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Proceedings

Eighth Research Advisory Committee meeting

4-5 April 2003

DIRECTORATE OF WHEAT RESEARCH
(INDIAN COUNCIL OF AGRICULTURAL RESEACH)
Aggarsain Marg, KARNAL – 132 001, Haryana

Proceedings of the 8th RAC meeting held on April 4-5, 2003 at DWR Karnal

The 8th meeting of the Research Advisory Committee was held on 4-5th April, 2003 under the chairmanship of Professor V.L.Chopra, President National Academy of Agricultural Sciences and National Professor, NRC on Plant Biotechnology IARI, New Delhi. Following members of the RAC attended the meeting.

1.	Professor V.L.Chopra	Chairman
2.	Dr. B.S.Dhillon	Member
3.	Professor D.N.Jha	Member
4.	Professor Randhir Singh	Member
5.	Dr. B.M.Singh	Member
6.	Dr. Bachan Singh	Member
7.	Mrs. Rajesh Kumari	Member
8.	Dr. Jag Shoran	Member
9.	Dr. A.D.Mongia	Member-Secretary

Dr. S.N.Shukla, ADG (FFC) ICAR was unable to attend the meeting because of his pre-occupation in some other official meeting.

At the outset, Project Director (Dr. Jag Shoran) DWR Karnal welcomed the members and requested Prof. Chopra, chairman to conduct the proceedings of the meeting.

Research Activities at DWR – An Overview

While presenting an overview of various activities of DWR, Dr. Jag Shoran Project Director mentioned that the main theme of the Directorate is to make India the largest wheat growing and exporting country in the world. He highlighted the role played by the resilient wheat production technologies in sustaining the production of wheat inspite of unfavourable climatic conditions during the preceding crop season of 2001-02. He mentioned that during the last five years, 1999-2000

was the best producing year (76.37 million tonnes) with productivity of 2778 kg per ha while the year 2001-02 was the worst year (69.68 metric tonnes), due to higher temperatures, with a productivity of 2708 kg per ha. He emphasised on the need to diversify the rice-wheat system by introducing pulses/oil seeds to sustain the soil and crop productivity and also to reduce the burden on imports. In this direction, Punjab has taken the lead by diversifying roughly 60,00 ha. of land under oil seed crops. He also pointed out that during the current Rabi season, due to erratic and low rainfall in the dry and semi dry belt of India, there was a reduction in wheat area to the tune of about 54% and 27% in Rajasthan and Madhya Pradesh, respectively. Keeping in view the vast potential existing for increasing wheat production and productivity in the eastern parts of India, emphasis has been placed on shuttle breeding approach and adopting new selection methodology for developing improved wheat germplasm resistant to brown rust and leaf blight and possessing tolerance to terminal heat. Resultantly , an early maturing high yielding and disease resistant variety of wheat , DBW 14 , has been developed and released for cultivation in NEPZ.

Touching on issues related to Resource Management, Dr. Jag Shoran highlighted the advantages of zero tillage and rotary tillage in rice-wheat system. Both the tillage systems have been successful in saving time, labour and fuel and providing equally high yields of wheat. FIRB system of wheat has indicated saving of seeds, fertilisers and water for irrigation. The new tillage options will cut down the cost of cultivation and help Indian wheat growers to compete in the international market under WTO regime. New promising strains of malt barley are also expected

to be released which will encourage barley cultivation for malting industry. He suggested to develop IPM module, on need base, keeping in view the requirements of the farmers. The best IPM module should integrate chemical and biological control measures in a judicious manner along with the use of suitable crop cultivar and agronomic practices . As far as possible the use of chemicals/pesticides should be kept at minimum in any IPM module. Keeping in view the non-tariff barriers in world trade, Pest Risk Analysis (PRA) should receive attention. Dr. Jagshoran further pointed out that software programme (GEOKB & KB RISKS) have been developed by DWR, Karnal for monitoring the occurrence of Karnal Bunt disease of wheat.

The results from the frontline demonstrations have shown the yield gap of 1.5 tonnes per ha in the NEPZ and 1 ton per ha in NWPZ which led to suggest that more extension of available wheat production technology in these wheat growing regions can provide an immediate jump in overall wheat production in India. The newer tools of biotechnology can become useful in bringing further improvement in wheat production in general and for grain quality, disease resistance and abiotic tolerance in particular. The possible biotechnological applications for wheat improvement are Marker Added Selection (MAS) for disease resistance and quality traits, production of double haploids and transgenics. At DWR Karnal, besides improving the grain quality of wheat, molecular markers have been used to differentiate head scab pathotypes and to tag Yr 16 gene providing adult plant resistance against yellow rust. An Atlas on grain quality of wheat of different region

of India has been documented by the Directorate wherein different genotypes of wheat have been characterised for bread, biscuits, pasta products etc.

