

**INDIAN COUNCIL OF AGRICULTURAL RESEARCH
ALL INDIA CO-ORDINATED WHEAT IMPROVEMENT PROJECT**

**REPORT OF THE
QUINQUENNIAL REVIEW TEAM
1983-87**



WHEAT PROJECT DIRECTORATE
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI-110012

1990

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1990



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RESI. 21

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Dr. Mahatim Singh
D. Sc. (Tokyo) Japan
Vice-Chancellor

No. VC/Camp 2/

Dated 12.7.90.

Dear Dr. Paroda,

Kindly refer to your letter No.F.5(2)/88-FC-II/I dated 6th January, 1989, regarding Quinquennial review of All India Coordinated Wheat Improvement Project 1983-1987. I am happy to submit the report of the QRT today. I am confident that it would be serving the purpose for which the team was constituted.

With kind regards,

Yours sincerely,

(Mahatim Singh)

Encl: as above.

Dr. R.S.Paroda,
DDG(CS), ICAR,
Krishi Bhavan,
New Delhi-110001.

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Constitution of the Team

The Indian Council of Agricultural Research vide their office order F.No.5(2)/88-FC-I/I dated 6th January, 1989 constituted the Quinquennial Review Team with the following members to review the work done by the All India Coordinated Research Project for improvement of wheat for the period 1982 to 1987.

- | | | |
|----|--|---|
| 1. | Dr. Mahatim Singh, Vice-Chancellor
G.B. Pant University of Agriculture &
Technology, Pantnagar | Chairman |
| 2. | Dr. L.M. Joshi, Retired Head, Mycology
& Plant Pathology, IARI, New Delhi | Member |
| 3. | Dr. Mahendra Singh, Director Research
(presently Professor Soil Science)
Haryana Agricultural University, Hisar | Member |
| 4. | Dr. S.P. Singh, Retd. Dean Agriculture,
JNKVV, Jabalpur | Member |
| 5. | Dr. S.M. Gandhi, Ex-senior Wheat Breeder
Rajasthan Agricultural University,
Durgapura, Jaipur (Rajasthan) | Member Secretary
(Resigned later) |
| 6. | Dr. A.K. Gupta, Prof. & Head, Genetics,
Punjab Agri. University, Ludhiana
(after discontinuation of Dr.S.M.Gandhi) | Member
(Added later) |
| 7. | Dr. Amar Singh, A.D.G. (FC-I), ICAR | Member Secretary,
(Added later in
place of Dr.S.M.
Gandhi) |

Terms of reference and operation of the team

To reievew the work done by the All India Coordinated Research Project for improvement of wheat for the period 1982 to 1987.

The team held a series of meetings at Delhi and Pantnagar and followed the following schedule of visit to various Wheat Research Centres:-

<u>Sl.No.</u>	<u>Name of place</u>	<u>Dates of visit</u>	<u>Names of visiting members</u>
1.	Delhi	8.6.89, 7.12.89, 23.1.90 and 20.2.90	All members
2.	Shimla	4-5.7.1989	Dr.L.M.Joshi
3.	Wellington	23-25.9.1989	Dr.Mahendra Singh Dr. L.M. Joshi Dr. S.P.Singh Dr.S.M.Gandhi
4.	Pantnagar	16.11.1989 25-26.6.1990	Dr.Mahatim Singh Dr.L.M.Joshi Dr.A.K. Gupta, Dr.S.M.Gandhi Dr.S.P.Singh, Dr.Mahendra Singh
5.	Hisar	8.12.1989	Dr.Mahatim Singh Dr.Mahendra Singh Dr.S.P.Singh Dr.L.M. Joshi
6.	Dharwar	18.12.1989	Dr.Mahatim Singh Dr. L.M. Joshi Dr. S.P. Singh
7.	Niphad	22.12.1989	Dr.Mahatim Singh Dr.L.M. Joshi Dr.S.P.Singh
8.	Powerkheda	31.12.1989 & 1.1.1990	Dr. S.P. Singh
9.	Kanpur	7.1.1990	Dr.Mahatim Singh Dr. S.P. Singh
10.	Faizabad	8.1.1990 28.2.90, 1.3.90	Dr.Mahatim Singh Dr. S.P.Singh Dr.L.M. Joshi
11.	Varanasi	9.1.1990	Dr.Mahatim Singh Dr. S.P. Singh
12.	Ludhiana	17-18.1.1990	Dr.L.M.Joshi Dr.S.P.Singh Dr. A.K.Gupta
13.	Meerut	24.1.1990	Dr.Mahatim Singh Dr.L.M.Joshi Dr.Mahendra Singh Dr.S.P. Singh Dr.A.K. Gupta

14.	Vijapur	6.2.1990	Dr.Mahatim Singh Dr. S.P. Singh
15.	Junagarh	8.2.1990	Dr.Mahatim Singh Dr.S.P.Singh
16.	Mahabaleshwar	7.2.1990	Dr.L.M.Joshi
17.	Pune	8.2.1990	Dr.L.M.Joshi
18.	Kalyani	21.2.1990	Dr.Mahatim Singh Dr.A.K.Gupta
19.	Ranchi	22.2.1990	Dr.A.K.Gupta
20.	Bombay	19.3.1990	Dr.A.K.Gupta
21.	Palampur	12-15.2.1990	Dr.Mahendra Singh
22.	Durgapura	10-13.1.1990	Dr.Mahendra Singh
23.	Bajaura	19-20.6.1990	Dr.A.K.Gupta

1. Historical Background:

Wheat research in the country was started in 1905 with the establishment of Indian Agricultural Research Institute-IARI (previously known as Imperial Agricultural Research Institute) at Pusa (Bihar) and Agricultural College at Kanpur and Layallpur (now in Pakistan). Similarly wheat research was started very early at Powerkheda in Mahya Pradesh and Niphad in Maharashtra.

A cooperative, multi-disciplinary research programme on wheat improvement on national basis, was initiated in 1961 by the Indian Council of Agricultural Research (ICAR). The Head, Division of Genetics, I.A.R.I., New Delhi acted as the Coordinator. Several wheat research centres, located in various parts of the country, cooperated in this programme on voluntary basis. Keeping in view the importance of cooperative research programme, this arrangement was formalised as the All India Coordinated Wheat Improvement Project (AICWIP) in 1965. Central financial

support to strengthen wheat research activities, was provided to several co-operating centres. A full time coordinator with headquarters at IARI, New Delhi was appointed in 1967. This project was further strengthened and its status was raised to the Wheat Project Directorate (WPD) in 1978.

2. Objectives:

The Project adopts a multidisciplinary research approach involving the fields of plant breeding and genetics, pathology, agronomy, physiology, entomology, nematology and grain quality. Its activities cover bread wheat (Triticum aestivum), macaroni wheat (T. durum) and limited work on T. dicoccum and triticales. The main objectives of the Wheat Project Directorate are:-

- To evolve and coordinate a multidisciplinary multi-locational research and testing programme for wheat improvement.
- To identify improved wheat varieties combining high yield with superior grain quality, resistance to diseases and insect pests and adaptability over a wide range of cultural practices.
- Development of wheat production and protection technologies.
- To undertake and encourage mission-oriented basic investigations.
- Enrichment of genetic variability in breeding programmes.
- To monitor the progress of all cooperating centres and integrate their activities.

- To develop collaborative research programmes with national and international agencies.
- To organise scientific training programmes.
- To assist in organisation of breeders-seed production programmes and monitor seed quality.
- To help in proper transfer of improved technologies.

3. Organisational Set-up:

The All India Coordinated Wheat Improvement Project (AICWIP) is headed by the Project Director who is assisted by senior scientists (designated as Principal Investigators) specialised in the disciplines of breeding, agronomy, pathology, entomology, nematology, physiology and grain quality. A senior statistician helps in the appropriate designing of field experiments and statistical processing of the data. In addition, there are scientists and technicians of various categories to help the Principal Investigators of each discipline.

All the staff located at the Headquarters is under the administrative control of the Director, IARI while the technical programmes are under the direct control of Indian Council of Agricultural Research.

4. Collaborating Centres:

Nearly 460 scientists participate (fully or partly) in different disciplines. This includes 200 breeders and geneticists, 78 agronomists, 71 pathologists and the rest in the disciplines of physiology (19), entomology (20), nematology (14), quality (24),

meteorology, soil physics, economics, extension etc.

Wheat research activities of about 57 centres located in different wheat growing regions of the country are coordinated through this project. Out of these only 30 centres receive financial support through the Project and others are supported by State Agri. Universities and Departments. List of important centres is given in Appendix-I.

5. International Collaboration:

The Project has established close collaboration with a number of international research organisations working on wheat improvement, such as CIMMYT (Mexico), ICARDA (Syria), PBI, Cambridge (UK) and PBI, Sydney (Australia).

