.0
C-6-YS7B	1.14	1.17	0.95	0.58	0.9	21.05
HC-9003	0.65	1.11	1.13	0.33	0.86	32.31
B.NAPUS						
N-20-7-1	1.17	1.23	0.71	0.92	0.95	18.52
N-20-23-1	1.17	1.19	0.65	1.02	0.95	18.52
N-20-12-1	1.1	1.27	0.77	0.77	0.93	15.76
N-20-26-1	0.98	1.25	0.88	0.93	1.02	4.08
HNS-8902	1.66	1.04	0.89	0.69	0.87	47.38

followed by in *B.juncea* (1.35) and *B.carinata* (1.00), respectively.

In C3 (higheast salinity solutions), the R:S ratio was maximum in HC-2 and minimum in CAR-5. The reduction in C3 was more mainly because of more reduction in root length compared to shoot length with shows that root is more sensitive to salinity than shoot.

Fresh weight and dry weight seedling and dry weight: Fresh wt ratio:

In control, the mean dry weight/ 5 seedlings was maximum in *B.juncea* followed by in *B.napus* & *B.carinata*(Table 6.3.4). But unlike other parameters dry weight of seedlings did not reduce with increasing salinity level upto C2 rather it increased. In C3 also, both an increase or decrease was recorded depending upon genotypes. It increased in varieties RH-781, RH-8113, RH-8812 of *B.juncea* var. HC-2 and C-6YS7B in *B.carinata* and vars. N-20-23-1 and N-20-26-1 of *B.napus*. Reduction was noted in remaining genotypes. The interesting observation was that with the increasing salinity level, the ratio dry weight to fresh weight increased significantly. In *B.juncea*, it increased in the order 6.0, 6.61, 8.80 and 11.03; in *B.carinata*, 5.78, 5.74, 6.48 and 14.39; in *B.napus*, 4.33, 5.43, 7.21 and 17.07. In general, the dry weight: Fresh weight ratio was towards higher side in *B.napus*(In C3) which shows higher absorption capacity of salts by *B.napus* plants.

Kanpur:

Fourteen genotypes belonging to *B.juncea*, *B.carinata* and *B.napus* were germinated in petridishes containing distilled water, 150 and 225 meq. salinity solutions. The results are given as under:

Seed germination:

In non-saline medium, most of the seeds germinated. In 150 meq. concentration seeds germination was reduced except in RH-30, C-6YS7B, N-20-7-1, N-20-23-2 genotypes where seeds germination increased slightly over control. In 250 meq. concentration seeds germination was reduced. Genotypes CAR-5 and HC-9003 were found to be most sensitive in terms of seed germination at 225 meq. salinity level(Table 6.3.5).

Root length:

In control(Table 6.3.5), maximum root length was recorded in N-20-7-1. Root length increased slightly at 150 meq. salinity level in RH-30, HC-2 and N-20-23-2. In 150 meq. salinity level maximum root length was recorded in RH-30. 225 meq. salinity level generally reduced root length than control and also than 150 meq. salinity level and maximum

TABLE 6.3.4 FRESH WEIGHT AND DRY WEIGHT(mg/5 seedlings) AS EFFECTED BY

Variety	FRESH WEIGHT (mg/5 seedlings)				DRY WEIGHT (mg/5 seedlings)			% CHANGE IN C3 OVER CONTROL		
	C0	C1	C2	C3	C0	C1	C2			
B.JUNCEA										
RH-30	500	750	550	300	42	46	45	-19.05		
RH-781	500	750	500	350	31	45	46	+16.13		
RH-819	500	500	500	250	29	28	36	-20.69		
RH-8113	500	500	450	400	22	33	37	+54.55		
RH-8812	750	800	500	350	41	56	56	+34.15		
B.CARINATA										
HC-2	350	400	440	100	18	25	22	+22.22		
CAR-5	200	440	250	30	14	26	17	-92.86		
CAR-6	300	450	450	200	16	25	25	-6.25		
C-6-YS7B	400	400	400	100	17	20	17	+5.88		
HC-9003	200	350	100	150	13	21	15	-38.46		
B.NAPUS										
N-20-7-1	400	450	400	150	21	27	31	-9.52		
N-20-23-1	300	450	490	100	17	27	36	+64.71		
N-20-12-1	450	500	400	100	21	25	22	-33.33		
N-20-26-1	490	550	450	250	22	28	33	-22.73		
HNS-8902	480	480	300	15	23	25	25	-26.09		
N-20-12-1	44.3	40.3		30.3		5.7		4.3	1.4	5.9
N-20-26-1	49	48.3		36.6		5.4		5.1	1.4	5.8
HNS-8902	44	44		31		5.5		5.2	2.5	7

B.JUNCEA	FRESH WEIGHT(mg/5 seedlings)				DRY WEIGHT(	
RH-30	392.2	555.5	215.5	34.5	40	23
RH-781	290	260	150.3	23.5	20	15.5
RH-819	297.5	270.5	160	27.5	26	17
RH-8812	332.5	295.6	170.6	30.5	27.5	17
B.CARINATA						
HC-2	185	202	150.2	19	21	17
CAR-5	192	175	-	21	14	-
CAR-6	182	177	120.3	19.5	19	16.5
C-6-YS7B	230.5	205.5	150	23.5	21	16.5
HC-9003	167.5	152.5	-	19	19	-
B.NAPUS						
N-20-7-1	267.3	250.6	155	28.5	26	18.5
N-20-23-1	230	375	170.6	22.5	32	21
N-20-12-1	325.6	227.3	215.6	30.5	20	18.5
N-20-26-1	225.5	275	210.6	22.5	28	20.5
HNS-8902	262.6	222.3	165.3	24.5	20	17.5

TABLE 6.3.5 :STUDIES ON SALINITY TOLERANCE IN BRASSICA SPECIES

SPECIES/VARIETY	NO.OF SEEDS GERMINARED OUT OF 50 SEEDS SEEDS SOWN			ROOT LENGTH (cm)			SHOOT LENGTH(cm)		
	1	2	3	1	2	3	1	2	3
	CONTROL	150 MEQ.	225 MEQ.	CONTROL	150 MEQ.	225 MEQ.	CONTROL	150 MEQ.	225 MEQ.
B.JUNCEA									
RH-30	48.3	49.6	33	5.6	6.5	2.4	6.4	6.4	2.6
RH-781	40.0	40.0	32	5.2	4.8	1.9	5.8	4.2	2.6
RH-819	47.0	43.0	31.6	4.0	3.2	1.9	4.8	4.2	2.3
RH-8812	49.0	48.0	34.6	5.2	4.3	2	5.2	4.7	2.7
B.CARINATA									
HC-2	47.0	46.0	32.6	4.1	4.2	1.1	5	5.0	2.3
CAR-5	36	32	-	4.8	2.9	-	5.5	2.6	-
CAR-6	42.6	34.6	30.3	4.9	3.1	1.5	6	4.2	1.7
C-6-YS7B	36.3	37.3	31.3	4.5	4.1	1.6	5.6	5.6	2.1
HC-9003	37.3	37	-	5.1	3.8	-	7.5	4.7	-
B.NAPUS									
N-20-7-1	44.4	45.3	32.6	6	4.3	2.3	6.2	5.7	3.3
N-20-23-1	46.0	46.3	37	5.6	5.9	2.4	6.6	6.8	3.5
N-20-12-1	44.3	40.3	30.3	5.7	4.3	1.4	5.9	5.9	3.5
N-20-26-1	49	48.3	36.6	5.4	5.1	1.4	5.8	6.3	3.0
NS-8902	44	44	31	5.5	5.2	2.5	7	7.0	3.3

B.JUNCEA	FRESH WEIGHT (mg/5 seedlings)			DRY WEIGHT (mg/5 seedlings)		
	1	2	3	1	2	3
RH-30	392.2	555.5	215.5	34.5	40	23
RH-781	290	260	150.3	23.5	20	15.5
RH-819	297.5	270.5	160	27.5	26	17
RH-8812	332.5	295.6	170.6	30.5	27.5	17
B.CARINATA						
HC-2	185	202	150.2	19	21	17
CAR-5	192	175	-	21	14	-
CAR-6	182	177	120.3	19.5	19	16.5
C-6-YS7B	230.5	205.5	150	23.5	21	16.5
HC-9003	167.5	152.5	-	19	19	-
B.NAPUS						
N-20-7-1	267.3	250.6	155	28.5	26	18.5
N-20-23-1	230	375	170.6	22.5	32	21
N-20-12-1	325.6	227.3	215.6	30.5	20	18.5
N-20-26-1	225.5	275	210.6	22.5	28	20.5
HNS-8902	262.6	222.3	165.3	24.5	20	17.5

root length was recorded in HNS-8902 followed by in RH-30, N-20-23-2 and N-20-7-1.

Shoot length:

At 150 meq. salinity level shoot length was reduced than control except RH-30, HC-2, C-6YS7B, N-20-12-1 and HNS-8902 where shoot length was at par with control. At 225 meq. salinity level shoot length was generaly reduced in all the genotypes. However, maximum shoot length was recorded in N-20-23-2 and N-20-12-1 at this highest salinity level.

Fresh weight:

Fresh weight of seedlings reduced at 150 meq. over the control except in RH-30, HC-2, n-20-23-2 and N-20-26-1 where fresh weight was increased over the control. At higher salinity level(225 meq.) seedlings fresh weight reduced in all the genotypes. However, maximum fresh weight was recorded in RH-30 and N-20-26-1.

Dry weight:

Dry weight trends were also similar to fresh weight. However, at 225 meq. salinity level higher dry weight was recorded in RH-30, N-20-23-2 followed by N-20-26-1.

7. CEMISTRY- BIOCHEMISTRY

7.1

Name of the Project : Screening of High Oil content, low glucosinolate, low erucic acid and low crude fibre

Objectives : To identify the germplasm of rapeseed-mustard for:

i) High oil content
ii) Low glucosinolate
iii) Low erucic acid and high linoleic acid

Locations : Ludhiana, Hisar and Kanpur

Progress of work :

7.1.1

High oil content

Ludhiana:

The material evaluated in coordinated trials of breeding, entomology and agronomy disciplines of three centres viz; Ludhiana, Bathinda and Gurdaspur were evaluated for oil content. Besides this, germplasm and new breeding material developed at Ludhiana and Bathinda centres were also evaluated. Result of this study showing the number of samples analysed, range of oil content and the promising genotypes in each Brassica spp. have been presented below:-

Mustard (B.juncea)

No.of samples analysed	:	4450
Range of oil content (%)	:	30.6 to 41.3
Promising entries	:	B/12(41.3%) R1-1359 (41.0%)

Toria (B.campestris)

No.of samples analysed	:	813
Range of oil content (%)	:	33.9 to 44.0
Promising entries	:	PBT(43.5%), TG(43.7%), PBT-37 (43.2%), TCN-22(43.5), T-9(43.7) and LDH-1(43.7). 13 low erucic acid lines had 43.1% and 44.0% oil content

Gobhi sarson (B.napus)

No.of samples analysed	:	695
Range of oil content(%age)	:	34.3 to 43.9%
Promising entries	:	GSL-1513 (43.8%), GSL-8877 (43.8%), GSL-8858(43.9%), GSL-9006 (43.9%), SEMU-249/24 (43.8%) and RCN (43.9%).

Hisar:

1000 samples of Brassica spp. from various trials of breeding, entomology, agronomy and pathology disciplines were analysed for oil content. The results regarding oil content have been discussed in detail in the respective disciplines and trialwise.

Kanpur:

About 800 samples of toria and mustard were analysed during the year under report. In case of toria the oil content varied from 39.63% to 47.56%. The entries TWB-876-1, TWB-876-2, PBT-38, DT-8, CN-7,8,12, 15, TK-90-1, TK-90-2, TK-90-3, TK-90-6, TK-90-9 and TK-90-13 gave the oil content value above 47%. In case of mustard (B.juncea), the overall range of oil content was recorded from 35.22% to 45.74%. The entries originating from various varietal trial, having 43% or more oil content values were; DIRM-52, DIR-489, PCR-4, TM-18-8, RW-7/86, RW-9469B and Kranti. The entry DLM-29 gave the highest oil content of 45.74%. In case of napus trial, NT-1, NT-2, NT-4, NT-8, NT-12, NT-13, NT-14 had the oil content values more than 43%. The highest oil content in this trial was recorded in case of NT-12(44.75%).

The oil content was also recorded in single plant selections of exotic double low materials. The results showed that both cultures and their single plant selections had wide variability in respect of their oil content. It ranged from 32.75% to 41.14%. The highest value was recorded in EC-212659(3), but none of the materials reached the standard value of 42%. In quality trial MOCN-9 closely approached the standard value(42.24%).

7.1.2

Low glucosinolate

Ludhiana:

Rapeseed-Mustard varieties namely Varuna, Kranti, RLM-1359 (B.juncea) and TL-15 (B.campestris) were analysed for total glucosinolates (Table 7.1.2.3). Varuna had relatively higher content of glucosinolates as compared to Kranti. TL-15 had relatively low glucosinolate content.

Table 7.1.2.3 : Qualiity status of important cultivars.

Variety	Erucic acid	Meal glucosinolate(u mole/g)
B.juncea		
Varuna	48.06	102.00
Kranti	44.21	85.00
RL-1359	45.75	89.00
B.campestris:		
TL-15	48.92	63.24
7.1.3		

Hisar:

100 samples of mustard germplasm were analysed for glucosinolate content (Table 7.1.2.1). Glucosinolate content ranged from 38 micro moles (RC-267, RC-280, RC-289, RC-296, RC-329, RC-357, RC-370) to 71 micro moles (RC-286, RC-277, RC-324, RC-325, RC-347, RC-327). So far none of the germplasm line have been identified with very low glucosinolate content.

Kanpur:

As shown in Table 7.1.2.2, 18 plants of exotic materials were real zero in glucosinolate content. The results were confirmed by Tes Tape method. The amount of free sulphate was also taken into account. All the materials had low glucosinolate content wherein it varied from zero to 42 u moles/g of meal and only one sample EC-212662 had more than 30 u/moles/q of glucosinolate. Build up of glucosinolate under stress conditions was of interest. Entries of salinity trial were tested for glucosinolate by Tes Tape method. It was observed that entry SCN-2 was in low glucosinolate range

7.1.3

Low Erucic acid

Ludhiana:

Selected progenies of yellow seeded (56 Nos.) and brown seed (42 Nos.) of B.juncea, SM-1 were evaluated for low erucic acid and high oleic and linoleic acids. Content of erucic acid in yellow seeded types varied from 11.18 to 38.02%(Table 7.1.3.1). Six lines namely S-5-P-17-P7-P4, S-5-P7(E), S-45-P4-P4-P4, S-45-P1-P1-P1-P2(E), S-5-P15-P7-P4, S-5-P2(E) had erucic acid from 11.18% to 13%. These lines had oleic acid

TABLE 7.1.2.1 GLUCOSINOLATE CONTENT (U/g) OF MUSTARD GERMPLASM (IN SEED) AT HISAR

ACCESS	GLUC	ACCESS	GLUC	ACCESS	GLUC	ACCESS	GLUC
RC-251	59	RC-280	38	RC-307	53	RC-337	50
RC-252	59	RC-281	59	RC-308	56	RC-338	43
RC-253	56	RC-282	60	RC-309	50	RC-340	53
RC-254	53	RC-283	50	RC-310	56	RC-341	59
RC-255	53	RC-284	52	RC-311	71	RC-342	59
RC-256	56	RC-285	59	RC-312	61	RC-343	61
RC-257	50	RC-286	71	RC-313	64	RC-346	68
RC-258	62	RC-287	53	RC-314	43	RC-348	55
RC-259	53	RC-288	56	RC-315	59	RC-350	40
RC-260	38	RC-289	41	RC-316	57	RC-351	52
RC-261	65	RC-290	56	RC-317	60	RC-354	50
RC-263	56	RC-291	60	RC-318	60	RC-355	56
RC-264	60	RC-293	63	RC-319	56	RC-357	39
RC-265	59	RC-294	69	RC-320	50	RC-358	41
RC-266	71	RC-295	53	RC-321	61	RC-359	56
RC-267	38	RC-296	41	RC-322	53	RC-360	63
RC-268	58	RC-297	59	RC-323	60	RC-361	50
RC-269	51	RC-298	61	RC-324	68	RC-362	40
RC-270	52	RC-299	62	RC-325	71	RC-363	53
RC-271	54	RC-300	59	RC-326	59	RC-364	54
RC-273	56	RC-301	56	RC-327	71	RC-365	54
RC-273	60	RC-302	51	RC-328	53	RC-366	53
RC-274	65	RC-303	59	RC-329	38	RC-367	60
RC-276	44	RC-304	61	RC-331	53	RC-368	65
RC-277	68	RC-305	60	RC-333	60	RC-369	61
RC-278	63	RC-306	59	RC-334	49	RC-370	38