Soon after the presentation of Dr. Jag Shoran, Professor V.L.Chopra made a gesture for the benefit of Ms Rajesh Kumari and summed up the main issues in the form of popular Hindi language. Prof. Chopra made a point that while determing the need to import a certain quantity of wheat, we must keep in view the requirement of domestic market also, which offers huge opportunity for internal wheat trade. Therefore, the wheat varieties suitable for making various indigenous pasta preparations, bread and biscuit products should receive special attention since the demand of indigenous market is likely to increase in near future at much larger scale. He indicated the strong need to characterise & document various parameters associated with the quality of chapatti making. It will also be desirable to identify molecular markers for chapatti quality, if possible. Prof. Chopra stressed on the need to involve a criteria of selection in the segregating materials, received for testing in the coordinated yield trials, for various quality parameters .

Presentation of Action Taken Report

The Member-Secretary presented the action taken report on the recommendations/observations made by the earlier RAC meeting held on 2-3 April, 2002. In all there were 15 points in the action taken report. The action taken for 11 points was approved by the RAC, however, the remaining 4 points were elaborated by the RAC members for further necessary action as detailed inTable-1.

Suggestions offered by the RAC members on the Action taken Report(Table 1)

Sr. No.	Recommendations	Action Taken	Suggestions made
1.	Like zero tillage, rotary tillage technology for wheat cultivation should be popularised.	Rotary tillage is being popularised by making available rotary till drill to the farmers under on farm trials for wheat and rice cultivation. A research bulletin on rotary tillage has been brought out by RMP. The State Departments of Agriculture should come forward to help in speedy adoption as was done in case of zero tillage.	More efforts for popularising the rotary tillage technology should be made by DWR rather than depending on the state agriculture departments
5.	Development of suitable varieties of wheat possesing product specific properties keeping in view the international wheat trade and export requirements. Food technological aspects of wheat should receive attention.	A NATP project entitled quality improvement of bread and durum wheat (PSR-20) is in progress involving DWR Karnal (for chapatti and bread) as leading centre and GBPUA&T Pantnagar (for biscuit), PAU Ludhiana and RRS, IARI Indore (both for pasta & traditional products from durum wheat). All the AVT entries including checks were evaluated for product specificity and superior entries were selected. Wheat samples from 10 wheat-growing states of the country were analysed for 20 quality parameters including product specificity. A research bulletin "Quality of Indian Wheat" has been published.	Design specific crosses for quality and products should be made.

6.	It was suggested to try fortification of flour with iron and copper and work out the chapatti making properties.	Fortification does increase the concentration of the added nutrients i.e. iron and copper but it does not affect chapatti quality.	Metabolic processes leading to increase in iron content of wheat be studied.
11.	Special attention should be given to identify sources of resistance for powdery mildew.	A disease screening nursery namely " Powdery mildew screening Nursery' (PMSN) is constituted every year under the AICIPW&B for multi location testing. This contains materials of AVT 1st & 2nd year as well as earlier identified sources.	There is need to identify the diverse sources of powdery mildew resistance and efforts should be made to maintain the isolates of powdery mildew at DWR Karnal or at Flowerdale.

Disciplinewise presentation of research highlights

Presentation by Principal Investigator (Crop Improvement): The significant research findings of crop improvement were presented by Dr. S.S.Bisht , Principal Investigator (CI) . In his presentation he listed various germplasm improvement activities taken up at the Directorate . Dr. Bisht pointed out that North Eastern Plains Zone is the target area, which contributes about 30 per cent of total wheat production in the country. Out of 11.0 million-hectare area under rice-wheat cropping system , about half of the area lies in NEPZ alone. There is still a yield gap of 1.5 tons per ha and hence this zone has a great potential for increasing wheat production. Last year, a promising genotype namely, DBW 14 was released for NEPZ under late sown conditions. This is a high yielding and disease resistant variety suitable under late sown and very late sown conditions. For this zone leaf blight is also a major problem. Hence ,a project on resistant breeding on wheat for East and Far East region has been initiated with emphasis on leaf blight. The project is in progress and breeding materials resistant to leaf blight disease are being developed. For Central Zone durum wheat is of considerable importance and there is a great potential for export of durum wheat from Madhya Pradesh provided it meets the quality standard as per international norms. Efforts have, therefore, been made to improve the various quality traits of durum wheat and generate improved germplasm for sharing between durum breeders. There is an ambitious project on hybrid wheat and a few hybrids have been developed following CHA system. During 2002-03 crop season ,for the first time, two hybrids are being tested in the National Initial Varietal Trial (NIVT-IA) for assessing their