6. Agro-climatic Zoning of Wheat Growing Regions:

Considering the diverse agro-climatic conditions, cultural environments, disease spectrum and soil types in various wheat growing regions of India, the country was divided during the period of review into nine wheat zones, to facilitate the organisation of wheat research programmes relevant to specific environments. However, these have now been reorganised into 6 zones in 1988-89 which are listed below:-

1. Northern Hills Zone (NHZ)
2. North-Western Plains Zone (NWPZ)
3. North-Eastern Plains Zone (NEPZ)
4. Central Zone (CZ)
5. Peninsular Zone (PZ)
6. Southern Hills Zone (SHZ).

7. Progress of Work:

Details of various kind of trials organised in different research disciplines and the extent of cooperation received from different centres are given in Appendices: IIa, IIb, IIIa, IIIb, IVa & IVb.

8. Achievements:

The achievements of the project for the period 1983-87 are reviewed below:

Wheat production during the review period increased from 37.4 million tonnes in 1982 to the highest, 47 million tonnes in 1986. Productivity per unit also increased from 1691 kg/ha to 2046 kg/ha while area increased from 22.1 million hectares to 23.0 million hectares in 1985-86. (table-1). The major factors which contributed to the increased production and enhanced productivity are increase in proportion of area under high yielding varieties which went up from 75.6 per cent to 83.9 per cent (table-2); the consumption of fertilizers which increased from 34.3 kg/ha to 49.7 kg/ha; increased use of agro-chemicals particularly weedicides and increase in irrigation.

The area, production, yield and input in important wheat growing states is summarised in table-3. The highest productivity of 3496 kg/ha has been recorded in Punjab, followed by 2834 kg/ha in Haryana. In both these states almost all the area is under HYV and nearly 95% of the wheat is irrigated (see table-4). Consumption of fertilizers is as high as 158.3 kg/ha in Punjab. The trends in annual

Table 1: Productivity of wheat and the related input factors during the past decade in India

Year	Area under wheat (mil. Ha)	Production of wheat (Mil.Ton.)	Yield rate of wheat (Kg/ha)	% area of wheat under Hyv	Consumption of N+P+K Per gross cropped area (kg)
1	2	3	4	5	6
1982-83	23.2	42.5	1836	77.0	36.8
1983-84	24.4	45.1	1851	79.5	42.6
1984-85	23.6	44.2	1872	82.9	46.7
1985-86	23.0	47.0	2046	83.9	48.7
1986-87	22.8	45.6	1998	83.9	49.7

Source: 1,2: Agricultural situation in India
 3 : Calculated from area and production figures
 4,6: Calculated from data presented in Fertilizer statistic 1988
 5 : Reproduced from Fertilizer statistics 1988.

Table 2: Percentage area under H.Y.V. of wheat
in different states

(1981-82 & 1986-87)

State	% area under H.Y.V. of wheat	
	1981-82	1986-87
Bihar	100.0	100.0
Gujarat	66.5	80.0
Haryana	92.0	96.0
Himachal Pradesh	79.1	85.0
Jammu & Kashmir	95.0	88.0
Madhya Pradesh	28.6	55.0
Maharashtra	77.8	100.0
Punjab	98.8	100.0
Rajasthan	51.8	74.0
Uttar Pradesh	78.9	89.0
West Bengal	100.0	99.0
All India	75.6	84.0

Table 3: Area, production and productivity of wheat in important wheat growing states.

State	Area under wheat (000 'ha) (1986-87)	Production of wheat (000 'Tons) (1986-87)	Yield rate (kg/ha) (1986-87)
Bihar	1840	2863	1556
Gujarat	315	662	2100
Haryana	1782	5055	2837
Himachal Pradesh	377	492	1305
Jammu & Kashmir	244	272	1215
Madhya Pradesh	3251	3865	1189
Maharashtra	734	536	729
Punjab	3189	11150	3496
Rajasthan	1843	3402	1845
Uttar Pradesh	8312	16078	1934
West Bengal	398	683	1716
All India	22811	45576	1998

Source: 1,2,3 : Agricultural situation in India
4,6 : Fertilizer statistics 1988
5,7 : Calculated from data reproduced from Fertilizer statistics 1988.

Table 4: Input status in important wheat growing states.

State	% area under wheat irrigations (1984-85)	% area under H.Y.V. (1986-87)	Consumption of N+P+K per Gross cropped area (1986-87)
Bihar	78.6	100	51.2
Gujarat	78.5	80	39.2
Haryana	95.6	96	75.3
Himachal Pradesh	16.8	85	26.3
Jammu & Kashmir	25.3	88	29.5
Madhya Pradesh	36.0	55	22.1
Maharashtra	49.4	100	32.1
Punjab	94.4	100	158.5
Rajasthan	85.9	74	14.3
Uttar Pradesh	85.0	89	70.5
West Bengal	66.4	99	65.8
All India	74.0	84	49.7

Table 5: Annual growth rate of productivity of wheat
in important wheat growing states during the
two preceding quinquenniums

...

State	% annual growth rate of productivity of wheat for the period	
	1977-78 to 1981-82	1982-83 to 1986-87
Bihar	1.04	2.57
Gujarat	2.73	-1.73
Haryana	2.84	4.55
Himachal Pradesh	-8.65	6.25
Madhya Pradesh	2.02	1.72
Punjab	6.23	5.00
Rajasthan	3.44	3.58
Uttar Pradesh	3.06	1.39
West Bengal	-4.14	-5.67
All India	3.27	2.83

growth rate for each of the states are given in table-5.

Significant achievements:

8.1. Breeding:

Forty six wheat varieties including 2 durum wheat varieties were identified/released, (Table-6).

In addition to the development of improved varieties a number of stocks for use as sources of resistance were identified for all the three rusts, Karnal bunt and other diseases. Specific varieties adopted to intensive cropping sequences were also developed. Special attempts were made to identify varieties tolerant to salt affected soils. A number of varieties developed by the Indian programme are reported to have been released in Nepal, Afganistan, Bangla Desh, Thailand, Syria and Oman.

Other efforts included enrichment of genetic variability and identification of stocks with specific characters such as individual yield components, drought and heat tolerance. Breeders seed production programmes were organised as per demand of the seed production agencies.

8.2. Agronomy:

In addition to the experiments on evaluation of adaptability of materials in final stages of testing in the yield evaluation trials over a wide range of cultural variables, investigations were also carried out for the development of specific technologies for rice-wheat systems, seeding methods, methods of fertilizer application, weed control and inter-cropping systems.

Table-6

Wheat varieties released/identified during 1982-87

Zone	Irrigated timely sown	Irrigated late sown	Rainfed timely sown	Special situations
NPZ	CPAN 1676, HD 2281, HD2278, HD 2329, HD 2428, PBW 154, PBW 34(d)	HD 2285 HD 2270	WL 2265 Kundan, PBW 65, PBW 175	-
NWPZ	WH 283, Raj 1972, Raj 2575, Raj 3077	WH 91, Raj 2184, Raj 3077	WH 331	-
NPZ	HUW 55, HUW 206, HUW 234, BW 11*, HD 2402*	HD 2307, HUW 213, K 8020	K 8027, HD 2385	-
CZ	HI 1077	HD 2327, J 405, VW 120	Sujata	-
PZ	DWR 39, HD 2380	HI 977	MACS 1967(d)	-
NHZ	CPAN 1796, CPAN 1922, UP 1109, HD 2380	-	Same as for ITS	VL 616, Rainfed, early sown, HS 207, rainfed late sown
SHZ	NW 741 HW 971	-	-	-

* for Far Eastern Zone

d- indicates durum.

Significant findings include recommendations regarding seed rate and method of sowing in paddy fields in the Far Eastern Region, reduced row spacing and criss-cross sowing to partly counteract the damage caused by weeds, top dressing of phosphate fertilisers (super phosphate) under conditions of nonavailability at sowing and use of stomp at the rate of 1 kg/ per hectare as pre-emergence weedicide to control all types of weeds and a reduced dose of Isoproturon (0.5 kg/a.i. as against 0.75 kg a.i.). Another recommendation was made on intercropping of mustard in wheat in the ratio of 1:8 rows under medium to high fertility levels.

8.3. Plant Pathology:

Under the wheat pathology programme a large number of strains are being systematically screened and every year about 2,000 entries included in P.P.S.N. are grown in hot spots. Promising stocks for resistance to rusts, Karnal bunt, leaf blight, powdery mildew, loose smut, hill bunt, foot rot and scab have been identified. Apart from this, experiment on use of chemicals for the control of major diseases (loose smut, Karnal bunt, foliar blights) were conducted.

Studies on rusts and genetic basis of resistance have been done on selected varieties and breeding materials which revealed that in view of the already known Sr, Lr and Yr genes the released Indian wheat varieties have a

narrow genetic base. Only a few resistance genes viz. Lr 1, Lr 3, Lr 10, Lr 14 a, Lr 15 and Lr 26 with Lr 10 and some additional factors are present in majority of cases for leaf rust. Presence of Sr 5, Sr 8, Sr 9b, Sr 11, and Sr 12 in case of stem rust and Yr 2, Yr 5, Yr 7, Yr 8 and Yr 9 in case of stripe rust has been detected. However, collaborative research carried out under the ICAR-ACIAR project at Castle Hill Sydney has shown that there are gaps in gene identification work and several unknown genes, particularly adult plant resistant genes for leaf rust, are operative in Indian materials.