TABLE 7.1.2.2 SEED OIL AND MEAL GLUCOSINOLATE CONTENT OF EXOTIC SELECTIONS AT KANPUR

SN	CULTURE	OIL(%)	GLU.	SN	CULTURE	OIL(%)	GLU.
1	EC 212657	38.44	-	31	ZEM 1	39.81	19
2	EC 212658	37.05	22	32	ZEM 1	37.11	18
3	EC 212659	35.17	-	33	ZEM 1	37.90	20
4	EC 212659	36.44	18	34	ZEM 2	38.50	TRACE
5	EC 212659	41.14	15	35	ZEM 2	40.77	10
6	EC 212659	34.65	17	36	ZEM 2	40.10	TRACE
7	EC 212659	37.88	5	37	ZEM 2	39.86	17
8	EC 212660	37.18	-	38	ZEM 2	35.44	19
9	EC 212660	33.25	TRACE	39	ZEM 2	36.66	21
10	EC 212660	39.12	18	40	EC 212657	32.75	12
11	EC 212660	37.14	11	41	EC 212657	37.50	10
12	EC 212660	36.29	15	42	EC 212657	38.54	13
13	EC 212660	34.25	12	43	EC 212659	35.77	-
14	EC 212660	38.24	19	44	ZEM 1	39.33	11
15	EC 212660	33.94	16	45	ZEM 2	38.11	-
16	EC 212661	36.00	15	46	ZEM 2	35.75	TRACE
17	EC 212662	35.86	28	47	ZEM 2	38.44	24
18	EC 212662	37.19	-	48	EC 212660	38.00	-
19	EC 212662	36.15	28	49	EC 212662	37.44	22
20	EC 212662	36.77	30	50	EC 212662	37.68	-
21	EC 212662	39.00	42	51	MOCN 1	36.20	10
22	EC 212662	38.48	-	52	MOCN 2	35.26	16
23	EC 212662	39.88	10	53	MOCN 3	35.22	14
24	EC 287711	36.47	TRACE	54	MOCN 4	37.65	-
25	EC 287716	36.05	-	55	MOCN 5	38.31	18
26	EC 287717	35.57	-	56	MOCN 6	36.92	-
27	EC 287718	35.40	15	57	MOCN 7	38.99	TRACE
28	EC 287719	37.10	10	58	MOCN 8	38.69	-
29	EC 28720	39.17	17	59	MOCN 9	42.25	14
30	ZEM-1	36.98	11				

TABLE 7.1.3.1 FATTY ACID COMPOSITION OF SELECTED PROGENIES OF YELLOW SEEDED SM-1_MUSTARD (B. JUNCEA) AT LUDHIANA

SN	LINE NO.	FATTY ACIDS(%)						
		16:0	18:0	18:1	18:2	18:3	20:1	22:1
1	S-5-P7 E	3.8	0.2	21.1	27.1	12.4	12.3	22.7
2	S-45-P4 L	3.6	0.4	23.8	26.9	12.8	15.8	16.5
3	S-5-P-2 L	3.6	0.3	22.8	27.5	12.2	16.3	17.1
4	S-5-P2 L	3.3	0.2	21.6	27.5	13.6	17.1	16.5
5	S-5-P2 E	3.2	0.2	9.4	27.2	13.6	12.9	32.8
6	S-45-P13 L	3.8	0.2	20.3	26.6	13.8	16.4	19.4
7	S-45-P3-P-7-P2 L	4.0	0.3	27.7	28.0	8.6	15.1	16.2
8	S-45-P4 E	3.5	0.2	26.1	26.2	12.4	16.7	14.5
9	S-5-P7 L	3.5	0.2	21.0	28.8	13.9	16.1	16.2
10	S-5-P2 L	3.7	0.2	23	29.2	12.1	17.0	14.6
11	S-5-P2 E	3.6	0.1	22.2	30.1	13.0	18.0	12.9
12	S-5-P2 E	5.4	0.3	15.0	32.9	13.4	13.4	19.4
13	S-45-P4 L	4.3	0.2	15.6	27.4	14.8	13.0	22.0
14	S-45-P4 L	3.2	0.3	19.7	24.1	13.4	14.8	24.2
15	S-45-P3-P4-P4 L	3.1	0.2	18.5	27.9	14.8	17.7	18.8
16	S-45-P9-P1-P2 L	3.2	0.2	19.2	27.2	15.1	13.4	21.7
17	S-45-P4-P4-P4 L	3.4	0.3	18.3	31.2	17.7	16.8	12.1
18	S-45-P4-P1-P2	3.8	0.2	22.2	25.2	14.1	14.9	19.3
19	S-45-P5-P4-P4	3.5	0.2	25.3	27.8	11.5	15.1	16.5
20	S-45-P1-P4-P4	3.0	0.2	21.5	25.6	11.6	16.4	21.6
21	S-45-P10-P1-P2 S	3.6	0.1	21.5	28.0	16.0	16.7	13.8
22	S-45-P5-P1-P2 S	3.5	0.1	20.6	25.7	12.6	17.6	19.6
23	S-45-P7-P1-P2 S	4.0	0.2	17.3	28.3	16.9	18.3	15.0
24	S-45-P8-P1-P2 S	3.7	0.3	15.2	28.2	16.7	20.0	15.7
25	S-45-P2-P4-P4 S	3.4	0.2	24.7	24.0	10.5	16.7	20.2
26	S-45-P2-P4-P4 S	3.7	0.2	12.2	29.5	16.0	16.3	22.0
27	S-5-P7 E	3.4	0.2	22.4	24.0	12.5	14.3	22.5
28	S-45-P4 E	3.1	0.2	17.4	24.5	14.5	14.6	25.5
29	S-5-P7 E	3.7	0.3	20.9	28.3	16.8	17.7	12.0
30	S-45-P1-P7-P2 E	3.6	0.3	26.5	28.2	12.1	16.8	12.4
31	S-45-P5-P7-P2 E	3.5	0.3	28.3	24.5	9.4	15.5	17.4
32	S-45-P6-P7-P2 E	3.6	0.2	30.3	25.3	11.1	16.1	13.1
33	S-45-P4 E	2.9	0.2	16.8	21.1	9.8	11.7	37.0
34	S-45-P2 E	3.3	0.2	25.3	24.5	10.9	15.2	20.4
35	S-5-P2 L	4.0	0.2	24.0	27.1	12.2	14.9	17.4
36	S-5-P2 L	3.6	0.2	21.4	28.2	13.3	14.9	18.2
37	S-45-P7-P7-P2	3.9	0.3	24.2	29.7	10.2	15.8	15.7
38	S-45-P5-P7-P1	3.4	0.2	22.4	29.2	12.3	15.7	16.6
39	S-5-P4-P2-P1	4.2	0.2	27.0	26.1	10.5	15.8	16.0
40	S-5-P7-P7-P4	3.4	0.4	25.0	27.7	11.5	15.5	16.6
41	S-5-P6-P7-P4	3.5	0.5	23.9	27.9	12.0	17.0	14.4
42	S-5-P1-P7-P4	3.9	0.7	28.2	25.7	8.5	13.6	19.4
43	S-5-P2-P7-P4	3.4	0.5	25.8	25.6	10.6	16.0	18.2
44	S-5-P7-P4	3.5	0.5	24.7	27.6	10.2	16.4	17.0
45	S-5-P4-P7-P4	4.5	0.5	24.6	25.9	10.4	15.4	18.8
46	S-5-P10-P7-P4	5.0	0.6	28.0	23.1	8.4	13.9	21.1
47	S-5-P10-P7-P4	3.3	0.5	27.4	27.8	9.1	14.0	18.0
48	S-5-P11-P7-P4	3.7	0.5	14.5	23.4	9.9	10.0	28.0
49	S-5-P12-P7-P5	4.5	0.6	17.1	29.3	16.0	19.5	13.0
50	S-5-P13-P7-P4	6.3	0.5	23.4	28.3	10.1	14.6	16.8
51	S-5-P15-P7-P4	3.7	1.0	17.9	31.4	14.6	18.6	12.9
52	S-5-P16-P7-P4	3.2	0.6	19.4	27.6	15.3	19.6	14.4
53	S-5-P17-P7-P4	3.0	0.6	15.1	29.0	17.7	23.4	11.2
54	S-5-P19-P7-P4	3.3	0.6	18.7	28.4	16.0	20.1	13.1

and linoleic acids from 20.90% to 31.41% and 14.98% to 30.06%, respectively.

In brown seeded type, variation in erucic acid content was from 10.08 to 43.80%(Table 7.1.3.2) lines S-45-P13-P18-P1, S-42-P6-P1 and S-45-P6-P4-P4 contained maximum of 22.80% oleic acid and 33.09% linoleic acid.

With the objective of developing toria lines low in erucic acid and glucosinolates, a toria cultivar TL-15 (erucic acid = 50.5 and glucosinolates = 3%) was crossed to double low varity Tower (Brassica napus L.). F1 exhibited erucic acid 49.6% (Table 7.1.3.3). In the F2, visual selections towards toria types were made .Ten single plants were selected and their F3 progenies raised .Two of them showed 35% erucic acid. From the progeny of these two plants, 29 plants were selected with erucic acid range of 21.28% to 50.5% (F4). These plants were found to contain 0.5% to 3% (seed basis) glucosinolate. Two plants having erucic acid 21% and 24%, respectively and glucosinolate (1.0%) were selected and their progenies raised (F5). Sixty two plants were selected having 11.5% to 37.8% of erucic acid and 0.5-1.0% of glucosinolates. Eight plants with erucic acid between 11.5% to 23.8% and glucosinolates 0.5% were grown (F6). Two plants 34-2-P2 and 34-2-P6 had erucic acid 11.2% and 13.4% respectively. One out of 25 plants (bud pollinated) two had 5.4% erucic acid, 0.5% glucosinolates, 49.21% oleic acid and 25.9 linoleic acid. The oil content was 39%.

High yielding 36 genotypes of B.juncea, B.napus and carinata were evaluated for fatty acid profile (Table 3.1.3.4). Six lines of B.juncea (QM-13, QM-14, QM-15, QM-9, QM-43 and QM-47) possessed erucic acid below 2.5%. These lines possessed high level of oleic and linoleic acid. Similarly in B.napus six lines had erucic acid less than 2.5%. Out of the two high yielding B.carinata lines analysed, CE-8 possessed relatively low erucic acid (38.68%) in comparison to standard varieties of Raya and Toria (50%).

Crude fibre:

YSR-6 and YSR-9 genotypes of yellow seeded B.juncea had 8.9% crude fibre as compared to standard cultivar RLM-198 and RL-1359 having 11 to 13% crude fibre (meal basis).

Evaluation of toria samples from different markets of Punjab:

Twenty nine samples of toria were collected from different markets ofPunjab during the month of December to assess the quality status. The range of erucic acid was from 37.9% to 57.6% (Table 7.1.3.5). Oleic and linoleic acids varied from 11.49 to 16.51% and 11.37 to 19.51%, respectively. This variation in fatty acid profile may be due to location effects.

Hisar:

TABLE 7.1. 3.2 FATTY ACID COMPOSITION OF SELECTED PROGENIES OF BROWN SEEDDED SM-1 (B. JUNCEA) AT LUDHIANA

SN	LINE NO.	FATTY ACIDS(%)						
		16:0	18:0	18:1	18:2	18:3	20:1	22:1
1	S-45-P13	3.19	0.28	19.70	25.49	14.12	15.78	21.16
2	S-45-P18	3.08	0.31	19.11	25.43	13.92	19.07	18.90
3	S-42-P8-P2	3.44	0.33	25.59	24.29	12.46	14.27	19.37
4	S-42-P9-P2	3.89	0.21	23.71	26.87	11.27	12.39	21.08
5	S-45-P18	3.25	0.24	18.60	26.48	15.52	17.04	18.64
6	S-42-P4-P18-P4	4.68	0.28	14.41	37.78	12.92	13.27	16.41
7	S-42-P7-P18-P4	3.30	0.26	16.90	29.16	16.77	18.36	15.00
8	S-45-P3-P13-P4	3.81	0.25	16.00	29.56	13.76	14.65	29.90
9	S-45-P6-P4-P4	3.82	0.30	22.80	30.32	11.29	17.51	13.75
10	S-42-P2-P18-P4	3.41	0.33	20.68	26.38	14.01	15.83	19.32
11	S-42-P1-P18-P4	3.47	0.27	20.80	24.91	12.33	15.53	20.54
12	S-45 L	2.60	0.4	12.26	19.7	11.1	9.95	43.8
13	S-42-P6-P18-P4	3.21	0.26	20.02	27.90	15.18	16.83	17.41
14	S-42-P5-P18-P4	3.14	0.39	21.56	25.89	13.19	16.12	19.58
15	S-45-P18 E	3.27	0.41	25.16	24.38	13.13	17.42	15.99
16	S-45-P1-P18-P1	3.00	0.15	12.56	22.73	13.75	12.24	35.30
17	S-45-P4-P18-P1	3.55	0.19	20.81	30.10	13.31	11.84	19.80
18	S45-P6-P18-P1	3.01	0.22	21.10	29.78	15.66	14.34	15.66
19	S-45-P7-P18-P1	2.74	0.20	24.07	26.90	10.77	19.20	15.87
20	S-45-P8-P18-P1	3.50	0.27	22.17	29.21	11.44	13.25	15.01
21	S-45-P10-P18-P1	3.86	0.23	25.17	21.45	10.68	19.66	18.70
22	S-45-P2-P1	4.55	0.25	25.11	24.62	12.87	16.82	15.50
23	S-45-P13-P18-P1	3.20	0.28	19.37	32.09	17.29	17.66	10.08
24	S-45-P12-P18-P1	3.29	0.42	20.02	27.91	16.06	15.98	16.28
25	S-45-P11-P18-P1	3.34	0.44	23.28	24.96	11.28	15.46	21.20
26	S-42-P1-P2	4.08	0.46	27.03	27.28	10.24	18.69	12.18
27	S-42-P11-P2	3.18	0.50	22.06	26.48	13.23	16.43	17.99
28	S-42-P12-P2	4.68	0.51	18.85	24.05	11.45	15.91	24.56
29	S-42-P14-P2	3.82	0.54	18.13	27.70	13.53	13.46	22.81
30	S-42-P13-P2	4.67	0.60	21.81	24.04	10.83	14.83	23.19
31	S-42-P3-P2	3.67	0.46	24.19	24.37	12.42	14.21	20.68
32	S-42-P4-P2	3.55	0.58	28.15	23.51	9.54	16.58	17.71
33	S-42-P5-P2	3.46	0.51	23.46	24.75	10.59	12.65	24.34
34	S-42-P7-P2	2.77	0.45	17.00	18.72	12.46	7.70	41.31
35	S-42-P5-P1	3.26	0.60	15.08	23.37	14.62	14.14	28.94
36	S-42-P6-P1	3.28	0.53	16.63	28.89	18.96	21.21	10.51
37	S-42-P8-P1	4.27	0.41	12.47	25.12	16.31	18.40	23.02
38	S-42-P10-P1	3.39	0.61	22.11	25.75	16.12	16.91	15.10
39	S-42-P11-P1	3.55	0.72	25.54	25.93	13.15	15.73	15.32
40	S-42-P12-P1	3.41	0.58	20.57	27.40	13.05	16.27	18.60
41	S-42-P18-P1	3.27	0.42	17.90	26.49	14.41	15.99	21.51
42	S-5-P14-P7-P4	3.55	0.62	20.31	30.22	12.14	12.22	20.92

TABLE 7.1.3.3 VARIATION IN MAJOR FATTY ACIDS IN DIFFERENT GENERATIONS OF AN INTERSPECIFIC CROSS-TOWER X TL 15 AT LUDHIANA

GENERATION/LINE	FATTY ACIDS(%)				
	18:1	18:2	18:3	20:1	22:1
PARENT TOWER	59.50	20.50	10.50	1.30	1.20
PARENT TL-15	13.40	13.80	13.50	10.20	50.50
F1 SEED TOWERXTL-15	10.60	14.60	12.60	13.40	49.70
F2 SEED TOWERXTL-15	9.70	14.90	13.50	12.90	49.60
F3 P1	15.40	17.50	11.00	11.20	44.80
F3 P2	20.40	18.60	12.00	10.10	35.1*
F3 P3	16.10	18.20	13.50	10.50	37.7*
F4 P2-30	20.80	18.40	13.60	11.50	33.50
F4 P3-36	18.20	19.50	12.20	12.50	33.20
F4 P3-32	20.10	19.50	12.10	13.20	31.90
F4 P3-42	18.60	18.50	10.90	15.60	31.50
F4 P2-18	23.20	18.70	13.40	12.30	31.10
F4 P3-33	24.20	16.40	12.40	11.60	30.40
F4 P3-39	20.20	21.90	10.00	14.70	27.30
F4 P2-25	27.00	19.40	11.00	12.50	24.5*
F4 P2-24	28.00	22.90	10.40	13.80	21.1*
F5 P2-25-P13-P7	27.10	20.70	10.30	16.50	21.30
F5 P2-24-P34-P6	22.90	21.90	12.70	18.70	20.90
F5 P2-25-P13-P5	30.90	20.30	10.70	14.60	19.40
F5 P2-25-P22-P2	25.50	24.40	13.00	17.60	15.10
F5 P2-P25-P34-P6	33.40	29.60	11.00	12.70	13.8*
F5 P2-P25-P34-P2	32.50	27.00	11.50	13.10	11.5*
F6 P2-25-P34-P6-P7	39.60	18.00	10.40	9.80	17.80
F6 P2-25-P34-P2-P4	36.10	20.00	11.40	10.00	17.60
F6 P2-25-P34-P2-P7	38.90	19.10	9.60	11.10	14.80
F6 P2-25-P34-P6-P5	43.00	17.80	8.80	9.60	16.60
F6 P2-25-P34-P2-P3	38.60	19.90	11.00	9.60	16.40
F6 P2-25-P34-P6-P4	46.90	20.00	10.40	6.40	11.80
F6 P2-25-P34-P2-P9	46.00	21.60	11.10	7.20	10.00
F6 P2-25-P34-P2-P12	46.20	21.90	11.10	6.50	9.2*
F6 P2-25-P34-P2-P2	49.20	25.90	11.70	2.90	5.4*

TABLE 7.1.3.4 FATTY ACID COMPOSITION OF SOME HIGH YIELDING LINES OF B.JUNCEA (QM), B.NAPUS (GSL) AND BRASSICA CARINATA (CE) AT LUDHIANA