yield potential. Winter wheats are well known for their high yield potential, cold and frost tolerance and hence winter wheat germplasm has been exploited for widening the genetic base and bringing desired improvement in spring wheat materials through a project on Winter x Spring hybridisation in collaboration with VPKAS Almora. The segregating material is being supplied to the co-operating centres for enrichment of genetic variability. Maintenance of biodiversity in wheat and barley is an important aspect of crop improvement activity. Under this project 986 accessions in wheat and 376 in barley have been characterised for morphological and quantitative characters during the period under report. Germplasm is being conserved for medium term storage in a module at DWR Karnal and long-term storage at NBPGR New Delhi. Both wheat and barley germplasm lines have also been stored at Dalang Maidan (Lahaul & Spiti) Himachal Pradesh under natural conditions at an altitude of 12000 feet. Work is also in progress in the field of molecular approach towards wheat and barley improvement with an objective of creating novel variability for disease resistance, quality and yield components in wheat from alien species using in vitro techniques. In the field of Biotechnology, markers have been identified and utilised for identification of resistance genes. In barley, emphasis has been shifted from improving feed barley to malt barley . Now DWR is well equipped to breed superior barley materials for malt quality traits. A malt barley variety DWR 28 (1st two rowed malt barley variety) has been released in NWPZ for irrigated conditions with an average yield of 42.0 q/ha. An MOU has been signed with United Braveries Limited for development of malt barley strains with improved malting quality suitable

for breweries and other industrial products. Tillage specific genotypes of wheat are being tested in the NEPZ and at DWR. Through initial studies, 15 genotypes have been screened for zero/conventional tillage.

At the end. Dr. S.S.Bisht proposed for the closure of the project entitled, "Germplasm Improvement for Indo-Gangetic plains and Central India" as this project is not yielding desirable results because of unsuitable environment (irrigation, season and genotypes), unrecognised production conditions and high dependence on co-operators". The members agreed to sum up the project work and finally close it.

Discussions/suggestions offered by RAC members

After the presentation was over, Prof. Chopra emphasised that the presentation of the Principal Investigators should be brief and only those findings should be presented for which advice of RAC members is desired and it should be for the benefit of the heterogeneous group. Dr. B.S. Dhillon suggested that number of sites as well as genotypes for studying the genotypes X tillage interactions should be increased to make it statistically strong and also to arrive at the logical conclusions. Dr. Chatrath informed the house that out of 80 genotypes tried under zero/conventional tillage, only 15 have shown encouraging results at different locations and now these initially screened varieties will be tested under different tillage options at more number of sites. It was in general emphasised that the crosses must be performed carefully to achieve the set targets in breeding programmes rather than making crosses at random between parental lines.

Presentation by Principal Investigator (Resource Management)

Dr.A.D.Mongia, Principal Investigator (RM) presented the results of various field experiments conducted to address the issues like tillage and other inputs for sustainable productivity and cut down the cost of cultivation, diversification of rice-wheat system to reduce the pressure on import of pulses and oil seeds, integrated nutrient management for increasing productivity and quality of wheat and management of production technology for cotton-wheat system and to develop suitable weed management practices in wheat based cropping system. A comparison of wheat cultivation on FIRB, zero tillage, rotary tillage and conventional tillage has demonstrated that rotary tillage is a better option and it has produced highest grain yield among all the tillage options (7% higher yield than zero tillage and > 10% under FIRB) . The energy, time and labour requirement is also lower in rotary tillage with higher net return as compared to other tillage options except the zero tillage, which is almost at par. Rotary tillage has shown promise even for rice cultivation with or without puddling. FIRB technology of wheat production ,though less efficient, is also capable to cut down the cost of wheat cultivation by saving fertiliser, seed and irrigation water. Continuous use of zero tillage, however, is not desirable because it promotes incidence of wild palak (rumex) and *Malwa parviflora* in place of *Phalaris minor*. Therefore, after a period of 2-3 years, depending upon the soil type , field should be brought under conventional tillage/deep ploughed to break the compacted plough layer. With an objective to diversify the rice-wheat rotation, the economic analysis of various crops has shown that inclusion of crops like pigeon pea, potato, vegetable-pea, mustard

and green gram enhance the farm profit and diversify the rice-wheat system. The diversification/intensification has been found to sustain soil and crop productivity and also reduce the weed infestation. Since *Phalaris minor* has developed resistance against isoproturon weedicide, there is need to identify other suitable chemicals for the control of this weed. A large number of new molecules of herbicides alone and in combination have been tried. Among new herbicides, Leader and Sencor have been quite effective in controlling *Phalaris minor* and other broad-leaved weeds. Topic, Puma Super and Domain were also found to be equally effective in controlling the *Phalaris minor*.