Research on Karnal bunt is being carried out (IARI) at Ludhiana, Patnangar, and Dhaulakuan. At Ludhiana the techniques for artificial screening against Karnal bunt have been well standardized, and resistant genetic stocks for use in breeding programme against Karnal bunt have been identified. Basic studies on the biology and epidemiological aspects of the Karnal bunt fungus are also undertaken.

The incidence of wheat disease like rusts and Karnal bunt, in general, had remained very low and these did not have any adverse effect on wheat production in the country. There was no appreciable change in the incidence of loose smut which continued to be 2-3 per cent in the main wheat belt of the country. Diseases like leaf blight, powdery mildew and flag smut are becoming more important. During kharif 1984 head blight/scab of wheat caused by Fusarium gramineum posed a problem

in the Nilgiri hills.

The most predominant virulences of stem rust in the Indo-gangatic plains and Nilgiri hills were 21A1, 21A2, 40A and 117 while pathotypes 77, 77A, 77A-1, 104B and 12B of leaf rust were prevalent in the main wheat growing areas as well as in Nilgiri Hills.

8.4. Entomology:

Insects have posed very little problems in wheat, except termites, shoot fly, aphids and brown wheat mite. For termites, aldrin seed treatment @ 1.25 kg a.i./ quintal seed was most effective. Aldrin seed treatment was compatible with fungicidal seed dressing as well as nematicidal soil application. Significant reduction in termite damage could be achieved with several insecticides, but aldrin @ 0.38 kg a.i./ha was most effective.

Shoot fly (Atherigona nagvii S.) is emerging as a pest of wheat. Carbofuran granules applied in seed furrows and cypermithrin sprays during seedling stage were found effective in controlling this pest. Stocks showing some tolerance to this insect have been identified.

Brown wheat mite (Petrobia latens Mull) also emerged as a pest in recent years, particularly in un-irrigated wheat.

Screening germplasm for resistance to storage pests, Sitophilus oryzae and Rhyzopertha dominica revealed

moderate resistance to S. oryzae in Raj 911, Kalyansona, A-9-30-1, PV 18, HUW 262, HUW 271, PBW 175, CPAN 1992, K 68, K 8121, WL 4939 and DL 214-3.

8.5. Nematology:

Main problems are the Molya and ear cockle (tundu). In case of Molya disease only two biotypes have been encountered. Biotype-I comprises of populations present in Haryana, Rajasthan, Delhi and U.P. While biotype-II is confined to Punjab and Himachal Pradesh. Screening of new experimental chemicals showed that diazinon and selenfos are effective and are comparable to carbofuron and aldicarb. Summer ploughing has been found effective in improvement in wheat yields. A minimum of two summer ploughings, at an interval of 15 days during May-June resulted in yield increases.

8.6. Quality:

Wheat strains in various stages of coordinated trials are analysed for quality characteristics. Advance test samples (URT) are analysed for Protein content, Pelshenke value and hectolitre weight, physical grain appearance and 1000 grain weight. At the initial evaluation stage entries are analysed for protein content and chapati making qualities. Varieties having good bread and Chapati making properties have been identified.

Investigations show that protein content varied from 9 to 16% and is affected by agro-climatic conditions

in addition to varietal make up. Peninsular and Central zones normally tend to have higher protein content (15.5 to 16%) while lower values are obtained in Northern Hill Zone (9-12%).

8.7. Physiology:

The efforts were made to identify characteristics responsible for adaptation in rainfed situations and also for late sown conditions. Attempts were made to standardize rapid screening techniques for physiological characteristics. Work on drought resistance in wheat has indicated large difference in germinating ability of different cultivars which was affected by soil moisture and ambient temperatures. Work on irrigated late sown wheat has shown that it is not necessary to have short duration varieties for this purpose as medium and long duration varieties can also produce superior yields provided they have adequate heat tolerance. It was found important to identify wheat genotypes capable of giving good initial stand and vegetative growth during the early hot period (October).

9. Observations of team Members on various Centres visited:-

9.1 Dharwar: It is one of the best centres for wheat research in Peninsular zone. This centre has released two bread wheat varieties namely DWR 39 (Pragati) and DWR 16 (Keerti). The centre has also developed high yielding rust resistant durum wheats which are being put in multilocation trials.

Satisfactory work on wheat pathology is being carried out at this centre. Major diseases of wheat in this region are black and brown rust, foliar blight and foot rot (Sclerotium rolfsii). The centre is conducting a number of coordinated trials also. This station has also generated data on the effect of high temperature on the yield potential of Khapli wheat. In sizeable acreage the yield of Khapli wheat under 100 days duration was 2.5-3.5 tonnes/hectare.

9.2. Junagarh: Wheat experiments were timely and properly sown. This station also needs small plot and single plant threshers. This station has developed a couple of durum genotypes which are under test.

9.3. Niphad: This centre had sown all the trials meant for the station. But conducting irrigated trials was meaningless as there was no water for irrigation. The Department of Agriculture and the University concerned have to make an effort to bring irrigation water to this centre. Otherwise Niphad can be a good station for conducting research on rainfed wheat.

9.4. Varanasi: This centre has done commendable work with regard to wheat improvement by evolving half a dozen high yielding wheat varieties and contributed a good number of entries in the coordinated varietal trials. The status of trials conducted at the centre was very good. There is only one scientist borne on the staff with ICAR support. The centre needs to be strengthened in this respect.

9.5. Ludhiana: This centre has a very large research programme as seen from the list of trials sown at the station. The work on Karnal bunt, wheat quality, durum wheat breeding and genetic analysis of virulence of rust races is commendable. The status of trials conducted was very good.

Five varieties developed by the centre were centrally released during the period under review. These are: WL 2265, PBW 65, PBW 154, PBW 175 and PBW 34, a durum variety.

9.6. Kanpur: All the experiments meant for the centre were sown. The quantum of work was good. But there were certain lapses in conducting the rainfed trials. The centre has submitted a list of equipment needed. Two varieties (K 8020 and K 8027) were released during the period of review.

9.7. Powarkheda: The experiment meant for the station were sown properly. There seems to be many administrative problem with regard to priority of work, funds and field

operations. The centre requested for reinstating the staff withdrawn from the centre. They should work more on rainfed wheat which is so important in the region.

9.8. Hisar: The experimental work was upto the mark. The centre had taken all the experiments meant for the station. Wheat work is being carried out at Kaul, Karnal, Ambala and Bawal and during the period three varieties (WH 331, WH 291, WH 283) were released. Attempts are being made to incorporate specific genes for resistance to rust in some of the improved varieties. Brown and yellow rust are the major problems of the region. Apart from rust, varieties are being screened for loose smut, Karnal bunt and flag smut. In certain fields molya disease of wheat and ear cockle have appeared in serious form.

Field equipment and machines provided long back are out of order and some of the machines have outlived their utility.

9.9. I.A.R.I.: This has the biggest wheat improvement programme in the country and controls several of the wheat research service centres for use by all the wheat scientists. It has nine research projects (4 applied and 5 for basic research) employing 23 scientists. The committee feels that there should be a better coordination in the working of the wheat scientists who are presently working under different divisions without much liason

amongst each other. This institute has developed and released 15 wheat varieties during the period under review. Presently major area under high yielding varieties is covered by IARI wheats. The most outstanding among these can be named as HD 2329, which covers 75% of Punjab, HD 2285 which accounts for the largest quantities of breeder seed demanded in the country and HD 2189 which ^{is} the main variety of the Peninsular Zone.

9.10. Pune: The field experimental area of Pune centre is located at Hol where all coordinated project work is being done. Quality of experimentation is of high order. Some work has been initiated on dicoccum sp. The centre is especially meant for work on durum wheats. Efforts are being made to transfer Sr and Lr genes combination in NI 5439 & Kalyansona. This centre has released one durum wheat variety (MACS1967) for rainfed areas.

9.11. Pantnagar: This is one of the important wheat research centres in Uttar Pradesh catering to the needs of western and hilly parts of the state. One variety (UP 1109) was released during the period under review. It has one of the best breeders seed production programmes in the country. Special research programme on Karnal bunt is also operating at this station. It has carried out some fundamental and basic research investigations under this project but there is need to improve the

applied aspect of work in this disease. The centre lacks experimental plot machinery. This may be provided in future.

9.12. Meerut: The team visited the Western Campus of G.B. Pant University and Directorate of Cropping System Research of ICAR. The University campus is providing good cooperation in conduct of coordinated trials. Discussions were held with the Project Director of Cropping System programme and areas of closer collaboration were identified. These included research on wheat based cropping system and cooperation in conduct of varieties ~~x~~ cultural variables trials.

9.13. Ranchi: This centre is essentially for selecting wheat varieties under rainfed conditions and for early maturing and heat tolerant types. The conduct of trial at this centre was excellent.

This is an important research centre catering to the need of non-conventional wheat areas of Far East. This centre is carrying out good agronomic research work. By adopting no tillage in rice field and sowing wheat therein, we can obtain good results.

Strengthening of the station by way of providing equipment for field and laboratory operations is required.