SN	STRAINS	FATTY ACIDS(%)						
		16:0	18:0	18:1	18:2	18:3	20:1	22:1
1	QM-7	3.13	0.65	24.29	17.76	10.29	18.34	25.54
2	QM-9	3.10	0.38	9.65	14.23	13.35	6.65	52.64
3	QM-11	2.55	0.54	10.34	16.84	12.00	10.93	47.12
4	QM-12	2.25	0.44	7.80	14.93	12.08	10.13	52.32
5	QM-13	4.01	0.33	33.73	36.04	19.30	5.98	0.54
6	QM-14	4.90	0.30	28.40	45.47	14.98	4.61	0.30
7	QM-15	4.19	0.32	42.80	38.58	9.28	2.48	2.41
8	QM-19	2.66	0.53	12.68	18.52	14.85	7.68	43.07
9	QM-36	3.48	0.55	36.10	29.82	7.14	5.59	17.31
10	QM-39	4.28	0.84	48.59	35.15	10.12	0.60	0.41
11	QM-43	3.85	0.56	45.80	40.24	8.59	0.42	0.53
12	QM-47	4.01	0.59	39.00	39.56	11.78	5.73	0.33
13	GSL-6007	3.59	0.61	53.10	24.95	10.34	4.93	2.57
14	GSL-6016	3.07	0.55	10.35	10.80	13.58	8.81	49.73
15	GSL-6029	3.54	0.42	39.70	22.64	11.59	12.18	9.93
16	GSL-6032	4.10	0.46	54.00	21.58	13.24	5.81	0.81
17	GSL-6001	3.98	0.64	58.40	20.87	11.44	4.47	0.21
18	GSL-6009	3.77	0.66	64.00	21.70	9.13	0.30	0.47
19	GSL-6047	3.45	0.50	40.14	33.69	20.60	0.59	1.00
20	GSL-8933	3.35	0.65	26.00	16.23	10.32	13.83	29.39
21	GSL-9008	4.04	0.71	26.28	17.72	9.63	16.46	24.88
22	GSL-8896	3.66	0.78	27.70	16.75	7.89	12.98	30.24
23	GSLN-126	3.70	0.70	21.95	16.25	8.47	15.24	33.41
24	GSL-8858	4.29	0.66	24.60	16.94	9.10	15.20	29.30
25	GSL-8876	3.79	0.80	19.21	14.77	8.37	12.58	40.62
26	GSL-8835	4.38	0.46	26.00	17.65	9.78	15.36	26.14
27	GSL-8850	3.40	0.53	20.50	14.27	7.54	10.38	43.37
28	GSL-8895	3.47	0.55	17.60	15.98	8.81	13.51	39.85
29	GSL-5001	4.25	0.66	44.40	25.28	5.69	9.06	10.63
30	GSL-1	3.62	0.50	20.62	17.06	10.58	12.39	35.11
31	GSL-8911	3.77	0.55	23.50	17.17	8.34	10.50	35.90
32	GSL-8851	3.36	0.58	35.70	15.40	6.37	10.76	25.34
33	GSL-6063	4.08	0.99	65.00	18.16	6.13	3.06	2.46
34	GSL-334	4.39	0.61	27.80	17.80	8.61	14.94	25.79
35	CARINATA-P	3.04	0.50	10.30	14.97	14.33	11.01	45.82
36	CE-8	3.21	0.23	17.63	18.46	14.10	7.43	36.68

TABLE 7.1.3.5 FATTY ACID COMPOSITION OF TORIA SAMPLES COLLECTED FROM MARKETS OF PUNJAB

SN	FATTY ACIDS %							
	16:0	18:0	18:0	18:1	18:2	18:3	20:1	22:1
1	0.04	2.64	0.10	12.78	15.63	9.58	9.68	49.56
2	0.02	2.43	0.07	12.93	13.80	8.95	12.09	49.71
3	0.03	2.42	0.08	13.00	14.76	9.70	10.14	49.88
4	0.04	2.45	0.07	12.39	15.00	10.23	9.05	50.77
5	0.03	2.63	0.07	12.64	13.25	9.40	11.50	48.42
6	0.03	2.35	0.06	13.49	14.20	9.16	11.33	49.27
7	0.02	2.46	0.12	15.66	14.26	8.71	11.26	47.51
8	0.02	2.56	0.06	14.99	13.93	8.58	11.17	48.69
9	0.02	2.57	0.07	13.02	15.14	9.46	9.61	50.12
10	0.03	3.22	0.09	16.51	19.51	9.06	12.31	48.78
11	0.04	3.06	0.10	15.61	16.48	11.73	15.07	37.90
12	0.03	2.80	0.07	13.04	16.58	10.97	10.14	47.47
13	0.03	2.50	0.07	12.56	15.50	9.65	12.17	47.53
14	0.02	2.40	0.07	12.58	14.88	9.72	10.22	50.10
15	0.03	2.53	0.06	13.92	14.09	9.09	11.98	48.30
16	0.02	2.88	0.07	12.47	16.35	10.11	9.81	48.29
17	0.04	2.85	0.09	13.10	17.44	9.12	11.73	43.58
18	0.03	2.54	0.06	13.92	15.14	8.86	12.20	47.25
19	0.03	2.54	0.07	12.89	16.66	11.03	9.93	46.95
20	0.03	2.76	0.07	12.82	17.66	11.46	11.23	43.96
21	0.02	2.18	0.05	12.19	11.37	6.33	10.14	57.64
22	0.05	2.70	0.07	13.04	14.26	7.63	10.04	52.11
23	0.16	3.60	0.05	12.85	13.56	8.07	6.90	54.60
24	0.11	3.03	0.07	13.22	14.61	8.34	9.75	50.88
25	0.06	2.48	0.12	13.93	13.91	8.65	10.51	50.33
26	0.04	2.40	0.06	12.32	14.74	9.54	9.49	51.41
27	0.07	2.60	0.08	13.41	13.00	8.40	14.51	46.93
28	0.04	2.25	0.07	12.57	10.12	9.61	8.68	52.67
29	0.05	2.25	0.06	11.49	14.42	10.42	9.13	52.18

15 entries of toria (<u>Brasica campestris</u>) were analysed for fatty acid composition(Table 7.1.3.6). Erucic acid remained the major fatty acid which varied from 47.6% (TH-76) to 53.4%(TH-104). Variations in other fatty acids were oleic acid from 10.8% to 15.2%, linoleic acid from 9.8% to 14.5% and linolenic + eicosenoic acid from 18.3% to 22.5%.

15 entries of Taramira (<u>Eruca sativa</u>) were analysed for fatty acid composition (Table 7.1.3.7). Erucic acid remained the major fatty acid and varied from 43.5% (TC-46) to 51.2% (TC-2). Oleic acid ranged from 14.5%(TC-2) to 20.3%(TC-46). Linoleic acid from 7.3% to 11.3% while linolenic + eicosenoic from 19.5% to 25.7%.

Kanpur:

The spectrum of major fatty acids in exotic selections and the entries of quality trial was recorded. The ranges of variation in different fatty acids were as: Palmitic from 1.43% to 15.01%; Stearic from 0.85% to 3.42% oleic from 12.77% to 40.12%; Linoleic from 21.57% to 55.2%; linolenic from 3.94% to 24.32%; eicosenoic from 0.91% to 10.02% and erucic from zero to 57.77%. In case of Brassica juncea, the highest sparing effect of erucic acid was on linoleic acid. The samples low in erucic acid were also generally low in ecosenoic acid. The values of linolenic acid did not appear to vary considerably due to changes in the proportion of erucic acid. However, this variation had appreciable effect on oleic acid. The data suggested that the most desirable fatty acids i.e oleic and linoleic could be augmentedby lowering of erucic acid. Seventeen plant selections had zero erucic acid and 3 had less than 5%. Most of them have zero trace or low content of glucosinolates also. But several plant selections of seemingly double zero materials had considerable amounts of erucic acid probably on accoount of cross pollination with high erucic parents.

TABLE 7.1.3.6 FATTY ACID COMPOSITION OF TORIA STRAINS AT HISAR

STRAIN	PALMITIC	STEARIC	OLEIC	LINOLEIC	LINOLEIC+ EICOS	ERUCIC
	FATTY ACID					
TH-63	3.3	1.6	14.1	10.5	20.5	50.2
TH-76	3.8	1.2	15.2	11.3	21.4	47.6
TH-78	2.7	1.5	14.3	12.2	19.5	48.7
TH-83	4.0	1.0	11.7	13.2	18.7	52.3
TH-90	3.6	1.3	10.8	11.4	21.3	51.7
TH-91	4.1	1.4	14.3	9.8	20.3	50.2
TH-94	4.0	1.1	14.2	10.1	19.3	50.8
TH-103	3.4	1.3	12.3	11.5	22.4	49.3
TH-104	3.8	1.2	11.4	10.2	20.3	53.4
TH-106	3.0	1.5	13.7	12.3	19.7	49.8
TH-110	4.1	1.1	11.2	14.5	20.5	51.4
TH-115	3.6	1.3	15.2	13.3	18.7	52.3
TH-116	3.5	1.4	12.3	11.2	22.5	48.8
TH-123	4.2	1.0	12.8	14.3	18.9	49.3
SANGAM	3.5	1.3	13.2	11.2	18.3	52.7

TABLE 7.1.3.7 FATTY ACID COMPOSITION OF TARAMIRA E. SATIVA STRAINS AT HISAR

STRAINS	FATTY ACIDS (%)					
	16:0	18:0	18:1	18:2	18:3 + 20:1	22:1
TC-2	3.3	1.5	14.5	7.3	22.5	51.2
TC-19	4.1	1.0	16.3	9.2	20.4	49.3
TC-22	3.8	1.4	14.5	11.3	21.0	48.7
TC-20	3.3	0.8	15.4	10.2	19.7	50.3
TC-23	4.5	0.7	18.2	10.4	23.1	43.8
TC-26	3.6	1.1	17.5	8.3	19.5	50.3
TC-29	3.8	1.5	17.3	7.8	20.3	49.3
TC-31	3.6	0.8	19.5	8.5	22.6	44.8
TC-44	3.7	1.1	18.1	10.0	23.5	44.2
TC-46	4.0	0.7	20.3	9.1	25.7	43.5
TC-56	3.4	1.0	17.1	8.3	22.4	48.3
TC-70	3.5	0.9	15.8	9.2	21.6	48.6
TC-73	4.1	1.2	14.7	8.6	22.5	49.3
TC-78	4.5	0.7	15.3	10.1	20.5	48.4

7.2

Name of the Project : Effect of agronomical and plant protection measures on oil and oil quality

Objectives : a) Effect of nitrogen doses on chemical composition of mustard varieties

b) Effect of high fertility and thinning on quality of mustard variety RH-8602

c) Effect of severity of Alternaria disease on quality of yellow sarson

Location : Hisar, Ludhiana, Kanpur

Progress of work :

Hisar:

a) The application of nitrogen at the rate of 40, 60 and 80 Kg/ha did not show much effect on oil % (Table 7.2.1). However, protein content was observed to increase moderately with increase in nitrogen in all the varieties FFA content remained unaffected by nitrogen doses.

b) Results presented in table 7.2.2 revealed that with high fertility (Nitrogen 120 kg/ha), the oil content was not affected in RH-30(control) while RH-8602 showed a slight decrease in oil content at 120 kg/h in comparison to 80 kg/ha. Thinning, however, resulted in slight increase in the oil content over no thinning at both the doses of nitrogen. Protein content increased with the increase in nitrogen doses in both the varieties which was reverse to the oil content. Thinning showed a moderate increase in protein content over no thinning. Iodine value remained unchanged while FFA content was slightly higher at 120 kg N/h in comparison to 80 kg N/ha.

c) The effect of severity of Alternaria disease in yellow sarson (YSPb-24) on quality has been shown in table 7.2.3. Disease severity upto 25% did not show any effect on oil, protein, iodine value and FFA content. However, these parameters were affected considerably at disease severity above 40%. Oil content was decreased while protein, iodine value and FFA content were increased.

TABLE 7.2.1 EFFECT OF NITROGEN DOSES ON CHEMICAL COMPOSITION OF SEEDS OF MUSTARD VARIETIES AT HISAR

NITROGEN (Kg/ha)	VARIETY	OIL (%)	PROTEIN (%)	FFA(%)
40	RH-30	42.90	24.52	0.65
	CS-52	44.80	21.05	0.82
	KRANTI	44.70	21.87	0.70
60	RH-30	43.50	23.65	0.72
	CS-52	45.10	22.65	0.76
	KRANTI	43.70	22.75	0.74
80	RH-30	42.40	25.37	0.68
	CS-52	44.60	24.52	0.85
	KRANTI	44.10	23.37	0.76

TABLE 7.2.2 EFFECT OF HIGH FERTILITY AND THINNING ON THE QUALITY OF MUSTARD VARIETY AT HISAR

NITROGEN (Kg/ha)	VARIETY	OIL (%)	PROTEIN (%)	IODINE VALUE	FFA(%)
80	RH-30	43.0	23.7	105.0	0.6
	RH-8602 (NO THINNING)	42.6	24.5	106.0	0.7
	RH-8602 (WITH THINNING)	43.6	25.3	106.0	0.7
120	RH-30	43.7	24.4	104.0	0.7
	RH-8602 (NO THINNING)	41.9	25.8	106.0	0.8
	RH-8602 (WITH THINNING)	42.3	26.8	105.0	0.7

TABLE 7.2.3 EFFECT OF ALTERNARIA DISEASE SEVERITY ON QUALITY OF YELLOW SARSON VARIETY YsPb-24

DISEASE SEVERITY (%)	OIL(%)	PROTEIN(%)	IODINE VALUE (%)	FFA(%)
3	46.6	18.37	103	0.81
10	46.3	18.37	104	0.78
25	46.2	18.55	104	0.8
40	45.7	19.25	104	0.81
ABOVE 40	43.2	20.35	106	0.93

7.3

Name of the Project : Changes in chemical composition of rapeseed-mustard varieties due to low temperature

Objectives : To study the low temperature effect on metabolism of:

i) Lipids
ii) Protein
iii) Carbohydrates

Locations : Hisar

The low temperature was given with the help of frost chamber by keeping the plants of mustard genotypes(35 days after flowering) at -2^{o}C for 90 minutes followed by 30 minutes treatment at -3.5^{o}C. At maturity seed samples were collected both from control and treated plantas which were analysed for oil, protein, reducing sugars and fatty acid composition. The results have been presented in table 7.3.1 and 7.3.2. Oil content was observed to decrease in all the genotypes with low temperatue treatment while protein content and reducing sugar increased. Fatty acid composition was also affected by low temperature treatment. Erucic acid showed decrease in all the genotypes while oleic and linoleic acids showed increase with low temperature treatment. Palmitic and stearic acid which were present comparatively in small quantities were not affected. Similarly, linolenic + eicosenoic acid also remained unaffected by the treatment.

TABLE 7.3.1 CHEMICAL COMPOSITION OF BRASSICA JUNCEA GENOTYPES AS INFLUENCED BY LOW TEMPRATURE TREATMENT

GENOTYPE	OIL(%)		PROTEIN(%)		REDUCING SUGARS (%)	
	C	T	C	T	C	T
RH-8113	42.3	40.4	24.36	27.21	2.63	3.25
RH-7846	40.2	37.8	25.21	26.93	3.17	4.16
RH-781	43.5	42.7	25.67	25.31	2.98	3.23
RH-8693	42.5	38.4	24.81	27.13	3.24	4.10
RH-8605	43.4	39.5	23.71	24.16	2.75	3.34
RH-8606	42.2	39.4	24.14	27.38	3.16	5.37
RH-8688	43.2	42.1	25.46	26.18	3.26	3.74
RH-8315	42.8	35.1	24.41	26.76	3.10	4.81

C:DENOTES CONTROL

T: DENOTES LOW TEMPRATURE TREATMENT FOR 90 MINUTES AT -2^0 C FOLLOWED BY 30 MINUTES AT -3.5^0 C.

TABLE 7.3.2 FATTY ACID COMPOSITION OF BRASSICA JUNCEA GENOTYPES AS INFLUENCED BY LOW TEMPRATURE TREATMENT

GENOTYPES	FATTY ACIDS											
	PALMITIC		STEARIC		OLEIC		LINOLEIC		LINOLEIC + EICOSA		ERUCIC	
	C	T	C	T	C	T	C	T	C	T	C	T
RH-8113	2.5	2.7	0.8	1.0	9.5	12.0	14.5	16.8	19.9	19.8	52.8	48.1
RH-7846	3.1	2.9	0.9	0.8	10.3	12.3	15.2	18.7	20.4	19.1	50.6	46.4
RH-781	2.7	2.2	1.2	0.9	9.8	10.7	14.4	14.7	21.4	20.5	50.3	51.1
RH-8693	3.0	2.8	0.7	0.9	11.3	12.5	14.0	16.8	21.4	20.9	49.5	46.2
RH-8605	2.5	2.6	1.1	0.8	10.2	13.4	12.1	17.6	20.9	20.2	51.8	46.3
RH-8606	2.8	3.2	1.0	1.1	10.1	14.6	13.3	19.7	20.4	18.6	52.7	43.1
RH-8688	2.7	2.4	0.9	1.0	11.3	11.7	12.4	14.4	22.1	21.3	50.3	48.8
RH-8315	2.5	2.8	1.0	0.8	11.6	15.1	12.4	17.8	21.1	20.6	51.3	46.8

C=CONTROL T= LOW TEMPRATURE TREATMENT FOR 90 MINUTES AT -2^0 C FOLLOWED BY 30 MINUTES AT -3.5^0 C.

PROCEEDINGS OF

XXXIX ANNUAL RABI OILSEED RESEARCH WORKERS'

GROUP MEETING OF

RAPESEED-MUSTARD

HELD AT

ORISSA UNIVERSITY OF AGRICULTURE & TECHNOLOGY

BHUBANESWAR (ORISSA)

FROM

AUGUST 19-21, 1991

XXXIX ANNUAL RABI OILSEEDS RESEARCH WORKERS' GROUP MEETING OF RAPESEED-MUSTARD, RABI/SUMMER GROUNDNUT, SAFFLOWER AND LINSEED

Venue: Orissa University of Agri. & Tech., Bhubaneswar
Dates: August 19-21, 1991

PROCEEDINGS OF RAPESEED-MUSTARD PLANT BREEDING SESSION

Chairman:	Dr.R.S.Paroda, Deputy Director General(CS), ICAR
Rapporteurs:	1. Dr.P.Joshi 2. Dr.S.S.Dhillon

In his introductory remarks the Chairman gave a detailed account of increasing trend of oilseed production. He expressed great satisfaction about the record production of rapeseed-mustard witnessed during the year. Further he elaborated his views that the mission mode approach under Micro-Mission I has paid a lot to take the country towards self-sufficiency as well as to drastically reduce the import of oil and oilseeds in the country.