Using different tillage systems and suitable combination of wheat and cotton varieties in the cotton-wheat rotation on flat beds, the net income for wheat grain was found to be the highest under rotary tillage and flat bed system was significantly superior to FIRB system. Incorporation of defoliated leaves of cotton into the soil was found to add around 30-40 kg N/ha. Protein content of wheat grain was found to increase up to 14% following application of 25 kg Sulphur per ha. Split application of nitrogenous fertiliser alone could increase protein content up to 12 % in wheat grain.

Discussion/Suggestions offered by the RAC members

Professor D.N.Jha suggested that DWR should make more efforts to popularise low cost/zero tillage technology among the farmers rather than depending upon the State Agricultural Departments for this purpose. Ms Rajesh Kumari suggested to work on technologies, which can reduce the water requirement of crops. To this suggestion of Ms Rajesh Kumari, Dr. Mongia

informed that FIRB tillage technology has been found to reduce the water requirement of crops by 10-30% depending upon the soil type. Dr. Randhir Singh inquired as to why farmers are not going for diversification of rice-wheat system inspite of encouraging results obtained by the Institute. Dr. Mongia pointed out that farmers are ready to accept the diversification of rice-wheat system provided assured market is created for the diversified crops and the government has to come forward in this direction. Dr. Randhir Singh further pointed out that work on residue management needs to be addressed and burning of rice residue left over in the field after combined harvest should be avoided to reduce pollution and loss in organic matter. Dr. Mongia while replying to his queries informed the house that work on rice-residue management was carried out for 4 years at DWR but the results were not very encouraging. It could not increase the organic matter content significantly because of higher rate of decomposition due to higher temperatures under our climatic conditions. DR. Randhir Singh recommended to generate information on the residual effect of new weedicides on soil microflora as well as on subsequent crops.

Presentation by Principal Investigator (Crop Protection) : Dr. A.K.Sharma, Principal Investigator (Crop Protection) presented salient findings of the results obtained from plant protection technology for wheat through IPM, disease survey and surveillance of crop health including post harvest surveys, generating basic knowledge in important pests and diseases of wheat cropping system, synthesis of IPM modules and studies on PRA for Karnal Bunt and Head Scab of wheat. The basic studies were carried out on foliar blight and aphids. Losses due to aphids

were estimated in different varieties of wheat both under field as well as controlled conditions and variety C-306 showed minimum losses followed by UP 2425. Breeding lines and entries of the co-ordinated trials were evaluated against foliar blight through linkages. Mapping of pathogens in different agroclimatic zones indicated the preponderance of B. sororkiniana in most of the wheat growing zones, whereas A. triticina was dominant in NHZ.

The monitoring of disease dynamics in various tillage options has indicated that Incidence of powdery mildew and termite damage was severe under FIRBS. Under zero tillage, the termite damage and the Karnal bunt incidence (based on analysis of farmers' field samples) was low. Powdery mildew occurrence was also high in FIRBS at higher irrigation levels (IW/CPE =1.2). The termite damage was higher under FIRBS with low irrigation level (IW/CPE 0.6) but low under higher irrigation level (IW/CPE = 1.2). Management of Karnal bunt through biological and epidemiological approach was achieved through two sprays of bioagent fungus, Trichoderma viride at growth stage (Zadoks scale) of 30-39 and 41-49. The evaluation and validation of IPM modules at DWR farm and the farmers' field showed an increase of around 13-15 per cent in grain yield over the non-IPM plots. The population dynamics of the soil borne nematodes was also worked out in the three tillage systems and also in plots under different organic manure levels. Detailed PRA on Karnal bunt was done under a USDA sponsored consultancy project and it was found that KB does not occur in hot desert and cold high altitude conditions due to extreme temperatures. Mapping of molecular variants of KB (Tilletia indica) using SDS-PAGE technique of three population with a definite

geographical distribution pattern was presented. The distribution pattern of Head Scab disease and its causal organism and molecular variability in India Fusaria has been studied. One cultivar Raj 6533 has been identified to carry a combined resistance to KB and Head Scab disease. This carried significance in view of the fact that both these diseases are having a common area of distribution in the foothills of Punjab and Himachal Pradesh.