9.14. Kalyani: This centre represents important non-traditional wheat growing region in the East and the wheat crop is grown under boron deficiency with tolerance to heat due to short rains in season. From

the trials conducted a line BW 182 has shown tolerance to boron deficiency which should be tested in the relevant co-ordinated nursery for verification. C 306 has shown best heat tolerance.

The conduct of trials at this centre, was, however, poor. The centre has been unable to utilize the budget since 1980.

9.15. Bajaura (HPKVV): This centre has been conducting trials for timely sown, late sown and early sown conditions to identify wheat genotypes for hilly conditions. VL 616 has been doing well and recently HS 240 has shown good performance. Screening for yellow rust is effectively done, since excellent conditions prevail for rust development. Recent efforts to screen germplasm and prepare a catalogue of resistant gene sources for yellow rust and leaf rust, need to be streamlined by providing polythene house/glass houses at this centre.

9.16. BARC Bombay: The wheat research group at BARC is engaged in basic genetic research on inter-specific gene transfer, identifying isozyme numbers and developing high gluten stocks of wheat. Rust resistance genes Sr 26 and Sr 27 have been transferred to Kalyansona and early maturing C 306 have been selected. Variation in high molecular weight glutenin sub units in some Indian wheats has been estimated with a view to develop quality by analysing half kernels of wheat seeds.

This group represents one example where the coordinated programme could derive benefit through developing close linkages.

9.17. Faizabad: The pathological laboratory at Faizabad station is poorly equipped. Even basic equipment for fungal culturing are not available. The station needs some good autoclaves, balances, incubator, hot air oven, humidifier for the glass house, transfer chamber and research microscope, etc. for laboratories. This station has been identified specifically for work on foliar disease of wheat and to clear out the doubts about the identify of foliar pathogens.

Wheat experiments were in good condition. All the experimental material was sown properly in desired layout.

9.18. Vijapur: The wheat trials were in good condition. The wheat rust inoculation work in breeding material was very effective. The committee was able to see lot of breeding material being generated. This station needs strengthening by way of provision for equipment needed by the centre as per their request submitted separately to the Project Director.

9.19. Shimla: Good facilities, particularly temperature controlled glass house have been developed at Flowerdale. The second phase of the extension of the glass house

should be taken up in the immediate future.

The team appreciated certain other facilities such as ultra deep freeze for maintenance of cultures of host and parasite ^{which} have been developed in Flowerdale station during the last few years.

At present 14 pathotypes of yellow rust, 23 black rust, 27 of brown rust are being maintained in pure and viable conditions at Flowerdale. However, the SS culture room needs much greater care to avoid contamination.

The complexity of new nomenclature of rust races adopted since 198 , has created difficulties in interpreting and understanding rust reactions reported from different centres and laboratories. The committee suggested that to resolve this, active workers engaged in this work should meet and propose a common system of naming the races which is simple and at the same time conveys proper information on virulence genes in different races and biotypes.

At Tutikandi identification of genes using matching techniques is being attempted. However, such a work needs temperature controlled glass house facilities. The results obtained at Flowerdale and at Tutikandi show significant differences. The committee felt that these type of studies should be conducted where facilities and expertise are readily available.

9.20. Wellington: It is catering to the demands of all the wheat stations of the country. The committee felt that certain fields in the research station have very low fertility level due to inadequacy of FYM.

The committee felt that Wellington station needs more financial grants for efficient functioning and farm management. Additional grants are further needed for repair, replacement and purchase of equipment such as irrigation pumps, vehicles, fencing, tractor etc. Due to this being a Service Centre large number of scientists visit this station and there is no accommodation available. Rest house facilities are essential for such a station.

9.21. Mahabaleshwar: The committee members felt that there is a great need for improving the maintenance of glass house as also growing of test material. The temperature of glass houses was very high and not congenial for proper disease expression. With little care the situation can be improved significantly. For race analysis old set of differential is being used with the result that data of Mahabaleshwar Centre and Shimla cannot be compared. Many suggestions were given to the Incharge for the improvement of the station. It was also decided that the seed of differential utilised at Flowerdale will be supplied to Mahabaleshwar station regularly.

One of the redeeming feature of this station is that the material received from the breeders of the Peninsular Zone is being screened against mixture of rust races.

9.22. Durgapura: All the trials were conducted satisfactorily and good research programme is in progress. Due to early warming up of the season in Kota **region** heat tolerance during maturity stages is very important. There is a need to strengthen work on physiology and nematodes. Keeping in view large areas of salt affected soils in the state more work needs to be done. The centre has released 4 varieties namely: Raj 1555(d), Raj 2184, Raj 2535 and Raj 3077 during the period under report.

9.23. Palampur: There are good possibilities of developing this centre into an important research place for the hills. Work on breeding ^{for} disease resistance and agronomy should be strengthened. There is immediate need to provide small plot machinery for the Centre.

10. RECOMMENDATIONS

The team after having reviewed the organisational set-up of the project and its related administrative and financial provisions and also the recommendations of the previous team for the years 1977-82, makes the following recommendations:-

10.1. ORGANISATIONAL AND ADMINISTRATIVE:

10.1.1. It was observed that the QRT for the period 1977-82 made many constructive and need based recommendations. Unfortunately, several of these recommendations specially concerning administrative matters, were not implemented. Present team strongly feels that these recommendations and those being made now should receive full attention and implementation.

10.1.2. It is recommended that the budget of WPD which is presently merged with the budget of the Institute (IARI) should be distinctly demarcated by the ICAR to enable proper functioning.

10.1.3. It is also felt that the Project Director of this project should have sufficient autonomy and powers to deal with the problems being faced in the implementation of the project proposals. As long as the Wheat Project Director stays within the allocated budget he should be free to incur expenditure, perform visits and travels, operate and maintain transport vehicles and obtain supplies and material for his work. Therefore, it is strongly recommended that an independent Institute on Wheat Research be established with full infrastructural facilities.

10.1.4. The team also recommends that service stations like Wellington be directly under Project Directorate.

10.1.5. The wheat improvement project is headed by the Project Director and assisted by a number of Principal Investigators. This team strongly feels that the Principal Investigators should be redesignated as Associate Project Directors in the respective discipline.

10.1.6. This team is in full agreement with the previous team's recommendation that the vacancies of P.I./Associate Project Director should be selected through advertisement.

10.1.7. The funds made available to the participating centres on contingency as well as on T.A. be suitably modified to the tune of Rs.25,000/- in the contingency per scientist with a provision of 10% increase every year and travelling grants to the tune of Rs.10,000/- with a provision of 10% increase every year.

10.1.8. The Zonal Coordinator should be provided with special assistance in the form of one technical assistant, one stenographer and additional T.A. and contingency grants to enable them to perform their functions properly.

10.1.9. After reviewing the equipment available in different centres the team unanimously agrees for providing adequate funds for the replacement of the equipment, preferably small field plot machinery and laboratory equipment.

10.1.10. Several centres do not have senior scientists in the programme. At least one post of Senior Scientist should be provided at all the important centres.

10.1.11. The team was extremely disappointed after visiting certain centres where some of the vacancies of the Scientists have not been filled up. The committee strongly feel concerned on this account and recommends that immediate efforts should be made to fill all the positions of scientists as well as supporting staff in the early stage of next Five Year Plan.

10.1.12. At some of the centres it has been found that scientists under the project are frequently transferred which hampers the smooth functioning of the project work. Since provision has already been made in many universities participating in this programme that the persons working in the project should get promotion on the same position and efforts should be made to upgrade the position of the scientist through the scheme of personal promotion.

10.1.13. In view of the poor performance and conduct of trials at Kalyani, Cooch Behar, Imphal and Chiplima the team recommends that the status of these centres should be reduced to the testing centres. In order to strengthen research on wheat for non-traditional areas additional facilities be provided at Ranchi and Shillongoni.

10.1.14. The possibility of an independent Varietal Evaluation Committee be explored. This committee should have agronomist as its leader and plant pathologist and nematologist as members.

10.2. TECHNICAL:

The team appreciates excellent results achieved by the Wheat Project and the gains accrued to the nation through increased wheat production. Presently almost all the area under HYV programme is under cultivars evolved under the banner of this project. Due to varietal diversification and introduction of resistant varieties, no major rust epidemic has appeared for more than a decade. Karnal bunt which appeared in epidemic form in the seventies, has been contained in recent years through better management and replacement of varieties.

Following recommendations are made to further enhance the efficiency of research in different disciplines:

10.2.1 Breeding:

(i) Continuous intensified research on identification of rust resistance genes is needed, particularly for the adult plant resistance genes detected in recent years. Genetic enhancement of resistance to rust through gene combinations is now achievable and should be fully exploited. This work being done at Ludhiana, Shimla and Delhi be strengthened by providing additional facilities and research grants.

(ii) Maintenance, collection, characterisation and catclouging of wheat germplasm has been assigned to wheat project. This should be properly supported in terms of physical facilities and man-power.