While initiating the discussion on the promotion of strains from one stage to next, the Chairman emphasised that the promising strains should not be bogged down in procedural wranglings. Any strain with special attributes like earliness in case of Toria, resistance to mustard aphids and diseases (Alternaria, white rust) better in quality attributes (low in erucic acid/glucosinolates or both), salt tolerance, etc., in case of mustard, should be promoted even if it is at par with the best check in seed yield. However, due consideration be given to the fact that new strains in particular of toria provide a better fit in the prevalent crop rotations and are more efficient in providing higher net returns on the basis of annual cropping sequence. Secondly, all the entries tested in IVT and AVTs must be screened for diseases and pests both at hot spots and under artificial epiphytotic conditions. The agronomical data on varieties promoted from AVT-I to AVT-II should also be generated. Respective Principal Investigators must make sure that required data is documented properly in the annual report. Further, breeder concerned should also make sure that seeds of required strain is supplied to the respective scientists well in time. Principal Investigator (Agronomy) may also generate facilities for retention of seeds at the respective centres. The centres were advised to send their seed samples for oil analysis to the PC(R&M), where facility for oil analysis does not exist.

Commenting upon a large number of coordinated trials under progress, the Chairman called for the views of the house. It was agreed that as brown sarson cultivation is confined to H.P. and J.K., the evaluation of these strains may be taken up under the State programme. Similarly yellow sarson programme be restricted to Zone-V only under State programme. Dr.Pa[illegible] I/C [illegible] (R&M) [illegible]

Dr.Parkash Kumar, I/c.PC(R&M), highlighted the progress made by various centres on mandates assigned to them under Micro-Mission I and presented technical programme for 1991-92. After detailed discussions, the following observations were made by the Chairman. He emphasised the need for providing true sources of resistance. In this context, the responsibility to quantify the sources for biotic stress was assigned to respective Principal Investigators.

-- A bulletin on the 'Management of mustard aphid' be brought out on priority basis.

-- Work on inheritance studies on mustard aphid resistance and for mopping up the desired gene be taken up at 2-3 centres so as to provide information and materials for a systematic breeding programme.

-- To confirm true resistance for alternaria and white rust diseases, it was decided to conduct National Disease Nursery Trials at a few locations where the screening under artificial epiphytotic conditions will be undertaken. For laying out the National Disease Nursery the concerned Scientists must send 100 gm of seeds of each entry to Dr.S.J.Kolte, Principal Investigator(Pathology) latest by Sept.15, 1991, to be tested at following locations:

Alternaria:	Hisar, Pantnagar, IARI, Ludhiana, Bhatinda, Navgaon, Kanpur
White rust:	Ludhiana, Pusa, Kanpur, Sriganganagar, Berhampore, Pantnagar, Bhatinda

-- Looking to the non-availability of high oil content resources in the existing germplasm a trial be framed with entries having more than 40 per cent oil for multi-location testing:

High Oil content:	Hisar, Ludhiana, Kanpur, Pantnagar, Faizabad, S.K.Nagar, Mandore, Morena, Bhatinda.

After harvest the seed be sent to the Project Coordinator who would get them analysed for oil content.

-- Male sterial systems as well as segregating materials should be shared by all the centres involved in the hybrid programme to accelerate the progress. Delay in initiation of of hybrid project by Navgaon centre may be taken with the concerned University authority. However, ICAR will have no objection to shift the hybrid project from Navgaon to Mandore Centre. IARI, New Delhi, with all the required facilities, should intensify the programme and come out with experimental hybrids to be tested during rabi 1992-93.

-- In the trial for salt tolerance, DIRA 343 should be included as check. The trial may be continued after excluding low yield strains.

-- As regards '0' and '00' strains, they have to be maintained by the Project Coordinating unit and these seeds of these are to be supplied afresh in every season to all the cooperating centres. The Unit must ensure the quality attributes before despatching the seeds.

Disciplinewise performance of different centres was reviewed in the workshop and the Chairman emphasized that non-reporting centres without sufficient justification may be dropped; however, if those centres are willing to continue and conduct the trials this year, it may be considered on merit. The details of different trials finalised are under:

1.1. Germplasm screening nursery:

Uttar Pradesh	-	Pantnagar
Punjab	-	Ludhiana
Gujarat	-	S.K.Nagar
Haryana	-	P.C. (R&M) Unit
West Bengal	-	Berhampore
Rajasthan	-	Navgaon

1.2. Trial for salinity and alkalinity conditions:

Entries: CS-12, CS-15, CS-42, CS-50, PST-1, CS-52/AS, PST-3, CS-416, PST-2, CS-209, CS 395, CS 388, CS 416, RK 8502.

Checks : DIRA-343, Varuna, Kranti, NDR 8501, Local check

Locations: Karnal, Kanpur, Jodhpur, Faizabad.

Design: R.B.D. Replications: Three

Plot size: As per availability of salt affected plots

Observations to be recorded

Soil parametres: Soil pH and Ecce upto 60 cm at 15cm interval at sowing flowering and harvesting from each entry in every replication.

1.3. Varietal trial under late sown conditions

Entries

Species	Name of the strain	Centre
B.juncea	NDR-8602	Faizabad
	NDR-389	Faizabad
	RW-4186	Berhampore
	RW-4C-6-3/II	Berhampore
	RH-8812	Hisar
	PCR-3	PC (Unit)
	RL-962	Ludhiana
	PBM-16	HLL,Hyderabad
	Pusa Bahar	IARI, New Delhi
	Pusa Basant	IARI, New Delhi
	RN-100	Navgaon
	RK-9082	Kanpur
	RK-9046	Kanpur
	TM-17 (non-traditional)	BARC, Bombay
	TM-21 (,,)	,,

Species	Name of the strain	Centre
B.Juncea	RW-873	Berhampore
	RW-8716	Berhampore
	Vardan	Kanpur
	RLM-619	Ludhiana
	RK-918502	Kanpur
	RK 911290	,,
	PMS5	Pantnagar
	SEJ-2	New Delhi

Design: Randomized block design

Replications: Three

Plot size: Gross 5.00 x 1.5 m
Net. 4.5 x 0.9 m

Date of sowing: Non-traditional areas : 20th Nov.1991
10th Dec.1991

For other zones : 10th Dec.1991

Locations:

Zone-I	Khudwani, Kangra, Bajaura
Zone-II	Sriganganagar, Ludhiana, Bathinda, Hisar, IARI, New Delhi.
Zone-III	Pantnagar, Kanpur, Morena, Faizabad, BHU Varanasi
Zone-IV	Phaltan, Jalgaon, Jalna (MAHYCO)
Zone-V	Chianki, Kanke, Dholi, Berhampore, G.Udaigiri, Bhubaneswar
Zone-VI	Hiriyur, Bijapur,

1.4. Varietal Trials:

The varietal trials constituted for different zones/ crops are given below:

A. TORIA

IVT (Irrigated & Rainfed)

Centre	Entry	Pedigree
Hisar	TH 9101	Sel. from Karnal local
	TH 9102	- do -
S.K.Nagar	SSK-6	Sel. from Sel.11
	SSK-13	Sel. from YS 31
Pantnagar	PT 9005	Agrani x PT 303
	PT 8857	Tobin x TK 8401
	PPMS	Mutant

Centre	Entry	Pedigree
Morena	JMT-6901 JMT-9289	Composites of TWC-3, TGC-3, ITSA. PT501, T9 and Bhawani
Kanpur	TK 9101 TK 9102	Rec. Sel from open pollinated population
Berhampore	TWB 876-1 TWB 876-2	Sel. from B 54 - do -
IARI	DT.8 DT.10 SEJ-2	AMS x IT-472 Sel. from DT-3 Synthatic juncea
Bawal	PB 37 PB 38	Resel from TLC-1 - do -

Checks: T-9, PT-303 (NC)
B-54 (Zonal check for Eastern Zone)
Bhawani (Zonal check for Central Zone)

Loca Locations:

Irrigated

Zone-II Gurdaspur, Hisar, Bathinda, Kaul, Ludhiana

Zone-III Morena, Pantnagar, Kanpur. Faizabad. Jagdalpur, Raipur.

Rainfed:

Zone-v Chianki, Kanke, G.Udaygiri, Bhubaneswar, Berhampore, Shillongani.

AVT-I (Irrigated) - Zone-II

Entries: TH 9002, TW 872-2, T 9(NC), PT 303 (NC), Zonal check

Locations: Gurdaspur, Hisar, Bhatinda, Kaul, Ludhiana

B. TARAMIRA

IVT (Rainfed)

Centre	Entries	Pedigree
Bathinda	PBTM-1	Composite
Mandore	MTM-1 MTM-2 MTM-3	Local sel. Local sel. Local sel.
Morena	JMTA-902	Local sel.
Checks:	T 27 (NC) TMLC 2 (ZC)	

Locations: Bhatinda, Bawal, Jobner, Navgaon, Diggi, Ballowal (PAU), Morena, Jodhpur (CAZRI)

AVT-1 (Rainfed)

Entries: JMTA 901, TMH 9002, TMH 9001, RTM 312, TMH 9003, T 27 (NC), TMLC2 (ZC)

Locations : Bhatinda, Bawal, Jobner, Navgaon, Diggi, Ballowal (PAU), Morena, Jodhpur.

C. YELLOW SARSON

IVT (for Eastern zone only) (Zone-V)

Centre	Entries	Pedigree
Berhampore	YSBW 877	Sel. from local materials.
	YSBW 881	Sel. from B-9
Delhi (IARI)	YS-6	Cy x T10 B1P
	YS-7	DSH 17MD x DYS-1 BC
	YS-8	D-1-1-S
Check	YST 151 (NC)	
	Benoy (ZC)	

Locations:

Irrigated : Berhampore, Nakasipara, Faizabad.

D. B. Carinata (Karan Rai)

AVT I (Rainfed)

Entries: DLSC 1, NPC 2, HC 9001, BCRS 84, PCC 2, Varuna, Kranti.

Locations: Kangra, Bawal, Bhatinda, Ludhiana, Gurgaon (MAHYCO)

E. MUSTARD

(i) IVT (Irrigated and rainfed)

Centre	Entries	Pedigree
Bathinda	PBR 93	-
	PBR 94	-
(Bio-technology)	BIO-246	Somaclone of Varuna
IARI	BIO-94	- do-
Kanpur	RK 919015	Varuna x RH 30
	RK 919003	Varuna x RK 8502
Berhampore	RW 873	Sel. from RH 30
	RW 8726	- do -
Kangra	KBJ -24	RC 781 x RH 30
	KBJ -28	- do -

Hisar	RH 8824	11/7-1 x RSS-1A
	RH 8922	(RH 30 x EC 626746-1) x EC 126746 -1)
Ludhiana	RM 9	Sel. from RL 1359
	RL 90-1	To be supplied
Bombay (BARC)	TM-18-8	Sel. from TM 18
Morena	IMM 90-3	DIRA-337xYRT-3
	JMM 90-12	(RW 175 x RT-3) x RH 30
Sriganganagar	RSM 9001	To be later
	RSM 9007	,, ,,
Junagadh	RJ-9	Sel. from local
	RJ-14	- do -
S.K.Nagar	SK NM 90-4	Varuna x 11-37-P
	SKNM 90-13	RJ-2 x 11-37-P
Pantnagar	PR 8915	Varuna x PR 43
	PR 8943	Varuna x PR 52
PC Unit,Hisar (R&M)	PCR-4	Sel. from JMG 138
Pusa,	PSR-6	PR 45 x Kranti
	PSR-7	Pusa bold x RW 406
Mandore	RSM 151	
IARI,New Delhi	DIR 489	(RR 28 x TM8) x Pusa bold
	DLM 29	Pusa bold x D 313
	DIRM 52	B.J.56 x RH 30
	SJN 191	Synthetic juncea

Checks: Varuna (NC), Kranti (NC), Zonal Check (Zone-II- RL 1359, Zone-III- Rohini; Zone IV-RSK10, Zone-V- Sarma).

Locations:

Irrigated Zone-II	Ludhiana, Bathinda, Hisar, Sriganganagar, Hanumangardh, IARI,- New Delhi, Durgapura, PHI Biogene (Ghazibad).
Zone-III	Morena, Pantnagar, Fiazabad, Varanasi, Kota, Gwalior, Raipur, Kanpur.
Zone-IV	Mandore, Sumerpur, Keshwana, S.K.Nagar, Junagadh, Amreli, Phaltan, MAHYCO,Jalna
Zone-V	G.Udaygiri, Berhampore, Nakashipara, Dholi (Pusa)

Rainfed:

Zone-I	Kangra, Khudwani
Zone-II	Bawal, Navgaon, Jammu
Zone-V	Shillongani, Beldanga (Murshidabad)

Design: RBD

Replications: Two

ii) Advance varietal trial I (Irrigated)

Zone-II	JGM 9002, JGM 9056, RL949, Varuna(NC) Kranti (NC), RL 1359 (ZC).
Zone-III	PCR-3, PCR-7, RSM-8904, RSM-58, PR8902, RH-8701, RH-8904, PBR-91, DIR-457, DLM-23, PBM-16-12, PST-1, RL-949, KSRL-9, RSK-33, RSK-64, Varuna (NC), Kranti (NC), Zonal Check (Rohini).
Zone-IV	PCR 7, RJ 10, RJ 15, RK 9001, RL 949, B10902, JMM 904, RSK 69, Varuna (NC), Kranti (NC), Zonal check (Sarma).

Locations: As in IVT (Irrigated)

B. Alternaria blight disease nursery trial (National)

Entries:

Centre	Entry
Pantnagar	PR 8925, PR 9006
Bathinda	PBARR-1 PWARR-2 PWARR-3 PWARR-4
Ludhiana	RL 1359 I
Berhampore	RWDR 8412 RWDR 8411
Hisar	RH 8701 RH 8904 Tower (B.napus) C6HYS-7 (carinata)
PC Unit	DYS 25-10

Locations: As given in the proceedings on page 2

C. White rust disease nursery trial

Entries

Centres	Entry
IARI	DIRA 313-6, DIRA-313-7
Bathinda	PBWRR-1, PBWRR-2, PBWRR-3, PBWRR-4
Ludhiana	RL 1359
Pantnagar	PR 8998, PR 8921
Kanpur	CSR-721
PC Unit	DYS 25-10
Hisar	EC 129126-1, EC 129121, EC 174239, RH 8691, RH-8546, RH-8688, RH-8689, RH 8544, RH8545

Location: As given in the proceedings on page 2.

D. Trial on exotic materials of B.napus under New Seed Policy:

Entries: Semu 249/24, Semu 86/223, GSL-8914, PBGS-91, GSL-1, Wester (improved), Varuna (NC) and Kranti (NC).

Note: The strains GSL-8914, PBGS-91, GSL-1 & Wester improved will be tested in Zone-II only. However, the entry Semu 249/24 and Semu 86/223 will be evaluated at following locations:

Locations:

Zone-II: Ludhiana, Batinda, Gurdaspur, Sriganganagar, Hisar, P.C Unit (R&M), Navgaon.
Zone-III: Pantnagar, Kanpur, Morena, Faizabad, IARI, New Delhi.
Zone-IV : S.K.Nagar, Junagadh.
Zone-V : Berhampore, Shillongani

Desing : RBD Replications: Four
Plot size : Gross = 2.1 x 5 m
Net = 1.8 x 4.7 m

Trial on high oil content:

Entries: RW-7/86, RW-3/86, RW-9469B, RK-8605, RK-8604, CSR-79, RC-891, CSR-32, CSR-1110, RC-915, Varuna(NC), Kranti (NC).

Locations: Ludhiana, Bhatinda, Hissar, PC Unit (R&M), Pantnagar, Faizabad, Kanpur.

Design : as in case of IVT Mustard (Irrigated)
Plot size: Pair row of 5 m length Replications: Three

Fertilizers: As per recommended package of practices

Trial on hybrid Brassica:

Entries: PHR-2, PHR-7, Varuna(NC), Kranti(NC), Zonal check and Local check.
Locations: Ludhiana, PC (R&M), Navgaon, Faizabad, IARI New Delhi, S.K.Nagar, Hisar, Pantnagar.
Design: R.B.D Replications: Four
Plot size: Five rows of 6 m length.

Trial on '0' strain of Mustard:

Note: Material will be sent by Project Coordinator (R&M).

1.5 Allocatin for productin of bre der seed of oilseed crop in Rabi:

Indents for breeder seed to be produced during 1991-92 were discussed and finalised as is given below:

S.No:	Variety	Breeder Seed	Centre entrusted to produce
1.	Kranti	1.00	Dr.J.N.Sachan, Oilseed Breeder, GBPUA&T, Pantnagar.
2.	Krishna	0.15	-do-
3.	PT-303	0.50	-do-
4.	T-9	0.90	Dr.R.K.Dixit, CSAUAT, Kanpur
5.	Varuna	8.49	-do-
6.	Bhawani	0.20	-do-
7.	Rohini	0.60	-do-
8.	Vardan	0.25	-do-
9.	Vaibhav	0.20	-do-
10.	RL-1359	0.21	Dr. G.S.Sandha, PAU,Ludhiana,
11.	RLM-619	0.20	-do-
12.	TL-15	0.45	-do-
13.	B-9 (Yellow Sarson)	0.38	Dr.S.D.Chatterjee, Oilseed Breeder, Berhampore.
14.	M-27	2.30	Dr.D.P.Baruah, Assam Agril. Univer., Shillongani.
15.	RH-30	0.70	Dr. Hari Singh, Sr.Scientist (Oilseeds), HAU,Hisar.
16.	Sagam	0.15	-do-
17.	RH-8113	0.10	-do-
18.	Pusa bold	2.73	Dr.R.N.Raut, IARI, New Delhi.
19.	Rusa Bahar	0.20	-do-
20.	Pusa Basant	0.20	-do-
21.	NDR 8501	0.06	Dr. Y.S.Chauhan, Faizabad.