- (iii) Since land races of wheat possess many useful genes particularly for tolerance to stress environments and adaptability, these should be used more frequently in breeding work.
- (iv) With intensification of cropping patterns, time for wheat cultivation, has been reduced. This requires varieties with more efficient biomass production and improved partitioning for grain production to maintain high production levels. Breeding efforts should be directed towards this goal.
- v) Although loose smut resistance is controlled by one/two major genes, very little effort has been made to incorporate this resistance in the newly developed wheat varieties. This should receive adequate attention of breeders, particularly when gene sources have been identified and are available.
- vi) Durum have shown relatively high level of resistance to leaf rust to races like 77 and its biotypes. This resistance should be characterised and catalogued for use in breeding programmes.
- vii) Improvement of rainfed wheat has lagged behind and some specialised centres for this work should be developed in Central and Peninsular India. These programmes should have physiologists and adequate laboratory facilities for this work.

viii) Greater attention needs to be paid towards breeding varieties with superior chapati and bread making qualities in aestivum and macaroni in durums. Nutritional quality analysis in aestivum and durums should be under-taken.

ix) Wheat Project should make efforts in utilising latest findings in bio-technology, particularly for gene transfer from wild species. Suitable facilities for this should be developed.

x) Some genetic stocks of wheat are being developed by scientists including those outside AICWIP. These can be used for transfer of specific genes to cultivated varieties or for gene location and identification work. There should be a provision to release such wheat genetic stocks, with usual proprietary rights as done for new varieties.

xi) In order to develop stronger science-based programmes of wheat improvement, WPD should have closer linkages with groups of scientists engaged in specialised basic research. Certain basic queries for developing efficient techniques and methodologies should be addressed to these groups and specific time bound research grants be provided to them, if necessary.

10.2.2 Pathology:

(i) Foliar blights of wheat are considered as major disease in eastern and coastal regions of the country where high humidity and relatively higher temperature prevail during the crop season. The chief pathogens identified are species of Helminthosporium and Alternaria but the symptomology is rather confusing. It is therefore essential to first identify the pathogens causing these blights and then proceed with the identification of strains in the country. Keeping these points in view a National Centre on foliar diseases has been established at Faizabad. However, the progress of the station is not quite satisfactory and the station must be provided with basic facilities. This centre will also have the responsibility of screening the germplasm in the country against foliar pathogens so that the knowledge can be utilized for evolving varieties resistant or tolerant to these diseases.

(ii) Of late, powdery mildew has been reported in certain Tarai region and the pathologists located in this area like Pantnagar and Dhaulakuan should keep watch on the spread of this disease.

(iii) Flag smut of wheat though recorded as a minor disease in the past has shown gradual increase in its spread. It is now reported from many parts of Rajasthan,

Haryana and Madhya Pradesh. For screening the germplasm against this disease it is essential to develop sick plots at few locations and this work need strengthening. Germplasm should be critically screened for identification of suitable resistant types.

iv) Loose smut of wheat has always been an important disease in wheat and it is estimated that normally it causes 3-5% loss in northern wheat belt but in isolated fields and in regions where seed is not frequently replaced, the loss can be anything upto 50-60%. A number of research stations in our country are screening the varieties with local samples. Some basic information on diseases spread is available in the country. However, of late, there is a gradual increase in the instance of the disease in the main wheat area. Keeping this in mind, the committee feels that certain research centres should be identified for work on loose smut of wheat. These centres will have the responsibility of conducting basic research for identifying pathotypes in the fungus; identifying sources of resistance and evolve resistant varieties.

v) Loose smut of wheat can be easily controlled by proper farm management such as frequent replacement of the seed material, obtaining the seed from healthy sources and use of proper fungicides. A large number of systemic fungicides are available in the country and

all the seed agencies must sell only properly treated seed material.

vi) Wheat diseases survey and surveillance programme has provided excellent results in the last two decades. It has thrown new light on the directional movement of rust spores and also the relative importance of wheat pathogens in different regions of the country. Diseases survey has also given an idea about the losses caused by the different diseases from time to time. It also helped in developing a disease forecasting system for the inoculum originating from Nilgiri and Palni hills. The wheat disease survey provided the rust infected samples collected from farmers fields for race analysis which is an important duty of Shimla station.

The committee records with deep regret that the wheat disease survey is not receiving adequate support from IARI to continue its duties sincerely and honestly. The committee also feels that the past facilities of mobility, typing and communication should be restored to enable it to function properly.

vii) To effectively understand the epidemiology of rust, collaboration with SAARC countries should be strengthened in laying out trap nurseries and race analysis.

viii) Karnal bunt of wheat is at present receiving attention at Ludhiana, Pantnagar, Dhaulakuan and IARI. At Ludhiana facilities for screening the varieties have been developed. The committee records its appreciation for the work being done at these centres and suggest that if more facilities are required, these should be provided.

10.2.3. Agronomy:

- i) The team strongly recommends that greater emphasis should be laid on wheat grown in un-irrigated areas. It would be necessary to work out suitable cropping systems. Since All India Dryland Research Project is already making efforts in this direction, a close link-up with CRIDA would be necessary.
- ii) In most of the rainfed areas, requirement for N, P and K has not been worked out, therefore, experiments should be laid to work out this requirement for each region, to develop a package of practices for fertilizer use.
- iii) Since the wheat in rainfed areas depends upon conserved moisture from summer and rain in winter season, water management systems should be worked out for good wheat crop.
- iv) Weeds are a serious problem in rainfed wheat, therefore, the linkage with All India Weed Control Project

should be developed to overcome this problem jointly.

v) Based on the general observations that wheat yields are going down in relation to recommended fertilizer application, the team recommends that efforts should be made to find out reason for this and ways and means to sustain the high yield levels.

vi) The cost of wheat cultivation has gone up in recent years. Efforts should be made to bring down this cost without any loss in yields, through efficient utilization of inputs.

vii) The most popular cropping system rice-wheat has led to many problems. These need to be attended without any delay.

10.2.4. Nematology:

i) Tundu and Molya diseases of wheat are prevalent in western part of the country, particularly in Rajasthan, and appear to be spreading in the neighbouring areas. It is therefore essential to keep a watch on the spread of these diseases.

ii) Molya disease appears to be spreading to new areas of Haryana and Rajasthan and screening of the germplasm for identification of resistant strains should be intensified. In case of this disease, it is also reported that crop rotation with non host crops like fodder crops, rape and mustard, carrots, cumin and

coriander can considerably reduce the instance of the disease.

ii) Technologies for control of Tundu as well as Molya diseases are available and should be extended to farmers fields.

10.2.5. Quality:

i) The committee recommends that full quality testing facilities should be developed at one centre each in the major zones. The already identified centres namely, Ludhiana (NWPZ), Vijapur (CZ), Dharwar (PZ), Almora (NHZ) and Kanpur (NEPZ) should be strengthened.

ii) The chapati making qualities of the HYV is not yet fully comparable to the desi types. Attention should be given to improve these features.

iii) There is a need to strengthen work on identification of varieties for superior bread making qualities.

iv) In case of durum wheats quality aspects are extremely important but complete quality testing facilities are not available at any of the centres. These should be developed at selected identified centres.

v) The quipment in the quality testing laboratory of the Directorate has become obsolete through wear and tear and needs immediate replacement. New latest equipment should be added.

10.2.6. Entomology:

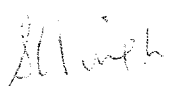
- i) In recent years some insect pests like shootfly, brown wheat mite and aphids have started posing threat to wheat cultivation in some regions. Appropriate technology to manage these pests should be developed.
- ii) In view of the increasing importance of insect pests at least one centre should be made operative in each of the zones.
- iii) Extensive wheat germplasm should be screened to identify insect tolerant material.
- iv) Work on storage grain pest should be further intensified.

10.2.7. Physiology:

- i) Physiologists have identified several important characters contributing to drought and heat tolerance. Rapid screening techniques should be developed.
- ii) Investigations on root system have been inadequate. Some centres should undertake such studies.
- iii) Physiological constraints to increase productivity specially at high productivity levels should be identified.