Nucleus seed of Rapeseed-Mustard to be produced during 1991-92

S.No:	Name of the Centre	Name of the Variety	Quantity indented(g)
(1)	(2)	(3)	(4)
1.	Dr. D.P.Baruah, Assam Agril. Univ., Shillongani.	M-27(Toria)	500
		TS-29(Toria)	200
2.	Dr.Vargheese, BARC, Bombay.	TM-2(Mustard)	500
		TM-4(Mustard)	1000
3.	Dr.S.D.Chatterjee, Oilseeds & Pulses Research Station, Berhampore.	YSBNC-1(Yellow Sarson)	1000
		YSR-19-7-C (")	1000
		TWC-3(Toria)	200
		RW-351(Mustard)	2000
		YSB-9(Yellow Sarson)	2000
		B-54(Toria)	200
		B-85(Toria)	200
4.	Dr. R.K.Dixit, C.S.A.U.&T., Kanpur.	T-9(Toria)	2000
		Bhawani(Torai)	2000
		Varuna(Mustard)	2000
		Vardan(Mustard)	500
		Vaibhav(Mustard)	500
		Rohini(Mustard)	500
5.	Dr. J.N.Sachan, G.B.Pant Univ. of Agril. & Tech., Pantnagar.	Kranti(Mustard)	1000
		Krishna(Mustard)	500
		PT-303(Toria)	2000
6.	Dr. Y.S.Chauhan, N.D.Univ. of Agril. and Tech., Faizabad.	ND-8501	500
7.	Dr. Hari Singh, HAU, Hisar.	RH-30	2000
		RH-819	2000
		RH-8113	2000
		Sangam	1000
		TH-68	2000
		RH-781	1000
		T-27	200
8.	Dr. R.N.Raut, IARI, New Delhi.	Pusa Bold	2000
9.	Dr.K.S.Labana, PAU, Ludhiana.	TLC-1	2000
		TL-15	2000
		RLM-619	2000
		RL-1359	2000
		RLM-514	2000
		RLM-198	2000
		GSL-1	2000
10.	Dr. R.N.Raut, RAU, Pusa.	RAUTS-17	100
		YS-19-7-3	100
11.	G.A.U., Gujarat.	Gujarat Mustard	200
12.	Dr. H.L.Thakur, HPKVV, Kangra.	BSH-1	200
		DK-1	200

EXPERIMENTAL DETAILS:

1) TORIA

1.1 IET: Entries: +PT-303 and T-9 as National check + B-54 and M-27 as regional check for Eastern Zone & Bhawani as Regional Check for Central Zone.

Layout : RBD
Replications: Three
Plot size : 1.50 x 5.0m
Spacing : 30 x 10cm
Fertilizers : 50 + 25 + 25 NPK kg/ha

2) BROWN SARSON

2.1 IET: Entries : + Pusa Kalyani as National Check
Layout : RBD
Replications: Three
Plot size : 1.50 x 5 cm
Spacing : 30 x 10 m
Fertilizers : 40 x 20 NP kg/ha to be drilled at sowing.

3) YELLOW SARSON

3.1 IET: Entries : +YST-151 as National Check
Layout : RBD
Replications: Three
Plot size : 2.7 x 5 m
Spacing : 30 x 10 cm
Fertilizers : 50+30 NP kg/ha to be drilled at sowing.

4) TARAMIRA

4.1 AVT-11 (Rainfed)
Entries : +T-27 as National Check
Layout : RBD
Replications: Six
Plot size : 2.7 x 5 cm
Spacing : 30 x 10 cm
Fertilizers : 30 kg Nitrogen per hectare

4.2 IET (Rainfed)
Entries : +T-27 as National Check
Layout : RBD
Replications: Four
Plot size : 2.7 x 5 m
Spacing : 30 x 10 cm
Fertilizers : 30 kg N/ha

5) MUSTARD

5.1 IET: Entries : +Checks (Varuna & Kranti for irrigated trial and Varuna for rainfed trial + regional check)
Layout : Simple Lattice Design
Replications: Two
Plot size : 1.5 x 5.0 m
Spacing : 30 x 10 cm
Fertilizers : 40+20+20 NPK kg/ha(Rainfed)

5.2 MUSTARD AVT-1
Entries : +Checks (Varuna & Kranti for Irrigated trial and Varuna for rainfed trial + Regional check)
Layout : RBD
Replications: Four
Plot size : 2.7 x 5.0 m
Spacing : 30 x 10 cm
Fertilizers : 80+40+40 NPK kg/ha (Irrigated)
40+20+20 NPK kg/ha (Rainfed)

NOTE: 1. In all the irrigated trials half the dose of N and full dose of phosphorus and potash to be drilled at sowing time. The remaining half of nitrogen dose to be applied at the time of first irrigation. In all the rainfed trials NPK is to be drilled before sowing.

2. In each case, proceeding crop may be reported.

3. Soil test for NPK may be got done and reported along with the results.

4. Set of characters to be recorded should be given in prescribed data sheets, to be supplied by the Project Director/Project Coordinator.

5. The trials having only one entry with NC should be laid out using paired plot technique with 15 replications. The plot size should be same as in AVT-1.

6. No irrigation is to be given. If there is no rain before the sowing, pre-sowing irrigation is not to be given. Soil moisture of the field at the time of sowing and rainfall data within the duration of crop should be reported alongwith the results.

7. Each entry in Varietal Trials will be screened for disease and insect pest reactions for which an additional replication will be grown and left unsprayed.

8. SEED SUPPLY: All the centres should send the seed material of toria by August 25, 1990 and remaining by September 5, 1990, the latest to the Project Coordinator (R&M). For IET, AVT-1 & AVT-2, 50, 100, 200 g, respectively seed material is to be supplied to Project Coordinator (R&M) for onward transmission to the Cooperating Centres.

9. DATA REPORTING: The data book and detailed Annual Report duly filled in should reach the Project Coordinating Unit and the Project Director (Oilseeds) by June 15, 1991.

10. Extra seed (25 gm each) should be supplied for entomological and pathological studies to Project Coordinator (R&M).

11. The centres which have accepted the trials must report data, otherwise their entries will not be included if the data are not supplied without any solid reason.

12. Performance of any entry in any trial will be compared with the most superior national check of the trial.

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57. Director of Agriculture, Shillong, Maghalaya.

58. Director of Agriculture, Govt.of West Bengal, Writer's Building, Calcutta, West Bengal.

59. Director of Agriculture, Govt.of Himachal Pradesh, Deptt. of Agril.Simla-171 001 (HP).

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61. Dr. S. Thangavelu, Professor of Oilseeds, TamilNadu Agril.University, Coimbatore-641 003.

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63. Director of Agriculture, Govt.of Arunachal Pradesh, New Itanagar (Arunachal Pradesh)

64. Director of Agriculture, Govt.of Rajasthan, Krishi Bhavan, Jaipur-302 001 (Rajasthan)

65. Director of Agriculture, Government of Jammu & Kashmir Lal Mandi, Srinagar (J&K).

66. Director of Agriculture, Jammu.

67. Director of Agriculture, Govt.of Gujarat, Krishi Bhavan, Gandhi Nagar, Gujarat.

68. Director of Agriculture, Govt.of Madhya Pradesh New Secretariate, Bhopal, (MP).

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71. Director of Agriculture, Govt.of Manipur, Imphal, Manipur.

72. Director of Agril., Govt.of Sikkim, Gangtok, Sikkim.

73. Director of Agril., Govt.of Orissa, Bhubaneshwar (Orissa)

74. Director of Agril., Govt.of Andamans & Nicobar, Port Blair (Andamans & Nicobar).

75. Director of Agril., Govt.of Punjab, Chandigarh, Haryana.

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Rapeseed and Mustard Entomology, 1991-92
(Supplementary Technical Programme)

4.8 Empirical approach of mustard aphid management

Centres: Ludhiana, Bathinda, Hisar, Pantnagar, Morena and Navgaon.

Programme of work:

Observations to be recorded:

i) Mustard aphid population per 15 cm long central twig/plant.

ii) Percentage of mustard aphid infested plants.

iii) Yield q/ha.

iv) Data on yield contributing traits.

a) No.of pods/central shoot of the plant per treatment.

b) No.of seeds/pod.

c) 1000 seed weight (g).

v) Economics of each treatment:

i) Grow latest recommended mustard variety in a plot size of 300 sq.m. area.

ii) Divide the main plot in 3 sub-plots of equal size i.e. 100 sq.m. each.

iii) Give the following treatments:

a) Standard practice of aphid control i.e. any of the systematic insecticide 2 or 3 sprays at an interval of 15 days (Oxy-demeton methyl (0.025%).

b) Removal of mustard aphid twigs manually twice or thrice at 15 days intervals (Engage labour in evening hours to remove the infested twigs).

c) Control.

Statistical approach to be followed:

i) Take observations at 20 sites of 1 sq.m. area/treatment (as mentioned in observations to be recorded).

ii) Compare all the parameter by using student(t) test or paired(t)test between 2 treatments.

Note:

i) Sow the experiment during first week of October or at normal sowing time of the region.

ii) Remove only those buds which have aphid infestation and avoid the excessive damage to normal flowers.

REQUIREMENT OF SEED OF DIFFERENT VARIETIES OF OIL SEED CROPS FOR TOT DEMONSTRATIONS DURING 1992-93

Crop: Mustard/Brown Sarson/Raya

S.No:	Variety	Requirement of Seed (Qtls)																
			Zone-I			Zone-II		Zone-III	Zone-IV		Zone-V	Zone-VI		Zone-VII		Zone-VIII		Total(q)
		HR	HP	PB	JK	WB	BH	New	UP	AP	MH	GJ	RJ	MP	OB	TN	KB	
1.	TM-2	--	--	--	--	--	--	1.8	--	--	--	--	--	--	--	--	--	1.8
2.	TM-4	--	--	--	--	--	--	1.0	--	--	--	--	--	--	--	--	--	1.0
3.	Bhagirthi	-	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	1.0
[illegible]	[illegible]																	
5.	Pusa Bahar	--	--	--	--	1	1	1	--	--	--	--	--	--	1	--	--	4.0
6.	Pusa bolo	--	--	--	--	.5	.5	.5	2	.4	--	--	--	--	--	--	--	3.9
7.	Vardhan	--	--	--	--	--	--	--	2	--	--	--	--	1	--	--	--	3.0
8.	Rohini	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	2.0
9.	Vainhav	--	--	--	--	--	--	--	2	--	--	--	--	1	--	--	--	3.0
10.	Narendra Rai	.5	--	--	--	--	--	--	2.8	-	--	--	1	1	--	--	--	5.3
11.	Pusa Basent	--	--	--	--	1	1	1	--	--	--	--	--	--	.5	--	--	3.5
12.	RH 8113	3	.5	1	.4	--	--	--	--	--	--	1	3	--	--	--	--	8.9
13.	RL 1359	--	.5	4	.2	--	--	--	--	--	--	--	3	--	--	--	--	7.7
14.	G.M.1	--	--	--	--	--	--	--	--	--	--	13	2	--	--	--	--	15.0
15.	RH 30	.5	.5	--	--	--	--	--	--	--	--	--	1	--	--	--	--	2.0
16.	RH 819	2.5	.5	--	--	--	--	--	--	--	--	--	3	--	--	--	--	6.0
[illegible]	[illegible]		.5															
18.	DSH-1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0
19.	KDS-1	--	--	--	0.2	-	--	--	--	--	--	--	--	--	--	--	--	0.20
20.	RLM 619	--	1	.5	--	--	--	--	--	.8	--	--	--	--	--	--	--	2.3
21.	RH 781	2	.5	.2	--	--	--	--	--	--	--	--	--	--	--	--	--	2.7
22.	RLM-514	.5	.5	.5	--	--	--	--	--	.8	--	3	--	--	--	--	--	5.3
23.	Pusa Barani	--	--	--	--	.5	.5	.5	--	--	--	--	--	--	.5	--	--	2.0
	Total:	9	5.5	6	1	5	4	6.8	10.8	.4	1.6	14	16	3	3			86.1

HR: Haryana, HP=Himachal Pradesh, PB=Punjab, JK= Jummu &Kashmir

REQUUREMENT OF SEED OF DIFFERENT VARIETIES OF OILSEED CROPS FOR TOT DEMONSTRATIONS DURING 1992-1993

Requirement of Seed (Qntl.)

CROP: TORIA

S.№ Variety	Zone-I			Zone-II		Zone III	Zone IV	Zone-V		Zone-VI		Zone-VII		Zone-VIII		Total (q)
	HR	HP	PB	WB	BH	NEH	UP	AP	MH	GJ	RJ	MP	OR	TN	KR	
1. Panch li	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5
2. RAUTS-17	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	2.0
3. Bhavani	-	0.1	-	-	1.0	-	1.6	-	-	-	-	0.1	-	-	-	2.8
4. TL-15	-	0.5	0.3	-	-	-	-	-	-	-	-	-	-	-	-	0.8
5. TH-68	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0
6. TLC-1	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	0.4
7. PT-507	-	-	-	0.5	1.0	0.1	-	-	-	-	-	-	0.1	-	-	1.7
	1.0	0.6	0.7	1.0	4.0	0.1	1.6	-	-	-	-	0.1	0.1	-	-	9.2

HR= Haryana, HP= Himachal Pradesh, PB=Punjab, JK=Jammu&Kashmir, WB=West Bengal, Bh= Bihar, NEH=North eastern Hill, UP=Uttar Pradesh, AP=Andhra Pradesh, MH= Maharashtra, GJ=Gujarat, Rj=Rajasthan, MP=Madhya Pradesh, OR=Orissa, TN= Tamil Nadu, KR=Karnataka.

REQUIREMENT OF SEED OF DIFFERENT VARIETIES OF OILSEED CROPS FOR TOT DEMONSTRATIONS DURING 1992-1993

CROP : Gobhi Sarson

S.No	Variety	Requirement of seed (Qntl) Zone-I HR	HP	PB	Zone-II WB	BH	Zone-III NEH	IV UP	Zone-V AP	MH	Zone-VI GJ	RJ	Zone-VII MP	OR	Zone-VIII TN	KR	Total (q)
1.	GSL-1	0.5	-	0.2	0.7	-	-	-	-	-	-	-	-	-	-	-	1.4
		0.5	-	0.2	0.7	-	-	-	-	-	-	-	-	-	-	-	1.4

HR Haryana, HP=Himachal Pradesh, PB=Punjab, NEH=North Eastern Hill, UP=Uttar Pradesh, AP=Andhra Pradesh, MH=Maharashtra, GJ=Gujarat, RJ=Rajasthan, MP=Madhya Pradesh, OR=Orissa, TN=TamilNadu, KR= Karnataka,

XXXIX ANNUAL RABI OILSEED RESEARCH WORKERS GROUP MEETING OF RAPESEED-MUSTARD, RABI/SUMMER GROUNDNUT, SAFFLOWER & LINSEED

Venue: Orissa University of Agril. & Tech., Bhubaneswar.

Dates: August 19-21, 1991

PROCEEDING OF RAPESEED-MUSTARD AGRONOMY SESSION HELD ON AUGUST 20, 1991

Chairman : Dr.D.Lenka
Dean(Extension),OUAT.

Rapporteurs : 1) Dr. Aravind Kumar.
2) Dr. A.S.Dhillon.

The experiments conducted at different locations were discussed and the technical programme was finalised for the next year. It was emphasised that the centres should not make any change in the treatments and should go strictly according to the guidelines provided in the technical programme. It was also decided that in future if the guidelines are not adopted properly, necessary action will be taken against that centre. It was also pointed out that many centres are not reporting the data well in time and as such June 15, was decided to be the last date for sending data in the requisite format as desired by the Principal Investigator. In case of station trials the results of previous years be complied along with supporting data in order to draw valid conclusions. The results of the agronomic trials already concluded by the respective centres may be sent to the Principal Investigators within two months time in order to compile the information and draw necessary conclusions. As suggested by Dr. R.S.Paroda, DDG(CS), ICAR it was also decided that the centres will take up agronomic trials with the identified/released new material available for the particular zone. However, such information is to be provided by the Project Coordinator(R&M) and accordingly the centres will take up the agronomical investigations.

The details of different experiments conducted are given below:

1. The trial to study the contribution of different factors of production on the yield of mustard and taramira was conducted at different locations. In this trial the reduction in seed yield was maximum when fertiliser was missing. However, it was suggested that the economics whereever not reported be given in future. The oil content also be reported from those centres where facility does exist. It was decided to continue this trialtaking new varieties at Khudwani, Hisar, Jobner (Taramira). It was suggested by the Chairman that regression analysis be done

in order to quantify the contribution of different packages of practices.

2. The trials on Jalashakti have been conducted under rainfed as well as irrigated conditions. Under rainfed conditions at Jobner and Diggi there was significant increase in yield with seed treatment of Jalashakti @ 3% + soil application @ 4 kg/ha but however, at Navgaon, the results were not significant. It was mentioned that the moisture content data be made available for making necessary recommendations. It was further decided that this trial may be conducted at Faizabad and Navgaon and Jobner for Taramira. Under irrigated conditions the seed treatment @ 3% + soil application @ 6 kg/ha has given significant yield advantage at Pantnagar, Ludhiana, Bhatinda and Mandore. This trial was concluded and recommendations evolved.

3. The trial to see the effect of source method and rates of sulphur application on mustard was reviewed and it was decided to conduct this trial as such for one more year. However, statistical analysis was suggested to be done taking control as a separate factor. It was also emphasized that in order to see the residual factor of sulphur a legume crop preferably fodder cowpea may be grown after the harvest of mustard and the dry matter be recorded.

4. The cropping sequence trial taking Toria as a catch crop was considered to be an important trial considering the emphasis being given on the cropping systems research. It was suggested by the Chairman that the programme be taken up as per the technical programme and detailed economics worked out for different treatments. He further suggested that a treatment taking previous sequence as control be also included at different centres.

5. To study the efficacy of seed drill a trial was conducted at Morena. The seed drill is to be made available by CIAE, Bhopal to different centres and accordingly they may plan a trial as per the technical programme suggested last year.

6. A number of centres have conducted the station trials and worthwhile information has been generated at different locations.

7. Based on the station trials conducted at Pantnagar and Ludhiana two new trials have been formulated on date of planting in mustard as well as in different oilseed brassica species.

TECHNICAL PROGRAMME FOR 1991-92

The scientists are advised to strictly adhere to the technical programme without any alteration in the treatment and design.

3.1 CONSTRUCTION OF DIFFERENT FACTORS OF PRODUCTION ON THE YIELD OF MUSTARD, BROWN SARSON AND TARAMIRA:

Treatments:

1.	Recommended package of practices.		
2.		-do-	-Improved variety.
3.		-do-8	-Fertilizer.
4.		-do-	-Irrigation.
5.		-do-	-Plant protection.
6.		-do-	-Fertilizer and irrigation.
7.		-do-	-Fertilizer and plant proection.
8.		-do-	-Irrigation and plant proection.

Note:

(A) Recommended package of practices should be used as recommended for a particular agro-climatic zone.
(B) The trial be conducted at optimum time of sowing.
(C) Economics of production should be worked out.
(D) Oil content should also be reported along with seed yield.

Design: R.B.D., Replication : Four.

Locations: Khudwani, Hisar, Jobner(For taramira), Navgaon, Dholi.

3.2 EFFECT OF STARCH POLYMERS (JALSHAKTI) UNDER RAINFED CONDITIONS ON SEED YIELD OF MUSTARD:

Treatments:

1. Seed coating @ 1.5
2. Seed coating @ 3.0%
3. Soil application @ 4 kg/ha
4. Seed coating @ 1.5% + soil application @ 4 kg/ha
5. Seed coating @ 3.0% + soil application @ 4 kg/ha
6. No treatment of seed and/or soil with starch polymer (control)

Note:

(A) Seed coating be done on the basis of weight of seeds.
(B) For uniform coating for seeds, use vegetable oil as the precoating agent.
(C) Soil application of Jalshakti should be done at the time of sowing. To increase its value for uniform distribution, it should be mixed up with dry soil.
(D) For Jobner, the crop shall be Taramira instead of mustard.

Design: R.B.D. Replications : Four.

Locations: Faizabad, Junagadh, Jobner, Navgaon.

Observations:

i) Initial germination and plant stand at about three weeks after sowing and at maturity.

ii) Yield and yield attributes be recorded (No. of branches, No. of siliquae/plant and 1000 seed weight).

iii) Per cent oil content data also be reported.

iv) Available soil moisture at sowing time, flowering siliquae formation and at the time of harvesting from the depth of (0-15cm) and (15-30cm) be taken.

3.3 PERFORMANCE OF PROMISING VARIETIES(IDENTIFIED) OF MUSTARD UNDER DIFFERENT LEVELS OF NITROGEN FERTILIZATION

Treatments:

1. Varieties: The number shall be 3 or 4 for a particular agroclimatic zone. Only recently identified varieties be included.

2. Nitrogen levels:

i) 40 kg N/ha
ii) 80 kg N/ha
iii) 120 kg N/ha

Note : In case there was no identified varieties available the trial may not be conducted at that location.

Design: R.B.D. Replications: Four.

3.4 STUDIES ON THE SOURCE, METHOD AND RATE OF SULPHUR APPLICATION IN MUSTARD:

Treatments:

1. Rate of sulphur application:

i) Control
ii) 25 kg sulphur/ha
iii) 50 kg sulphur/ha

2. Source of sulphur:

i) Pyrite
ii) Calcium sulphate

3. Method of application:

i) One week before sowing as finely general powder.
ii) At the time of sowing.

Note:1. The pyrite and $CaSO_4$ be obtained by respective centres from their own state.
2. After the harvest of this trial, a legume crop preferably cowpea be grown during spring/kharif season to assess the residual effect.
3. Drymatter accumulation by cowpea/legume crop be recorded at the peak vegetative phase.
4. Sulphur content in soil as well as plant at maximum vegetative phase be also recorded (where facili-

Design: R.B.D., Replication : Three.

Locations: Pantnagar, Kanpur, Bhatinda, Faizabad, Navgaon, Khudwani, Jobner and [illegible] (Taramira), Kangra, Dholi, Shillangani, Kalyani, Bhubaneswar.

3.5 CROPPING SEQUENCE TRIAL TAKING TORIA AS A CATCH CROP:

The treatments may vary for different centres as suggested below:

Treatments:

1. Green gram-Toria-Wheat.
2. Black gram-Toria-Wheat.
3. Fodder Cowpea-Toria-Wheat.
4. Green manuring-Toria-Wheat.
5. Fallow-Toria-Wheat.
6. Maize-Toria-Wheat (Control).

Design: R.B.D., Replications : Four

Location: Pantnagar, Kanpur, Faizabad, Berhampore, Ludhiana, Morena, Bhatinda, Hisar.

Berhampore: 1. Jute-Toria-Wheat.
2. Rice-Toria-Wheat.

Note: In Toria 3 varieties be included in both treatments to make total number to Six.

Ludhiana/Bhatinda:

1. Toria followed by wheat.
2. Toria followed by transplanting of gobhi sarson.
3. Toria followed by mustard.
4. Toria followed by sunflower.
5. Torai + Gobhi Sarson intercrop.
6. Gobhi Sarson alone.

Morena:

1. Green gram - Toria - Wheat.
2. Black gram - Toria - Wheat.
3. Cowpea (Fodder)-Toria-Wheat.
4. Guar(Fodder-Toria-Wheat.
5. Fallow-Mustard-Standard check.
6. Fallow-Toria-Wheat.

Note: 1. Where the number of treatments are limited, the toria varieties may be taken 2 to 3. Similarly, at other locations toria should be tried as a catch crop without affecting the yeild of subsequent rabi crop. The trials according to the need may be framed by respective zones to work out the suitability of a crop rotation.

2. The prevailing sequence (control) may vary according to the location. In addition a treatment with fallow - Toria + G.Sarson be also included by the centres where this combination has shown promise.

3. Date of sowing and harvesting of each crop should be recorded.

4. Sowing date of Toria should not be affected.

5. Economics giving cost of cultivation and net returns be also reported.

3.6 TO STUDY THE EFFICIENCY OF SEED DRILL:

Treatments:

i) Tractor drawn seed drill.
ii) Bullock driven seed-cum-fertilizer-drill.
iii) Comparison with conventional method.

Experimental layout: R.B.D., Replications : Three.

Locations: Morena.

Observations:

i) Seed rate.
ii) Seed distribution.
iii) Plant to plant spacing.
iv) Depth of sowing.
v) Germination percentage.
vi) Plant stand.
vii) Seed yield.
viii) Cap. of machine (ha/day).
ix) Power requirement.
x) Cost of operation.

Note: The locations where seed drill is made available may also conduct this trial

pl.

3.7 EFFECT OF DATES OF SOWING AND ROW SPACING ON MUSTARD UNDER LATE PLANTING CONDITIONS:

Treatments:

1. Date of sowing: 25 October, 9 November, 24 November and 9 December.
2. Row spacing: 20,30,40cm.

3. Design: Split plot with dates as main plot treatments.

4. Replications: Four.

5. Locations: Pantnagar, Ludhiana, Bhatinda, Kanpur, Morena

6. Varieties: As per recommendations made for that particular centre.

3.8 Centrewise allocation for conduct of number of onfarm demonstrations under C.ss fund assistance during 1991-92 are given as under:

Sl No	Centre	Break-up of demonstrations in different crop sequences	Var.	Total No. of demonstrations (0.4 ha) to be conducted during 1991-92
1.	Bawal	Fallow-Mustard-3 (R) Bajra-Mustard -3 (R) Bajra-Mustard -6 (I) Taramira 1 (R) Groundnut-Mustard-2	RH-8-19 RH-18-1 RH-88113 T-27	15
2.	Berhampore	Jute-Mustard-8 Upland Rice-Mustard-3	Sarma Pusa Bahar	15
3.	Bhatinda	Mustard-8 Toria_3 G.Sarson+Toria-4(to be compared with wheat as local)	RL-1359 TL-15	15
4.	Bhubaneswar	Toria(Panchali)-5 Mustard(Pusa Bahar)-5 Toria(PT-507)-5		15
5.	Dantiwada	Groundnut-Mustard -5 Bajra-Mustard-5 Moong-Mustard-5	GM-1 GM-1 GM-1	15
6.	Dholi	Maize-Mustard-5 Rice-Mustard-5 Sesamum-Toria-5	Pusa Bahar Pusa Bahar Panchali	15
7.	Faizabad	Rice-Mustard-8 Fallow-Toria-Wheat-2(R) Mustard-5 (Improved variety)	NDR-8501 Rohini MR-8501	15
8.	Hisar	Fallow-Mustard-2(R) Bajra-Mustard-10 Maize-Toria-Wheat-1 Fallow-Toria-Wheat-2	RH-8113 TH-68 TH-68	15

contd..

Sl No	Centre	Break up of demonstrations in different crop sequences	Var.	Total No. of demonstrations (0.4 ha) to be conducted during 1991-92
9.	Jobner	Fallow-Taramira-8 Bajra-Taramira-7	T-27 T-27	15
10.	Junagadh	Groundnut-Mustard-8 Bajra-Mustard-7	GM-1 GM-1	15
11.	Kangra	Maize-Toria-Potato-5 Maize-Toria-Wheat-5 Maize-G.Sarson + Toria2 Maize-Brown Sarson-3	TL-15 Bhavani TL-15 BSH-1	15
12.	Kanpur	Maize-Mustard-6 Fallow-Toria-Wheat-2 Maize-Toria-Wheat-2 Potato+Mustard-3 Wheat+Mustard-1 Gram+Mustard-1	Rohini Bhawani Bhawani Vardan Rohini Rohini	15
13.	Khudwani	Rice-Brown Sarson-15(R)	KOS-1	15
14.	Ludhiana	Pulse-Toria-3 Rice-Mustard-4 G.Sarson alone-2 Toria+G.Sarson-2 Toria-Wheat-2 Transplanting of Gobhi Sarson-2	TL-15 RL 1359 GSL-1 GSL-1 TL-15 GSL-1	15
15.	Morena	Fallow-Mustard-5(R) Fallow-Mustard-5(I) Moong-Mustard-3 Toria+G.Sarson-2	Pusa bold Pusa bold Pusa bold GSL-1, Bhawani	15
16.	Navgaon	Fallow-Mustard-6(R) Fallow-Mustard-7(I) Bajra-Mustard-2	RH 819 RH 8113 RL 1359	15
17.	Pantnagar	Rice-Mustard-5 Rice-Toria-Sugarcane-6 Maize-Toria-Wheat-2 Toria+G.Sarson-1 Wheat+Mustard-1	Rohini PJ 303 Bhawani PJ 303, GSL-1 PR-43	15

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Sl No	Centre	Break up demonstrations in different crop sequences	Var.	Total No. of demonstrations (0.4 ha) to be conducted during 1991-92
18.	Shillongani			15
		Spring Rice-Fallow-Toria-3	Panchali	
		Blackgram-toria-Spring rice-5	"	
		Jute-Toria-3	"	
		Jute-Mustard-4	TM-4	
19.	Sriganganagar			15
		Fallow-Mustard(R)-6	RH 819	
		Bajra-Mustard-7	RH 8113, RL 1359	
		Pulse crop-Mustard-2	RH 8113	

R = Rainfed
I = Irrigated

NOTE: 1. The improved varieties be taken as accepted for DOT for that region/state.

2. All the discipline are equally responsible at a particular centre for conduct of frontline demonstrations.

LIST OF ADDRESSES OF AGRONOMISTS/SCIENTISTS RESPONSIBLE FOR CONDUCTING ONFARM DEMONSTRATIONS

1. Dr. Arvind Kumar, Principal Investigator, Dept. of Agronomy, Pantnagar-263145(UP).
2. Dr. A.S. Dhillon, Agronomist, Oilseeds Section, Punjab Agricultural University, Ludhiana-141004(Punjab)
3. Dr. D.S. Sandhu, Agronomist, Punjab Agril. University, Regional Research Station, Bhatinda(Punjab).
4. Dr. J.B. Chaudhary, Asst.Agronomist, HPKVV, Oilseeds Research Station, Kangra-176001.
5. Dr. Suresh Singh Tomar, Agronomist(R&M), JNKVV, Zonal Agril.Res.Stn., A.B.Road, P.B.No.14, Morena-476001.
6. Dr. S.D. Ram, Jr.Agronomist, Birsa Agril. University, Kanke(Ranchi)-834006.
7. Mr. V.L. Behra, Asst.Agronomist, Agril.Res.Stn., Hanumangarh, Distt. (Ganganagar(Rajasthan)
8. Dr. S.B. Prasad, Sr.Scientist(Agronomy), Tirhut College of Agriculture, Dholi-843121, Dist.Muzaffarpur.
9. Dr. Y.S.Chauhan, Oilseeds Breeder, Narendra Dev.Univ., of Agril. & Tech., P.O.Kumarganj, Dist.Faizabad-224229.
10. Mr. M.A. Agarwal, Asst.Agronomist(Taramira), Dept. of Genetics & Pl.Breeding, S.K.N. College of Agril. Jobner-303329(Rajasthan (ALSO FOR DIGGI)

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11. Dr. Chaniara, Assoc.Research Scientist(Agronomy), Gujarat Agril. University, Junagadh-362001.

12. Dr. R.P. Sharma, Prof. Agronomy(Oilseeds), Agril.Res.Stn., Navgaon-301025(Alwar) Rajasthan.

13. Dr. A.L. Bhola, Agronomist(Oilseeds Section) Haryana Agril. University, Hisar-125004.

14. Dr. O.S. Verma, Agronomist(Oilseeds), Chandra Sekhar A zad Univ. of Agril. & Tech., Kanpur-208002.

15. Dr. H.L. Thakur, Breeder(Oilseeds), Oilseeds Research Station, Kangra-176001.

16. Dr. G.M. Tak, Sr.Scientist(Oilseeds) Oilseeds Research Station, S.K.U.A & T., Khudwani P.O. Vanpoh-Anantnag-192102(J & K)

17. Mr. S.C. Satpathi, Jr.Agronomist (R&M), Dept. of [illegible] Plant Breeding & Genetics, O.U.A.&T., Bhubaneswar-751003

18. Dr. R.C. Samui, Reader in Agronomy, B.C.K.V.V, P.O. Krishi Viswavidyalaya- Dist. Nadia-741252(W.B.) (For Kalyani Centre)

XXXIX ANNUAL RABI OILSEED RESEARCH WORKERS GROUP MEETING OF RAPESEED-MUSTARD, RABI/SUMMER GROUNDNUT, SAFFLOWER AND LINSEED

Venue: Orissa Univ. of Agril. & Tech., Bhubaneswar

Dates: August 19-21, 1991

PROCEEDINGS OF PLANT PHYSIOLOGY OF RAPESEED-MUSTARD HELD ON AUGUST 20, 1991

Chairman : Dr. D. Lenka
Dean(Extension), OUA&T

Rapporteurs: 1. Dr. Arvind Kumar
2. Dr. A.S. Dhillon

Dr. M.L. Chabra (Principal Investigator), Plant Physiology apprised the audience with the brief findings of the previous years' experiment and requested the Project Coordinator(R&M) for grant of additional funds for the operation of movable free-zing chamber. Project Coordinator(R&M) assured fullcooperation in this regard.

TECHNICAL PROGRAMME FOR 1991-92

5.1 Studies on front tolerance in Brassica genotypes:

Objectives: i) Identification of frost tolerant genotypes.
ii) To examine the cryprotective role of chemicals.

5.1(i) Screening of genotypes for frost tolerance:

The experiment will be repeated with same set of genotypes.

Genotypes: RH-9001, RH-8812, RH-8701, RH-8904, RJ-8, RJ-11, JGM-881, RH-819, RH-8113, RH-8814, RLM-198, RLM-514, RL-1357, Krishna, RH-781, RH-848

Spacing : 20 x 15 cm

Sowing pattern and freezing treatment

Already supplied

Seed supply: The concerned centre will supply the seed for screening experiment not later than 20th October. directly to Dr.M.L.Chabra for onward transmission.

5.1(ii): To assess the cryprotective role of various chemicals:

The experiment will be repeated with slight modification.

Obser ... No. ... iliquae ... ilig ... 1..0 ... y wei

Location.. His

Treatments

i) Control, unsprayed, unfrozen
ii) Control, water sprayed, unfrozen
iii) Unsprayed, frozen
ix) CCC 100 ppm, unfrozen
v) CCC 100 ppm, frozen
vi) Etheral 100 ppm, unfrozen
vii) Etheral 100 ppm, frozen
viii) NAA 100 ppm, unfrozen
ix) NAA 100 ppm, frozen

II Variety: RH-30

III) Freezing treatment: +2^{o}C, 2 and 3.5^{o}C for 30, 90 and 30 minutes respectively

IV) Stage of spray: 30 days after flowering initiation

Locations: Hisar, Navgaon

Seed supply: Seed to be supplied by the concerned centre. directly to Dr.M.L.Chabra.
Chemical supply: To be purchased by the centres. These a[illegible] l abl [illegible] h [illegible] pliers.