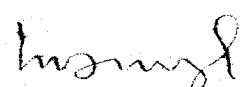
(Dr. MAHATIM SINGH)
Chairman



(Dr. S.P. SINGH)
Member



(Dr. L.M. JOSHI)
Member



(Dr. MAHENDRA SINGH)
Member



(Dr. A.K. GUPTA)
Member



(Dr. AMAR SINGH)
Member Secretary

AICWIP

Statewise Location of 'AICWIP' and other collaborating
wheat research centres in India and their objectives

Centre	Controlling authority	Major objectives
<u>ASSAM</u>		
Shillongani (PC)*	AAU	Breeding, Agronomy
<u>BIHAR</u>		
Sabour (PC)	RAU	Breeding, Pathology, Agronomy
Kanke (PC)	RAU	Breeding, Agronomy, Pathology, Physiology, Entomology (Centre for rainfed (wheat))
Patna (CC)*	RAU	Breeding, Pathology, Agronomy
Pusa (CC)	RAU	Breeding, Pathology, Agronomy, Entomology
Pusa (CC)	IARI	Breeding, Pathology, Agronomy
<u>DELHI</u>		
Delhi	IARI	Breeding, Genetics, Cytogenetics, Pathology, Agronomy, Entomology, Nematology, Quality, Physiology.
Delhi	NBPGR	Germplasm In. trodution
Delhi	IASRI	Statistics
<u>GUJARAT</u>		
Junagarh (PC)	GAU	Breeding, Pathology, Agronomy
Vijapur (PC)	GAU	Breeding, Pathology, Agronomy, Entomology, Quality
Sanosar (CC)	Lok Bharti	Breeding

RAJASTHAN

Durgapura (PC)	RAU	Breeding, Agronomy, Pathology, Nematology, Entomology, Quality
Kota (PC)	RAU	Breeding, Agronomy, Pathology, Quality, Entomology (centre for durum wheat)
Udaipur (PC)	RAU	Agronomy
Sriganganagar (CC)	RAU	Breeding

UTTAR PRADESH

Pantnagar (PC)	GBPUAT	Breeding, Pathology, Agronomy, Quality, Entomology, Physiology, (centre for karnal bunt work)
Kanpur (PC)	CSAUAT	Breeding, Agronomy, Pathology, Quality Entomology, Physiology
Faizabad (PC)	NDUAT	Breeding, Genetics, Agronomy, Pathology (centre for foliar blights)
Varanasi (PC)	BHU	Breeding, Agronomy
Almora (CC)		Breeding, Pathology, Agronomy, Physiology, Quality
Bhowali (CC)	NBPGR	Germplasm
Meerut (CC)	MU	Cytogenetics
Ranichauri (CC)	GBPUAT	Breeding

WEST BENGAL

Kalyani (PC)	BCKVV	Breeding, Pathology
Cooch Behar (PC)	BCKVV	Breeding, Agronomy
Burdwan (CC)	Deptt. of Agriculture	Breeding, Agronomy
Malda (CC)	Deptt. of Agriculture	Breeding

HARYANA

Hissar (PC)	HAU	Breeding, Pathology, Agronomy, Quality, Entomology, Nematology.
Karnal (CC)	CSSRI	Breeding, Agronomy, Physiology (centre for salinity/Alkalinity work) Breeding, Pathology

HIMACHAL PRADESH.

Palampur (PC)	HPKVV	Breeding, Pathology, Agronomy
Dhaulakuan (PC)	HPKVV	Breeding, Pathology, Agronomy
Bajoura (CC)	HPKVV	Breeding
Shimla (CC)	IARI	Breeding
Shimla (CC)	IARI	Pathology, (rust testing Laboratory)
Dalang Maidan (CC)	IARI	Breeding (Summer Nursery)

JAMMU & KASHMIR

Srinagar (PC)	SKUAT	Breeding, Agronomy
R.S.Pusa (CC)	SKUAT	Breeding, Agronomy, Pathology
Leh (CC)	DRDO	Breeding

KARNATAKA

Dharward (PC)	UAS	Breeding, Agronomy, Pathology, Quality
Anigeri (CC)	UAS	Breeding

MADHYA PRADESH

Powerkheda (PC)	JNKVV	Breeding, Pathology, Agronomy, Physiology, Entomology
Bilaspur (PC)	JNKVV	Breeding, Agronomy

(iv)

Sagar (PC)	JNKVV	Appendix-I cont. Breeding, Agronomy, Pathology, Physiology, (centre for rainfed wheat)
Gwalior(PC)	JNKVV	Breeding, Agronomy
Indore (PC)	JNKVV	Breeding
Indore (CC)	IARI	Breeding, Agronomy, Pathology, Physiology, (centre for rainfed wheat & durums)
Jabalpur (CC)	JNKVV	Breeding
<u>MAHARASHTRA</u>		
Niphad (PC)	MPKV	Breeding, Agronomy, Pathology, Physiology, Quality
Mahabaleshwar (PC)	MPKV	Genetics, Pathology (Rust Laboratory)
Pune (PC)	MACS	Breeding, Genetics, Pathology (centre for durum wheat)
Parbhani (CC)	MKV	Breeding
Akola (CC)	PKV	Breeding, Agronomy, Pathology, Physiology, Quality
Washim (CC)	PKV	Breeding
<u>MANIPUR</u>		
Imphal (PC)	Deptt. of Agriculture	Agronomy
<u>ORISSA</u>		
Chiplima (PC)	QUAT	Agronomy
<u>PUNJAB</u>		
Ludhiana (PC)	PAU	Breeding, Genetics, Pathology, Agronomy, Quality, Entomology, Nematology (centre for karnal bunt work)
Gurdaspur (CC)	PAU	Breeding, Genetics, Pathology, Agronomy (centre for rusts & karnal bunt work)

TAMIL NADU

Wellington (CC)	IARI	Breeding, Pathology, (off season summer nursery)
Coimbatore (CC)	TNAU	Breeding, Agronomy

*PC - Project centre (AICWIP)

CC - Co-operating centre (Voluntary)

BREEDING

Series of Varietal Evaluation Trials
organised

A. INITIAL EVALUATION TRIALS (IET)

- i) Irrigated Timely Sown
- ii) Irrigated late sown
- iii) Rainfed Timely sown

B. Uniform Regional Trials (URT)

- i) Irrigated Timely Sown
- ii) Irrigated Late Sown
- iii) Rainfed Timely Sown

C. Special Trials

Varies according to needs and includes

- i) Salinity/Alkalinity tolerant varieties trials.
 - ii) Identification of varieties for very late sown conditions.
 - iii) Rainfed late sown trials in NHZ & FEZ
 - iv) Special materials trials.
-

Table : Percentage of conducted trials reported during 1983-84, 1984-85, 1985-86 and 1986-87 crop seasons

Zone	Percentage of conducted trials reported				
	1986-87	1985-86	1984-85	1983-84	1982-83
Northern Hills Zone	71.9	83.6	73.2	61.1	66.0
Northern Plains Zone	85.3	87.7	85.0	73.2	84.5
North Western Plain Zone	89.5	97.2	88.1	77.1	67.6
North Eastern Plain Zone	67.2	93.5	85.9	71.2	75.7
Far Eastern Zone	69.0	75.0	75.0	54.0	54.0
South Eastern Zone	57.1	62.5	48.6	41.4	30.8
Central Zone	69.2	70.0	57.6	55.7	65.0
Peninsular Zone	48.4	76.0	77.5	67.1	71.6
Southern Hills Zone	100.0	100.0	100.0	100.0	100.0

All Zones	71.3	82.0	75.4	64.5	64.8

BREEDING

Status of trial conducted at major wheat
research centres between 1983-87

	Proposed	Conducted	Reported	% conducted	% reported
1	2	3	4	5	6
<u>Assam</u>					
Shillongoni	19	19	11	100.00	57.89
<u>Bihar</u>					
Sabour	30	28	23	93.33	82.14
Pusa, IARI	30	30	30	100.00	100.00
Patna	28	27	12	96.42	44.44
RAU, Pusa	23	23	20	100.00	86.95
Kanke	34	34	34	100.00	100.00
<u>Delhi</u>					
IARI	42	41	39	97.6	95.1
<u>Gujarat</u>					
Vijapur	25	25	25	100.00	100.00
Junagadh	21	21	20	100.00	95.23
<u>Haryana</u>					
Hissar	25	25	25	100.00	100.00
<u>Himachal Pradesh</u>					
Dhaura Kuan	28	27	26	96.43	96.30
Bajaura	23	22	18	95.65	81.82
Shimla	23	23	20	100.00	86.96
Palampur	21	19	10	90.48	52.63

1	2	3	4	5	6
<u>Jammu & Kashmir</u>					
Shalimar	14	9	5	64.28	55.56
R.S.Pura	14	14	5	100.00	35.71
<u>Karnataka</u>					
Dharwar	30	28	22	93.33	78.57
Annegeri	10	8	6	80.00	75.00
<u>Madhya Pradesh</u>					
Sagar	19	17	7	89.47	41.17
Jabalpur	25	20	18	80.00	90.00
Indore	36	35	34	97.22	97.14
Powerkheda	38	29	24	76.31	82.75
Bilaspur	28	27	26	96.42	96.29
<u>Maharashtra</u>					
Niphad	29	26	22	89.65	84.61
Parbhani	28	23	18	82.14	78.26
Nagpur	12	12	12	100.00	100.00
Akola	28	25	19	89.28	76.00
Poona	21	19	17	90.47	89.47
<u>Orissa</u>					
Chiplima	17	16	1	94.11	6.25
<u>Punjab</u>					
Ludhiana	38	37	36	97.36	97.29
Gurdaspur	38	38	37	100.00	97.29
<u>Rajasthan</u>					
Kota	38	33	26	86.84	78.78
Udaipur	26	24	24	92.30	100.00
Sriganganagar	33	33	33	100.00	100.00

(x)

Appendix II-c contd.