5.2 Studies on salinity tolerance in Brassica species:

Since the growth was in general promoted at 125 meq. salinity level. The reduction in growth at 175 meq. salinity level was not marked in all genotypes. Therefore, the genotypes needs to be tested at higher salinity levels.

Genotypes

B. juncea	RH-30, RH-781, RH-819, RH-8113, RH-8812
B. carinata	HC-2, CAR-5, CAR-6, CGIS-7B, HC-9003
B. napus	HNS-8902

Salinity levels : 150 meq. and 225 meq.

Observations : Germination per cent
Root length
Shoot length
Seedling fresh weight
Seedling dry weight

Locations : Hisar and Kanpur

Seed supply : To principal investigator for onward transmission to concerned centre.

5.3 To study partitioning index in Brassica genotypes

Varieties: RH-781, RH-8812, RH-9001, RH-8701, RH-8954, RH-819, RLM-198, RLM-514, RLM-1357, Varuna, RH-30. Kranti

Observations: The senesce leaves of the plant would be pooled and their dry weight be recorded

$$\text{Partitioning index (PI)} = \frac{\text{Seed yield/plant}}{\text{Seed yield + dry wt. of leaves/plant}} \times 100$$

Observations: Seed yield/plant, No.of siliquae/plant, No.of seeds/siliquae, 1000 seed weight, harvest index, pooled dry weight of all leaves and partition index.

Locations: Hisar and Kanpur

XXXIX ANNUAL RABI OILSEED RESEARCH WORKERS' GROUP MEETING OF RAPESEED-MUSTARD, RABI/SUMMER GROUNDNUT, SAFFLOWER & LINSEED

Venue: Orissa University of Agril. & Tech., Bhubaneshwar.

Dates: August 19-21, 1991.

PROCEEDINGS OF CHEMISTRY AND BIO-CHEMISTRY SESSION OF RAPESEED-MUSTARD HELD ON AUGUST 20, 1991

Chairman : Dr. G.N. Mitra
Prof & Head, OUAT

Rapporteurs : 1. Dr. K.L. Ahuja 2. Dr. R.K. Pathak

The session started with the presentation of results by different centres. At Kanpur, Toria lines TL-9001, TL-9002 and TK-9001 gave more than 42% oil. In case of Indian mustard entries PST-1 had more than 42% oil and in napus material, GSL-1501 gave the highest oil content of 42.8%. No entry had low glucosinate content.

At Ludhiana in *B. juncea* lines RL-1359, No.227 in Toria, PBT-26, PBT-66, TL-22, TNC-2, TNC-9, and TNC-17 and in *B. napus* GSL-1501, GSL-2 lines with oil content more than 42% were identified.

Erucic acid in *B. juncea* lines S-5-P_2, S-5-P_4, S-5-P, S-45-P_4 had less than 20% erucic acid. In *B. campestris* P_2-25-P-34-P_2 had 5% erucic acid. The glucosinolate was low in SIJ-22-2, SIJ-13-4 lines.

6.1 SCREENING OF HIGH OIL, LOW GLUCOSINOLATES, LOW ERUCIC ACID AND LOW CRUDE FIBRE

Centres: Hisar, Ludhiana, Kanpur, IARI, New Delhi.

6.2 TO ASSESS THE MAGNITUDE OF VARIATION OF OIL CONTENTS DUE TO ANALYTICAL TECHNIQUES ADOPTED BY DIFFERENT CENTRES

Centres: . Ludhiana, . Kanpur, Hisar, DOR Hyderabad, PC Unit, Hisar, IARI

Project Coordinator to supply same set of 50 samples about 5% each to all the centres for analysing of oil content.

6.3 CHANGES IN LIPID COMPONENTS DUE TO FROST INJURY:

At Hisar, oil FFA and protein content were lower in the seed samples collected from unirrigated fields as compared to irrigated fields.

RH-781 is frost tolerant. Reducing sugars and glucosinolate content were higher under unirrigated conditions.

Programme of work:

The experiment will continue.

Centres:

Hisar.

6.4 FEEDING TRIALS IN NON-RUMINANTS:

Programme of work:

Feeding trials will be undertaken with the following varieties:

1. Improved quality exotic cultivars:
   a) Tower (*B.napus*)
   b) Candle (*B.campestris*)

2. Indigenous cultivars:
   1) Varuna (*B.juncea*)
   2) Sangam(*B.campestris*)
   3) GSL-1 (*B.napus*)

Centres:

CFTRI(Mysore), and National Institute of Nutrition, Hyd.

GENERAL RECOMMENDATION:

1. All the centres should adopt a modern method for estimation of glucosinolate and the method be standardised for coordinating of results.

2. GLC's be provided to all centres for analysing of fatty acids. Fatty acid composition should be determined for breeding materials receiving at low erucic acid content.

XXXIX ANNUAL RABI OILSEEDS RESEARCH WORKERS' GROUP MEETING OF RAPESEED MUSTARD, RABI/SUMMER GROUNDNUT, SAFFLOWER AND LINSEED

Venue: Orissa University of Agril. & Tech., Bhubaneswar (Orissa)

Dates: August 19-21, 1991

PROCEEDINGS OF RAPESEED-MUSTARD ENTOMOLOGY SESSION HELD ON AUGUST 20, 1991

Chairman : Dr. D.R.C.Bakhetia, PAU, Ludhiana (Punjab)

Rapporteurs : 1) Dr. Harvir Singh, HAU, Hisar, (Haryana)
2) Dr. B.S.Sekhon, RRS, PAU, Bhtinda (Punjab)

In his opening remarks, the Chairman Prof D.R.C.Bakhetia stated that the integrated pest management strategy is of great significance in oil crops like Rapeseed-Mustard. The resistant variety serves an important component of any IPM programme. Hence developing aphid resistant variety consitittutes a priority area of research in oilseed Brassicas. The topic was discussed at length yesterday in the special session on "the review of ongoing research programme on aphid resistance in Rapeseed-Mustard". The more pertinent points emerging out of yesterday's discussions are reiterated below:

1. A time-bound mission oriented research project on germplasm screening for identification and characterisation of aphid resistance in *Brassicas* will be taken up at two centres namely PAU, Ludhiana and HAU, Hisar.

2. Dr. Bakhetia assisted by Dr. Harvir Singh will prepare the project proposal and submit it to the Project Coordinator/ Project Director by 30th September, 1991 for its expeditious processing.

3. The entire germplasm will be made available to these centres by the Project Coordinator (R&M) for extensive screening

4. Urgent steps will have to be taken to initiate the research work right in the ensuing rabi season.

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4.1 ... A. MUSTARD AP... ...PAPHIS ERY...

...ime-bound mission oriented proj... evaluation to top the sources o...

REVIEW OF THE RESEARCH WORK OF 1990-91

The following points emerged out of the review of l st years research work at different centres:

1. Two new insect species viz. Dasineura hisarensis and Eurydema species have been reported from Pantnagar and Morena.

2. Yield losses due to aphid pest varied with the species/ variety and location.

3. The lines identified as aphid tolerant included:

   a. B.juncea: RW-32-2, RW-2-2, RW-29-6, DLC 1, DLC-2, White flower (glossy), DNWF 1, RE 5 and RE 21.

   b. B.campestris: EAL 9 .

   c. B. napus : GSL 8858, GSL 8861, FM 23,

   d. B.nigra: N IE 2

   e. Eruca sativa: T 27, TMH 52 and TMH 9001

4. The physical and morphological characters associated with aphid resistance were early flowering, dwarfness, hairiness of leaves and dull yellow flowers.

5. The aphid appeared in the fields in November and attained the peak population in first week of February on rapeseed and 3rd -4th week of March on B.napus and B.carinata

6. The aphids survived upto middle of May at Hisar and migratates to root zone of the plants, which these could survive for 3-4 days.

7. Mechanical removal of aphid infested twigs was found to be quite effect and economical method of aphid control at Hisar, the cost involved for 3 operations was Rs.184/ha as against Rs.500/- with chemical control.

TECHNICAL PROGRAMME FOR 1991-92

4.1. SCREENING OF BRASSICA GERMPLASM AND THE BREEDER MATERIAL FOR INSECT-PEST RESISTANCE

4.1.A) MUSTARD APHID (LIPAPHIS ERYSIMI)

a. Time bound mission oriented project on germplasm evaluation to top the sources of true resistance.

   Centres; Ludhiana and Hisar.

   Programme: Detailed project proposal to be prepared by Drs. Bakhetia and Harvir Singh and submitted to ICAR by 30th Sept. 1991.

b. Screening of working germplasm and breeding material.

Centres: Bathinda, New Delhi, Mandore, Navgaon, Junagadh, Pantnagar, Kanpur, Faizabad, Varanasi, Morena, Pusa/Dholi, Shillongani, Berhampore, Kangra and Khudwani.

Experimental details: Same as given in last year's Technical programme of work.

4.1. (B) Other insect pests:

Experimental details are same as given in last year's technical programme.

4.1. (C) UNIFORM PEST NURSERY TRIAL-MUSTARD APHID:

Centres: All centres listed under Project No.4.a (A) and B)

UPN-1. Since the aphid incidence remained low or mild at almost all the centres during 1990-91, the set of 35 entries/lines constituted and tested during 1990-91 to be repeated during 1991-92.

UPN 2. The following entries will comprise this trial:

i) *B. juncea*: DNWF1, RE 5, RE 21, NDR 190, MCM 18, MCN 45, MCN 45, IDYR 1, PCR 7, PCR 3, RK 9001, RK 9002, RJ 12, PR 8905, RSM 8904, JGM 9054, JGM 9062, RK 8903.

ii) *B. napus* : GSL 8858, GSL 8861, FM 23, GSL 8876, GSL 8887, FM 27, GSL 1509, GSL 1501, ISN 129.

iii) *B. carinata*: CE 9

iv) *B. nigra*: NIE 2

v) *B. campestris*: EAL 9, TCN 13, TCM 14, TCN 15, YS 4, PBT 35, TM 18, TMM 926.

vi) *Eruca sativa*: T 27, TMH52, TMH 9001.

The experimental details will be the same as given in last year's technical programme.

4.2. BASIS OF RESISTANCE AGAINST MUSTARD APHID IN BRASSICA CROPS.

Centres: Ludhiana, Hisar, Pantnagar, Faizabad and Kanpur.

Entries: T 6342, GSB 7027, DLC-1, DLC-2, SC-2, BTMC-90, RH 7847, RW 32-2, RW-2-2, RW-29-6 and a susceptible check. Experimental details will be same as given in the last year's technical programme.

4.3. POPULATION DYNAMICS OF VARIOUS INSECT-PESTS OF BRASSICA CROPS

Centres: Ludhiana, Bathinda, Hisar, New Delhi, Navgaon, Pantnagar, Kanpur, Morena and Faizabad.

Crops: i) *Brassica juncea*
ii) *B. campestris var.* (Yellow sarson, Brown sarson & Toria)
iii) *B. napus*

Programme of work: Same as given in last year's technical programme.

4.4. Economic Threshold of Mustard aphid:

Centres: Hisar, Navgaon, Shillongani and Morena

Crops: i) *Brassica juncea*.
ii) *B.campestris* var. Brown 'Sarson'
iii) *B.campestris* var. Yellow 'Sarson'
iv) *B.napus*

Programme of work: Same as given in last year's technical programme.

4.5. ASSESSMENT OF YIELD LOSSES IN VARIOUS BRASSICA CROPS CAUSED BY MUSTARD APHID:

Centres: Ludhiana, Bathinda, Navgaon, Pantnagar, Kanpur, Faizabad, Pusa, Bhubaneswar, Berhampore, Kangra, Hisar and Khudwani.

Methodology/Experimental details:

The experiment is to be repeated as per last year's technical programme.

4.6. STUDIES ON THE OFF SEASON BIOLOGY AND MIGRATION OF MUSTARD APHID

Centres: Hisar, Bathinda, Shillongani, Morena, Faizabad, Kanpur, Pantnagar and Navgaon.

Methodology: Same as given in last years technical programme.

4.7. ENTOMOLOGICAL STUDIES IN NON-TRADITIONAL AREAS:

Centres: Coimbatore, Tindivanam, Banglore, Bijapur, Guntur, Nandyal, Rahuri, Phaltan.

Programme of work:

Preliminary studies on the Entomological problems of the areas.

ADDRESSES OF ENTOMOLOGISTS FOR SEED SUPPLY:

1. Dr. D.R.C.Bakhetia, Sr.Entomologist (Oilseeds), Deptt. of Pl. Breeding, PAU, Ludhiana - 141 001.
2. Dr. B.S.Sakhon, Entomologist, Regional Res. Station PAU, Bathinda (Punjab)-151 001.
3. Dr. A.K.Saxena, Jr. Scientist(Entomology), Reg. Agril. Res. Station, PB No:14, A-B-Road, Morena-476 001(MP).
4. Dr. D.C.Borah, Scientist (Entomology), Regional Argil. Res. Station, Shillongani, PB No:33, Nowgogn-782 001(Assam).
5. The Entomologist (Oilseeds), Pulses and Oilseeds Res. Station, Ranibagh, PO Berhampore, Distt. Murshidabad (WB) 742101.
6. Dr. M.N.Lal, Jr. Entomologist (oilseeds), NDUA&T, Kumarganj, Faizabad-224 229.
7. Dr. G.C.Sachan, Entomologist, COA, GBPUA&T, Pantnagar, Distt. Nainital - 263 145.
8. Dr. K.M.Srivastava, Entomologist(Oilseeds), CSAUA&T, Kanpur-208 002.
9. Dr. Harvir Singh, Entomologist (Oilseeds), Dept. of Pl. Breeding, HAU, Hisar.
10. Dr. V.K.Sharma, Entomologist (Oilseeds), ARS, Navgaon, Alwar (Rajasthan)-301 025.
11. Dr. A.Srivastava, Astt. Engomologist (Oilseeds), Regional Res. Station, H.P.Krishi Bishva Vidalaya, Kangra(HP)176 001.
12. Entomologist(Oilseeds), Regional Res. Station, Gujarat Agril. Uni., S.K.Nagar, Dist. Banaskantha(Gujarat)335 506.
13. Entomologist(Oilseeds), College of Agril. Raipur(MP).
14. Entomologist(Oilseeds), Crop Res. Unit (Oilseeds), Punjabrao Krishi Vidyapeeth, Akola(MS)-444 104.
15. Entomologist(Oilseeds), Univ. of Agril. Sc., Banglore (Karnataka) 560 065.
16. Entomologist(Oilseeds), Tamilnadu Agril. University Coimbator-641 003.
17. Dr. G.M.Tak, Sr.Sciantist(Oilseeds), Regional Res. Station, S.K.U.A. and Tech. Khudwani, P.O.Vanpon, Dist. Anantnag (Jammu Kashmir)-192 102.
18. Entomologist(OS), Regional Res. Station, Chianki, Dulton Ganj, Dist. Palamau (Bihar) - 822 133.
19. Entomologist(OS), Regional Res. Staion., G.Udaigiri, Phulbani (Orissa).
20. Entomologist(OS), University of Agril. Sciences, R.R.S., Dharwad(Karnataka) 580 005.
21. Entomologist(OS) Nimbkar Agril. Research Station, Phalton (Maharashtra)-415 523.

YEARWISE FRAME FOR ENTOMOLOGICAL RESEARCH ON RAPESEED-MUSTARD

Sl. No.	Project	Present status	Target	Time frame (years)	Centres
1.	Development of aphid resistant varieties	Mild or low level of tolerance available in some *B. juncea*, *B. carinata* and *B. napus* strains	To identify and characterise the sources of aphid resistance for the in breeding programme.	5	Ludhiana, Bathinda, Hisar, Pantnagar, Kanpur, Faizabad.
2.	Economic threshold of major insect-pests	i) An average of 9 to 19 aphids/plant (Av.14 aphids) on rapeseed or 30% infested plants with aphids (Haryana) ii) Average of 28 to 39 aphids/plant on rapeseed at 30% plant infestation (Assam) iii) In Punjab, ETH established as: A. 40-50% Plant infestation b. 50.60% aphids/10-cm control shoot c. 0.5-1 cm colony length on control shoot.	To evolve need based system of pest management.	5	Khudwani, Kangra, Hisar, Navgaon, S.K.Nagar, Morena, Kanpur, Pantnagar, Faizabad, Dholi, Berhampore, G.Udaigiri, and Shillongani.
3.	Integrated management of major insect-pests	i) Early sown crops escape aphid infestation. ii) Systemic insecticides give effective kill of the aphids. iii) Use insecticides on ETH basis. iv) Lady bird beetle and syrphids are good predators, protect them.	To find out economically feasible and ecologically sound strategies for the control of mustard aphid.	5	Hisar, Ludhiana, Bathinda, Navgaon, Morena, Pantnagar, Kanpur, Faizabad, Pusa, G.Udaigiri, Berhampore, Shillong.
4.	Pest forecasting and lifetable studies on major insect-pests	i) Aphids appear towards the end of December on R&M crops.	To find out the off-season survival of major insect-pests and preparation of life tables.	6	Hisar, Bathinda, Pantnagar, Kanpur.

XXXIX ANNUAL RABI OILSEED RESEARCH WORKERS' GROUP MEETING OF RAPESEED-MUSTARD, RABI/SUMMER GROUNDNUT, SAFFLOWER & LINSEED

Venue: Orissa University of Agriculture & Technology, Bhubaneswar

Dates: August 19-21, 1991

PROCEEDINGS OF RAPESEED-MUSTARD PATHOLOGY SESSION HELD ON AUGUST 21, 1991

Chairman: Dr.A.Narain
Dean College of Agriculture
OUAT, Bhubaneswar (Orissa)

Rapporteurs: 1. Dr.C.D.Kaushik
2. Dr.L.S.Chauhan

The Chairman at the outset requested Dr.S.J.Kolte, Principal Investigator to present the highlights of the results of work done during 1990-91. Accordingly, the results of different trials conducted at various centres were discussed in detail. The Chairman emphasized on the seriousness of white rust and Alternaria diseases of rapeseed-mustard. He also stressed the need of taking observations on new problems like club root and sclerotinia rot of mustard in different states. During the course of discussions some of the participants explained their difficulty in conducting the artificial inoculation trials on screening for resistance to diseases for want of facilities at their centres. It was pointed out by Dr.S.J.Kolte that Kangra centre should be actively involved in screening for resistance sources to diseases because of the naturally favourable weather conditions in that area. It was suggested by Dr.Parkash Kumar, I/c Project Coordinating Unit that Kangra centre should give proposal for providing facilities out of the ICAR funds.