1	2	3	4	5	6
Durgapura	25	23	21	92.00	91.30
<u>Uttar Pradesh</u>					
Bhowali	30	30	30	100.00	100.00
Howelbagh	32	32	32	100.00	100.00
Ranichauri	11	6	2	54.55	33.33
Pantnagar	43	43	28	100.00	65.11
Meerut	18	16	11	88.88	68.75
Kanpur	30	30	28	100.00	93.33
BHU, Varanasi	30	29	28	96.6	96.5
Faizabad	30	28	26	93.33	92.85
<u>Tamil Nadu</u>					
Wellington	10	10	10	100.00	100.00
Coimbatore	14	13	2	92.85	15.38
<u>West Bengal</u>					
Kalyani	19	17	10	89.47	58.82
Malda	31	26	20	83.87	76.92
Burdwan	21	17	14	80.95	82.35
Cooch Behar	23	17	9	73.91	52.94

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BREEDINGStatus of Yield Evaluation Trial Conducted at all Co-operating Centres including only test locations and research centres from 1983-87Northern Hills Zone:

- Himachal Pradesh : Dhaulakuan(28/27/26); Bajaura(23/22/18);
(11) Nagrota(10/8/6); Simla(23/23/20); Khaltoo
(13/11/7); Sundernagar(6/5/2); Berthani
(5/4/4); Katrain (6/5/3); Palampur(21/19/10);
Bhagani(4/3/1); Malan(2/1/0).
- U.P. Hills : Bhowali(30/30/30); Howalbagh(32/32/32);
(9) Pithorager(15/9/6); Chinyalisaur(15/15/12);
Majhera(17/14/9); Ranichauri (11/6/2);
Gwaldam(5/3/2); Deheradun (3/1/0);
Joshimath(3/0/0).
- Jammu & Kashmir : Poonch(6/6/5); Shalimar(14/9/5);
(3) R.S.Pura(5/5/3);
- Nepal & Bhutan : Bhur(2/0/0); Sintokha(2/0/0); Kumultar
(3) (2/2/2).

Northern Plains Zone:

- Punjab : Ludhiana(38/37/36); Gurdaspur(38/38/37);
(5) Jalandher(29/28/27); Faridkot(43/43/40);
Balachaur (2/0/0).
- Uttar Pradesh : Pantnagar(43/43/28); Raya(14/9/5); Hardoi
(8) (9/6/5); Meerut(18/16/11); Bulandshahar
(27/25/15); Nagina(30/30/19); Daurala(8/8/4);
Haldwani(2/2/0).
- Haryana : Karnal(36/36/33); Kaul(36/31/31); Ambala
(4) (10/10/8); Yamunanagar(1/0/0).
- Rajasthan : Sriganganagar(33/33/33); Hanumangarh
(3) (12/10/10); Alwar(12/2/1).
- Himachal Pradesh : Dhaulakuan (1/0/0).
(1)
- Jammu & Kashmir : R.S.Pura(14/14/5).
(1)
- Madhya Pradesh : Morena(2/0/0).
(1)
- Delhi(1) : IARI(42/41/39).

North Western Plains Zone:

- Haryana (3) : Hisar(25/25/25); Bawal(25/24/21); Sirsa(9/4/4).
- Rajasthan (6) : Durgapura(25/23/21); Ajmer(8/8/7); Pilani(1/0/0); Sumerpur(1/0/0); Jodhpur(9/7/4); Tabiji(6/6/5).
- Gujarat (8) : Vijapur(25/25/25); Talod(5/4/4); Bhachau(4/1/1); Charrodi(1/0/0); Dantiwada(18/18/12); S.Krishinagar(3/3/3); Chamodi(1/0/0); Dehgam(4/3/2).

North Eastern Plains Zone:

- Uttar Pradesh (18) : Kanpur(30/30/28); B.H.U.Varanasi(30/29/28); R.R.S.Varanasi(14/12/9); Faizabad(30/28/26); Azamgarh(15/14/9); Bakewar(13/9/5); Etawah(15/10/9); Gorakhpur(2/0/0); Barabanki(15/13/11); Araul(5/5/5); Bahraich(4/2/1); Goghraghat(2/1/0); Tissuhi(4/2/2); Gazipur(1/0/0); Raibareilly(9/8/7); Allahabad(3/0/0); Ajithmal(6/6/5); Hardoi(3/3/1).
- Bihar (9) : Bikramganj(4/4/4); Sabour(30/28/23); Pusa, IARI(30/30/30); Dholi(8/8/7); Patna(28/27/12); Madhopur(5/3/2); RAU-Pusa(23/23/20); Dhangaon(6/4/2); Jhanjhanpur(2/0/0).
- Nepal (1) : Bhairava(1/0/0).

Far Eastern Zone:

- Bihar (3) : Kanke(34/34/34); Chianki(28/26/24); Falakata(1/1/1).
- Meghalaya (2) : Sanasngiri(2/0/0); Shillong(1/0/0).
- West Bengal (4) : Kalyani(19/17/10); Malda(31/26/20); Burdwan(21/17/14); Cooch Behar(23/17/9).
- Assam (4) : Jorhat(4/0/0); Gosaigaon(4/4/0); Shillongoni(19/19/11); Tezpur(10/5/3).
- Arunachal P. (5) : Naharlagen(1/1/1); Sonajuli(8/1/1); Basar(8/0/0); Pasighat(1/0/0); Tezu(1/0/0).

<u>Manipur</u> (1)	:	Mantripokri (27/5/0).
<u>Tripura</u> (2)	:	Lakshhera (0/4/0); Arundatinagar (3/0/0).
<u>Sikkim</u> (5)	:	Majiter (2/2/0); Gangtok (5/3/0); Bermioki (2/2/0); Dikling (1/0/0); Nachi (1/0/0).
<u>Bengla Desh</u> (2)	:	Joydebpur (1/1/1); Jamalpur (1/1/1).

Central Zone:

<u>Madhya Pradesh</u> (18)	:	Sagar (19/17/7); Jabalpur (25/20/18); Narsinghpur (4/3/0); Indore, IARI (26/35/34); Khargone (5/3/1); Powerkheda (38/29/24); Guna (5/0/0); Nowgaon (3/0/0); Mandasaur (6/0/0); Sehore (6/2/1); Khandawa (4/0/0); Tikamgarh (10/3/0); Rewa (12/8/2); Chhindwada (10/7/3); Visish (10/8/3); Dhar (2/0/0); Amlaha (3/1/0); Bohani (1/1/1).
<u>Rajasthan</u> (7)	:	Banswara (8/8/4); Kota (38/33/26); Udaipur (26/24/24); Bundi (1/0/0); Chhatarpur (2/2/2); Aklera (1/0/0); Bhilwara (1/0/0).
<u>Gujarat</u> (15)	:	Junagadh (21/21/20); Dhari (4/2/2); Anand (10/10/8); Dohad (5/4/4); Amreli (4/3/3); Mahuva (4/1/0); Bardoli (10/10/10); Navsari (5/4/3); Tancha (5/4/1); Arnej (15/10/9); Dhanduka (15/10/3); Sanosara (1/1/1); Ratia (3/2/2); Vallabhipur (2/1/0); Jam-Khambalika (1/1/0).
<u>Uttar Pradesh</u> (6)	:	Mauranipur (27/12/8); Bharari (15/5/1); Amrukh (10/8/1); Gursarai (10/5/3); Girthan (7/3/0); Belatal (8/2/1).

Peninsular Zone:

<u>Maharashtra</u> (17)	:	Kolhapur (2/2/2); Vandar (1/1/1); Niphad (29/26/22); Parvarnagar (19, 19/19); Parbhani (28/23/18); Badapur (22/15/14); Washim (23/20/16); Nagpur (12/12/12); Akola (28/25/19); Poona (21/19/17); Amarawati (5/3/2); Jalgaon (10/8/6); Karad (5, 4/3); Dhule (6/6/5); Kopergaon (6/6/5); Bhausabalnagar (2/0/0); Panharpur (1/1/0).
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<u>Karnataka</u> (10)	:	Dharwar (30/28/22); Arabhavi (14/13/11); Siruguppa (11/8/3); Bangalore (6/4/3); Bijapur (8/4/2); Annegiri (10/8/6); Hebbal (1/1/1); Bagalkot (5/1/0); Saundatti (2/2/2); Gangawati (4/0/0).
<u>Andhra Pradesh</u> (3)	:	Rajendra Nagar (4/4/4); Rudrur (23/21/11); Amberpet (2/2/2);
<u>Tamilnadu</u> (4)	:	Kaveripattum (5/4/1); Madurai (1/1/0); Coimbatore (14/13/2); Bharanisagar (2/2/0).

South Eastern Zone:

<u>Madhya Pradesh</u> (11)	:	Rajnandgaon (9/2/2); Durg (10/9/5); Bilaspur (28/27/26); Ambikapur (19/16/14); Raipur (10/2/2); Rajgarh (12/4/2); Kumarwand (6/1/0); Shahdol (3/0/0); Waraseoni (16/10/8); Jagdalpur (7/5/2); Waree (1/1/1).
<u>Orissa</u> (3)	:	Similiguda (11/5/3); Bhubneshwar (11/3/0); Chiplima (17/16/1).
<u>Andhra Pradesh</u> (4)	:	Ragolu (5/4/0); Bapatta (4/1/0); Tirupati (1/0/0); Perumalapati (2/0/0).