With regards to obtaining the pure culture of Alternaria brassicae, Dr.A.S.Chahal informed that malt extract agar medium is quite good and should be tried. Similarly Dr.S.J.Kolte also informed that radish root extract agar medium with sucrose of manitol is also quite good for isolating Alternaria brassicae.

The results were discussed critically trialwise and as per the suggestions put forward by the group and the Chairman, the technical programme was formulated. At this juncture the Chairman expressed his concern about the prevalence of club-root (Plasmodiophora brassicae) in West Bengal. It was pointed out that disease is still destructive in Berhampore district of West Bengal. Dr.A.K.Chattopadhaya from Berhampore centre reported that club root disease could be managed by the soil application of 3 metric tonnes lime/ha + 1.5 metric tonnes mustard cake/ha. Finally the Project Coordinator thanked the Chairman and the pathologists participating in the discussion giving valuable suggestions in formulating the technical programme.

3.1. SCREENING OF BRASSICA MATERIALS AGAINST DIFFERENT DISEASES:

Plan of Work: The experiment is to be carried out in two different sets of conditions i.e. under artificial and natural inoculations conditions.

A. Under artificial inoculation conditions:

Locations	Diseases
Hisar	Alternaria blight, downy mildew and white rust
Kanpur, Pusa (Dholi)	Alternaria blight
Pantnagar	Alternaria blight, white rust and downy mildew
Navgaon	White rust and Alternaria blight
Morena	White rust
Junagadh	Powdery mildew
Ludhiana	Alternaria blight

B. Under natural conditions:

Centres: Shillongani, Berhampore, Pusa, Faizabad, Kanpur, Pantnagar, Hisar, Ludhiana, Kangra, Junagadh, Morena, Navgaon, Sriganganagar, Diggi/Jobner (Taramira), Khudwani, Ghaziabad, S.K.Nagar, Bathinda.

Materials Germplasm, Breeding and advanced material available with centre and entries included in IET, AVT-1, AVT-2 etc.

Layout i) Single row (Two replications), 3m length
ii) Susceptible check will be used after 5 test rows
iii) Resistant check will be used after every 20 rows

Observations to be recorded:

1. Date of first appearance of each disease
2. The maximum disease score should be taken periodically using 0-5 scale
3. Cotyledonary infection due to downy mildew and pod infection due to Alternaria blight should be recorded separately.
4. Staghead formation should be recorded on per cent plant incidence and per cent twigs infected.

Scale to be used:

0 = No disease, 1=1-10% leaf or pod area infected
2 = 11-25% leaf or pod area infected
3 = 26-50% leaf or pod area infected
4 = 51-75% lead or pod area infected
5 = 75% and above leaf or pod area infected

$$\text{Staghead formation (\% twigs infested)} = \frac{\text{No.of twigs infected} \times 100}{\text{Toral No.of twigs present}}$$

3.2. UNIFORM DISEASE NURSERY TRIAL UNDER ARTIFICIAL CONDITIONS

Programme:

Sl. No.	Genotype	Sl. No.	Genotype
1.	Susceptible check	37.	GSL-1501
2.	PR-8805	38.	Susceptible check
3.	PYS-841	39.	PC-781
4.	PYS-843	40.	HNS-8
5.	RHC-9005	41.	RH-8545
6.	NDR-871	42.	HC-1
7.	Susceptible check	43.	HNS-3
8.	NDR-873	44.	Susceptible check
9.	NDR-872	45.	HNS-4
10.	RWARB-3	46.	Gulivar-1
11.	SSK-1	47.	DOMO
12.	YRT-3	48.	EC-129126-1
13.	Susceptible check	49.	DIRA-313
14.	RSK-10	50.	Susceptible check
15.	RH-8544	51.	DIRA-326
16.	Trawase	52.	PC-5
17.	KTV-tall	53.	PHY-1
18.	CSR-448	54.	PYSR-3
19.	Susceptible check	55.	BJ-1
20.	Midas	56.	Susceptible check
21.	NDYS-2	57.	PHR-2
22.	NDR-8601	58.	BJ-2
23.	WRR-3-1	59.	Norin-14
24.	CSR-142	60.	Tower
25.	Susceptible check	61.	PYS-842
26.	Resistant check	62.	Susceptible check
27.	CSR-416	63.	PWARS-9
28.	YSK-8502	64.	DIR-247
29.	Zem-2	65.	RN-100
30.	Susceptible check	66.	RN-246
31.	PSAN	67.	RN-248
32.	Susceptible check	68.	RN-249
33.	PT-303	69.	Susceptible check
34.	GSL-1	70.	RN-253
35.	GSB-7006	71.	RN-263
36.	GSB-7027	72.	RN-293
		73.	RN-345
		74.	RN-356
		75.	Susceptible check

Centres: Shillongani, Berhampore, Pusa, Kanpur, Faizabad, Pantnagar, Hisar, Ludhiana, Morena, Sriganganagar, Navgaon, Junagadh, Shillong, Bathinda, Kangra, S.K.Nagar and Gaziabad.

Materials: Concerned breeders will supply the material to Project Coordinator who in turn will sent the material to different centres.

Layout: As in 3.1.

Methodology:

1. Add cosporic material after grinding hypertrophied plant material collected from the previous year crop alongwith seed for white rust and downy mildew.

2. For secondary spread of the diseases make repeated inoculations after collecting inoculum from the naturally infected plants for all the major diseases.

3. Give frequent irrigations (preferably sprinkler irrigation). for creating disease in epidemic

4. Record disease data as per instruction given in 3.1.

Note: To maintain uniformity in recording the data on different diseases pathologist should use all above mentioned entries.

3.3 National Screening Nursery trial for Alternaria blight resistance

3.4 National Screening Nursery trial for white rust resistance

The details of the experiment No.3.3 and 3.4 are given under Breeding proceedings page 8-9.

3.5 Chemical control of Alternaria blight and white rust

Centres :

Hisar, Ludhiana, Pantnagar, Kangra, Kanpur, Morena, Dholi, Navgaon, Faizabad.

Treatments:

1. Mancozeb (Dithane M-45 0.2%)
2. Foltaf (Difolatan 0.2 %)
3. Ridomil MZ (0.25%)
4. I prodione (Rovral 0.2%)
5. Check (Unsprayed)

Layout

1. No. of sprays = 2

   a) One at 75% flowering
   b) 2nd at completion of flowering

2. Plot size 5x3 m

3. Replications - 5

4. Variety Varuna/local cultivar

Observations

1. Date of sowing
2. Date of 1st appearance of disease
3. Percent disease intensity of different diseases at leaf and pod infection stages
4. Yield (kg/ha)
5. 1000 seed weight
6. Cost benefit ratio
7. Scale to be used as in 3.1

Percent disease intensity (PDI)

$$\frac{\text{Sum of all numerical ratings}}{\text{Total no. of leaves observed}} \times \frac{100}{\text{max. grade}}$$

Stag head formation (%) as in 3.1

Note: Chemicals will be supplied by the Project Coordinating Unit, Hisar to different centres.

3.6 Chemical Control of Powdery Mildew

Centre : Junagadh

Treatments :		
	Karathane 0.1	3 sprays
	Calaxin 0.05%	2 sprays
	Topas 0.05%	2 sprays
	Wettable 0.02% Sulphur	3 sprays
	Carbendazim 0.05%	2 sprays

Control (Unspread)

Layout and observations: as in 3.5

3.7 Integrated disease management trial

Centres: Hisar, Ludhiana, Pantnagar, Kangra, Kanpur, Morena, Dholi, Navgaon, Faizabad.

Detailed programme:

Dates of sowing (As main plots): October 1st, 15th, 30th and November 15th.

Sprayed (S1, S2, S0 treatments are given below as sub plot treatment in each main plot)

S_0 = No spray of fungicide

S_1 = a) 1st spray of Ridomil MZ (0.25%) at 75% flowering followed by

b) 2nd and 3rd spray of Iprodione 0.2% at 15 days intervals.

S_2 = a) 1st spray of Ridomil MZ (0.25%) at 75% flowering followed by

b) 2nd and 3rd spray of foltaf (0.2%) at 15 days intervals.

Layout:

Design: RBD in split plot arrangement

Main plot size: 12 x 3 meter

Sub plot : 4 x 3 meter

Distance between subplots : 1 meter

Replications : 3

Observations to be recorded : As in 3.5

3.8 STUDIES ON EPIDEMIOLOGY OF ALTERNARIA BLIGHT AND WHITE RUST

Centres: Pusa, Morena and Pantnagar centres are engaged in this programme and will continue and submit the results.

3.9 TESTING VARIABILITY IN ALTERNARIA BRASSICAE AND ALBUCO CANDIDA:

The studies are done at Pantnagar and will be continued.

3.10 DISEASES OF LOCAL IMPORTANCE

Remarks: All centres should initiate and report the work on disease of local/importance especially West Bengal club root and Rajasthan on Sclerotinia rot and Orobanche. Since these diseases have started in taking heavy toll.

Note: Detailed work on sources of resistance, epidemiology, losses and control of disease of local importance should be taken up by respective centres. It will be helpful to combat these diseases before they become national problems to cause economic losses.

3.11 PLANT GROWTH RESPONSES TO VA MYCORRHIZA:

Project Coordinating Unit

Remarks: It is proposed to carryout detailed study on plant growth responses to VA Mycorrhiza- a microbial system which has been demonstrated to have probiotic influence on crops of economic importance. This symbiotic association between the fungus and the plant root has been shown to have significant effect in terms of efficient phosphate uptake as well as biological suppression of potential soil borne pathogens.

Initially, it was proposed to carry out bench mark studies at Project Coordinating Unit, Hisar in collaboration with Department of Plant Pathology, HAU, Hisar. Now undertaken biological suppression of Sclerotinia Sclerotiorum causing Sclerotinia rot in mustard. The preliminary studies on the interaction of VAM inoculation and Sclerotinia Sclerotiorum indicate that VAM inoculation restricted the spread of the pathogen in host root tissue of mustard. To confirm these studies the experiment is proposed to repeat once again.

Note: Investigation on various aspects of mycrorhizal research are in operation in the Department of Plant Pathology, HAU, Hisar on different crops. The mycorrhizal cultures available with them alongwith techniques shall be given by that department for carrying out this collaborative work on mycorrhiza.

RECOMMENDATIONS:

1. For transfer of resistance to white rust in Indian mustard, exotic B.juncea lines Domo, cutlass, Zem-1 and Zem-2 have been identified and the same are recommended for using as sources of resistance in breeding programme. The nature of resistance to white rust in these sources appears to be dominant and specific in nature. The seed of these sources would be maintained through selfing at Project Coordinating Unit for further use.

2. Presently no good resistance sources are available against Alternaria blight. However, based on the least degree of susceptibility EC 189126-1, RC-781 and PHR-1 should be used in the breeding programme. Since this type of resistance/tolerance appears to be quantitative, the appropriate breeding methodology should be used.

3. Based on three years data effectiveness of Iprodione (Rovral) has been conclusively proved beyond doubt at all centres for the control of Alternaria blight disease with significant increase in yie d. Hence the group felt that Government of India/ICAR should make efforts to make this chemical available.

4. Presently disease management strategies in Rapeseed-mustard involve early planting in October (Ist fortnight) in late planting the diseases (AB, WR & DM) can be managed by spraying with foltaf or Mancozeb(@ 0.2%) 3 sprays at an interval of 15 days starting 1st spray 60-75 days after sowing.

Addresses of concerned Pathologists:

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22. Dr.A.M.Bhartaria, Pathologist, JNKVV Campus.

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27. Shri.R.R.Misra, Director Research, MAHYCO, Jalna-431 202 Maharashtra, P.B.No.67.

28. Sri R.K.Arora, Plant Breeder M/s PHI BIOGENE (T), KK-154 Kavi Nagar, Ghaziabad (UP).

TIME FRAME FOR PATHOLOGICAL RESEARCH ON RAPESEED-MUSTARD

Sl. No.	Project	Time frame (years)	1987-88	1988-89	1989-90	1990-91	1991-92
A.							
1.	Assessment of losses of yield	5	To standardise disease intensity scale for correlation with yield loss.	To correlate disease intensity with actual yield loss.	Repeat	Repeat	To standardise actual yield loss estimation equation.
Centres: Khudwani, Kangra, Ludhiana, Bathinda, Hisar, Navgaon, Morena, Junagadh, Kanpur, Pantnagar, Faizabad, Pusa, Chianki, Bhubaneswar, Berhampore, Shillongani and Kota.							
2.	Physiological	5	Identification standardization of host differentials for major pathogens	Collection maintenance & inoculation of different isolate of pathogens on host differentials.	Repeat	Repeat	Establishment of virulence in different pathogens.
Centres: Pantnagar, Hisar and Morena.							
3.	Epidemiology	5	To identify critical environmental factors favouring infection and disease development	Analysis of environmental factors in different combinations to predict epidemic development of each disease	Repeat	Repeat	To formulate disease.
Centres: Pantnagar, Hisar and Morena.							

BREEDER SEED INDENTS OF OIL SEED CROPS FOR RABI 1993-94
(Breeder Seed to be produced during Rabi 1992-93)

CROP: Rapeseed-Mustard (Qty. in Qtls.)

Sl. No.	Variety	Year	NSC	SFCI	U.P.	J&K	Haryana	Punjab	Rajasthan	Gujarat	M.P.
1.	T-9	1978	0.35	0.02	0.20	-	0.02	-	0.02	0.40	0.20
2.	M-27	1978	0.10	0.50	-	-	-	-	-	-	-
3.	Varuna(T-59)	1976	0.50	2.0	0.60	-	0.02	-	0.40	1.00	0.18
4.	Bhawani	1986	0.05	-	0.06	-	-	-	-	-	0.05
5.	Kranti	1982	0.10	-	-	-	-	-	0.10	0.10	-
6.	NDR-8501	1990	0.20	-	-	-	-	-	-	-	-
7.	B-9	1981	-	0.10	-	-	-	-	-	-	-
8.	Rohini	1986	-	0.05	0.10	-	-	-	0.03	0.30	-
9.	PT-303	1987	-	0.05	0.20	-	-	-	-	0.25	0.05
10.	Pusa Bold	1985	-	1.00	-	0.05	0.02	-	0.40	0.75	0.30
11.	RH-30	1985		0.05	-	0.01	0.03	-	0.25	0.25	-
12.	RLM-1359	1988	-	0.05	-	-	-	0.10	-	-	-
13.	TL-15	1982	-	0.10	-	-	0.02	0.15	-	-	-
14.	Pusa Bahar	1991	-	0.05	-	-	-	-	-	-	-
15.	Vaibhav	1984	-	-	0.10	-	-	-	-	-	-
16.	Vardan	1985	-	-	-	-	-	-	-	0.20	0.15
17.	RH-8113	1987	-	-	-	-	0.02	-	-	-	-
18.	RH-781	1991	-	-	-	-	0.02	-	-	-	-
19.	RH-819	1991	-	-	-	-	0.02	-	-	-	-
20.	RLM-619	1985	-	-	-	-	-	0.10	-	-	-
21.	Sangam	1986	-	-	-	-	-	-	0.20	-	-
	TOTAL		1.30	3.97	1.41	0.06	0.17	0.35	1.58	3.25	0.93

BREEDER SEED INDENTS FOR RABI 1993-94 (Breeder seed to be produced during Rabi 1992-93) :

CROP: Rapeseed & Mustard

Sl. No.	Variety	Maharashtra	Assam	Bihar	Orissa	KRIBH CO.	Total
1.	T-9	-	-	-	-	-	1.39
2.	M_27	-	2.0	-	0.40	-	3.00
3.	Varuna(T-59)	0.10	-	0.10	-	0.06	5.56
4.	Bhavani	-	-	0.10	-	-	0.26
5.	Kranti	-	-	0.10	-	-	0.40
6.	NDR-8501	-	-	-	-	-	0.20
7.	B-9	-	-	-	-	-	0.10
8.	Rohini	-	-	-	-	-	0.48
9.	PT-303	-	-	-	-	-	0.55
10.	Pusa Bold	0.02	-	0.10	-	0.02	2.66
11.	RH-30	-	-	-	-	0.02	0.61
12.	RLM-1359	-	-	-	-	-	0.15
13.	TL-15	-	-	-	-	-	0.27
14.	Pusa Bahar	-	-	-	-	-	0.05
15.	Vaibhav	-	-	-	-	-	0.10
16.	Vardan	-	-	-	-	-	0.35
17.	RH-8113	-	-	-	-	-	0.02
18.	RH-781	-	-	-	-	-	0.02
19.	RH-819	-	-	-	-	-	0.02
20.	RLM-619	-	-	-	-	-	0.10
21.	Sangam	-	-	-	-	-	0.20
	TOTAL	0.12	2.00	0.40	0.40	0.10	16.49

BREEDER SEED INDENTS OF PRIVATE PARTIES FOR RABI 1993-94
(Seed to be produced during Rabi 1992-93)

OILSEED CROPS (Qty.in Qtls.)

Sl.No.	Crop/variety	Year of release	Maharashtra Hybrid Seed Co.	Mittal Seeds & Chemicals	Total
RAPESEED & MUSTARD					
1.	Varuna	1976	0.20	0.10	0.30
2.	Pusa Bold	1985	0.20	0.10	0.30
3.	RH-30	1985	-	0.05	0.05
	TOTAL		0.40	0.25	0.65