Southern Hills Zone:

<u>Tamilnadu</u> (1)	:	Wellington (10/10/10).
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AGRONOMY

Series of Agronomic trials organised and number conducted from 1982-83, 1986-87.

Name of the trial series	Number of trials conducted 82-83 to 86-87.
1. Dates of sowing x varieties (Irrigated)	136
2. Levels of Irrig. x varieties	102
3. Levels of Fert. x varieties (Irrig.)	37
4. Dates of sowing x varieties (Rainfed)	60
5. Fertilizer levels x varieties (R.F.)	35
6. Weed control by herbicide	58
7. P. minor & wild oat control	29
8. Nitrogen(urea) top dressing before and after 1st Irrig.	42
9. Response of potassium	23
10. Phosphorus placement V/s top dressing	28
11. Plant geometry in wheat	24
12. Herbicidal sensitivity in <u>Aestivum</u> wheat	17
13. Herbicidal sensitivity in <u>durum</u> wheat	6
14. Smothering of weed by plant geometry & Genotype	19
15. Fert. as per critical need of the wheat plant	16
16. Micronutrient studies in wheat	22
17. Crop geometry & Fert. use in late sown wheat	23
18. Fert. schedule in Northern Hills	5
19. Rainfed wheat after Kharif Legumes	4
20. Sarson wheat intercropping	27
21. Rainfed intercropping of oil seed & pulses	3
22. Intercropping of oilseed & pulses in fert. constraint	4
23. Groundnut wheat rotation	1
24. Rice wheat rotation (gap period utilization)	2
25. Rice wheat rotation (compatibility of varieties)	1
26. Seed fortification trial	5
27. Effect of Agrochemical on wheat yield	7
28. Fert. management in R.F. wheat	3
29. Fert. management in wheat-kharif crop rotation	5

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AGRONOMY

Status of Agronomic Trials conducted at various centres from 1982-83 to 1986-87.

Name of Centre	Type of trial	No. of trial	Name of Centre	Type of trial	No. of trial
<u>Andhra Pradesh (A.P.)</u>			<u>Maharashtra</u>		
Hyderabad	7	7	Akola	7	20
Rudrur	5	10	*Niphad	15	30
			Parbhani	3	4
<u>Assam</u>			*Pune	3	12
*Shillongoni	5	11	Washim	3	7
<u>Bihar</u>			<u>Orissa</u>		
Patna	2	2	Bhubneshwar	3	4
Pusa (IARI)	11	16	*Chiplima	5	7
Pusa (RAU)	13	23			
*Ranchi	15	30	<u>Punjab</u>		
*Sabour	7	17	Gurdaspur	8	21
<u>Delhi</u>			*Ludhiana	15	35
IARI, New Delhi	12	25	<u>Rajasthan</u>		
<u>Gujarat</u>			*Durgapura	13	30
*Junagarh	10	26	*Kota	4	5
*Vijapur	9	23	Sriganganagar	4	5
			*Udaipur	9	24
<u>Haryana</u>			<u>Tamil Nadu</u>		
*Hisar	10	25	Coimbatore	4	13
<u>H.P.</u>			<u>U.P.</u>		
Bajaura	4	6	Agra	12	24
*Palampur	9	12	Almora	8	26
Solan	4	6	Baraut	3	3
<u>J & K</u>			Bhowali		5
R.S. Pura	11	23	*Faizabad	5	13
*Srinagar	-	-	Jhansi		1
			*Kanpur	14	40
<u>Karnataka</u>			Majhera	3	3
Bagalkot	2	2	Mathura	3	4
Bangalore (Hebbal)	4	7	Meerut	3	6
*Dharwar	7	21	*Pantnagar	18	44
			Pithoragarh	1	1
<u>Manipur</u>			*Varanasi	2	10
*Imphal	-	-	<u>West Bengal</u>		
			Burdwan	3	4
<u>M.P.</u>			*Cooch Behar	-	-
*Bilaspur	4	6	*Kalyani	6	14
*Gwalior	2	2	Malda	1	1
*Indore	3	5			
Morena	1	1			
*Powarkheda	9	25			
*Sagar	-	-			

PATHOLOGY

Location wise status of useful* data reporting/
nursery allotment for pathological nurseries
from 1982-1983 to 1986-87

Location	<u>NURSERIES</u>					
	P.P.S.N. **	K.B.S.N. AI***	NI	P.M.N.	L.B.N.	H.B.N.
1. BIHAR						
Pusa, IARI	1/3	-	-	-	3/5	-
Ranchi	-	-	-	-	0/1	-
2. DELHI (WFD) IARI						
	5/5	-	-	-	-	-
3. GUJARAT						
Junagarh	3/5	-	-	-	-	-
Vijapur	1/1	-	-	-	4/5	-
4. HARYANA						
Hissar	0/2	-	-	-	-	-
Karnal, IARI	-	-	0/4	-	-	-
Yamunanagar	1/1	-	0/4	-	-	-
5. HIMACHAL PRADESH						
Bajaura	1/1	-	0/2	0/2	-	-
Dhaulakuan	3/5	-	3/5	4/5	-	-
Palampur	-	-	-	4/5	-	3/3
Shimla, IARI	-	-	-	-	-	3/3
6. JAMMU & KASHMIR						
R.S. Pura (Jammu)	-	-	2/5	-	-	-
7. KARNATAKA						
Dharwar	5/5	-	-	-	1/3	-
8. MADHYA PRADESH						
Indore, IARI	5/5	-	-	-	-	-
Powerkheda	3/5	-	-	-	-	-

Locations	NUMERIES		P.M.N.	L.B.N.	H.B.N.
	P.P.S.N.	K.B.S.N.			
	AI	NI			
8. MAHARASHTRA					
Akola	-	-	-	0/1	-
Mahabaleshwar	5/5	-	1/2	-	-
Niphad	3/5	-	-	1/3	-
9. PUNJAB					
Gurdaspur	5/5	-	0/3	-	-
Ludhiana	5/5	5/5	-	-	-
Ropar	-	-	0/2	-	-
10. RAJASTHAN					
Jaipur	-	-	-	2/5	-
11. TAMILNADU					
Wellington	5/5	-	0/5	-	-
12. UTTAR PRADESH					
Almora	-	-	2/5	0/1	3/3
Bhowali	3/5	-	5/5	-	3/3
Faizabad	0/1	-	-	4/5	-
Hempur	-	-	0/3	-	-
Kanpur	1/5	-	-	5/5	-
Nagina	-	-	0/2	-	-
Pantnagar	3/5	-	2/5	0/4	-
13. WEST BENGAL					
Kalyani	0/3	-	-	3/4	-
Malda	0/2	-	-	1/2	-

**P.P.S.N. : Plant Pathological Screening Nursery

K.B.S.N. : Karnal Bunt Screening Nursery

P.M.N. : Powdery Mildew Nursery

L.B.N. : Leaf Blight Nursery

H.B.N. : Hill Bunt Nursery

***AI : Artificial infection

NI : Natural infection

*Useful : Considered for annual report.

PATHOLOGY

Location-wise status of useful* data reporting/
trial allotment for different pathological
trials from 1982-83 to 1987-88

Location	Trial 1** No.	2	3	4	5	6	7
1. <u>BIHAR</u>							
Pusa, IARI	-	-	-	-	-	0/3	-
2. <u>DELHI</u>							
W.P.D., IARI	5/5	-	-	-	-	4/4	-
M.P.P., IARI	-	-	1/3	0/2	-	-	-
3. <u>GUJARAT</u>							
Vijapur	-	-	-	-	-	-	1/1
4. <u>HIMACHAL PRADESH</u>							
Dhaura Kuan	-	-	-	-	0/5	-	-
Palampur	-	-	-	-	-	2/3	-
5. <u>HARYANA</u>							
Hissar	-	-	0/1	-	-	3/3	-
Karnal, IARI	-	-	-	0/1	-	-	-
6. <u>JAMMU & KASHMIR</u>							
R.S.Pura (Jammu)	-	-	-	-	0/4	1/3	-
7. <u>MAHARASHTRA</u>							
Niphad	-	-	3/3	2/2	-	-	-
8. <u>PUNJAB</u>							
Gurdaspur	-	-	-	-	0/5	-	-
Ludhiana	5/5	-	1/3	2/2	0/2	3/3	-
9. <u>UTTAR PRADESH</u>							
Almora	-	-	2/3	0/1	-	2/3	-
Faizabad	-	-	-	-	-	-	1/1
Kanpur	-	-	-	-	-	1/2	1/1
Pantnagar	1/5	-	2/3	2/2	0/5	2/3	-

Location	1	2	3	4	5	6	7
10. WEST BENGAL							
Kalyani	-	-	-	-	-	2/3	-
Malda	-	-	-	-	-	1/1	-

**No.1-7 denotes

- 1 : Studies on Karnal bunt of wheat
- 2 : Monitoring of Karnal bunt and black point in coordinated material.
- 3 : Studies on slow rusting
- 4 : Estimation of yield losses due to rusts.
- 5 : Chemical control of Karnal bunt of wheat
- 6 : Chemical control of loose smut of wheat
- 7 : Chemical control of leaf blight.

*Useful : Considered for annual report.