Discussions/suggestions offered by the RAC members

Dr. B.M.Singh stressed that the work on powdery mildew (use of diverse sources of resistance) needs to be intensified. He was of the view that the infection responses of B. sorokiniana on the host needs to be further looked into before they are called as infection types. He also suggested that the IPM and biological control should be further strengthened as has been done in other crops. The effect of the use of pesticides on soil microflora and seed germination needs to be investigated.

Presentation by the Head , DWR, Regional station , Flowerdale (Shimla)

Dr. M. Prashar , Head DWR regional Station, Flowerdale (Shimla) presented the work done especially on variability in wheat and barley rusts, sources of resistance and development of rust resistant genetic stocks and variability at DNA level. Among 948 samples analysed, pathotype 121R63-1 of the brown rust was the most frequent in Niligiri hills, both 21R55 and 121R63-1 predominated in Northern Hills and pathotype 109R31-1 was the most frequently identified in North Eastern India. Black rust was reported only from Central Zone and Peninsular Zone and pathotype 62G29 was the most frequent in Nilgiri Hills. Yellow rust pathotypes 38S102 and 46S119 were found to be the most prevalent in Nilgiri Hills and North

Indian Hills, respectively. Two new pathotypes were detected during the season. Pt 93647 for brown rust was the 11th Pt virulent on Lr26 . Another isolate of yellow rust from Punjab (Batala) was found virulent on PBW 343.

Multipathotype evaluation of elite lines (AVT I&II) at seedling stage revealed that eighteen lines were resistant to both black and brown rusts whereas none was found resistant to yellow rusts. Most frequently postulated resistance gene for brown rust was Lr26 followed by Lr23 and others. For black rust Sr31 imparted resistance in most of lines followed b Sr2. Yr9 was postulated in maximum number of lines followed by Yr18and others.

Five genetic stocks carrying brown, black and yellow rust resistance (Lr26/Lr24/Sr31/Sr24/Sr2) have been registered. These have been assigned the INGR nos. and the national identity nos. Other genetic stocks with diverse rust resistance are in the process of development . Detection of Lr26 in these stocks was done through the identified molecular markers.

Inheritance studies have been done with some of the important cutivars like Cappelle Desprez and PBW 343 to find the number of resistance genes operative in these cultivars. F2 data of these crosses indicate the presence of single dominant gene against 46S119 whereas CD, seemed to have more than one recessive genes against the same pathotype.

Presentation by Principal Investigator (Quality & Basic Sciences) : Dr. R.K.Gupta, Principal Investigator (Quality) while presenting the salient results, mentioned that all the AVT entries (1st & 2nd year) were evaluated for various end products like chapati, bread, biscuit & pasta and superior entries were selected.

Based on the analysis of about two thousand wheat grain samples for 20 quality parameters , collected from mandis, covering 10 major wheat growing states an atlas has been prepared. Indian wheat has been divided into 5 classes and 6 grades and if the wheat produce is passed through wheat cleaning and grading machines, most the wheat lots fall in grade 1 or II. For improving the wheat quality for chapati and bread, crosses are being attempted between parents of better quality in the background of high yield and disease resistance. At molecular levels, the samples were analysed for 1D x 5 gene and 1B-1R translocation. The RILs developed for bread quality and grain hardness were grown at Pune, Kota & Karnal and analysed for various physico-chemical properties. Attempts were made to identify molecular markers linked with quality parameters in association with NCL Pune. Investigations on biscuit making quality have shown that AWRC and lactic acid SRC are negatively and significantly correlated with biscuit diameter and can be used to screen the wheat genotypes. Grain hardness has been found to be associated with biscuit quality and it is caused by mutation in either component of friabilin (Pin A or Pin B), a starch surface protein. Certain exceptions like NI 5439, Hyb 65, HP 1633 and HD 2380 which should be soft as both Pin A and Pin B are present are actually hard. These have been cloned and the reasons for their hardness are being investigated.

Discussions/suggestions offered by the RAC members

Dr. Randhir Singh suggested that studies on identification of specific polypeptides for specific end use product and role of low molecular weight (LMW) gliadins & glutenins in the overall process should be taken up .Dr Jag Shoran

expressed reservation in pursuing such work at DWR in view of non-availability of technically sound man power in the laboratory. Dr. Chopra , while acclaiming the work of Dr. Gupta, heretically expressed that such basic works should be carried out in the universities where expertise and facilities for such works exist. However, he emphasised on the need to initiate work to generate information on the components associated with chapatti making quality. He also emphasised on the need to identify the requirements of domestic market for biscuits and work should be strengthened . The chairman recommended to hold a brain storming session at DWR, on chapatti making quality components by inviting 5-6 known scientists in this area of specialization.

Presentation by Principal Investigator (Stat. & Social Sciences): The presentation of Statistics and Social Sciences was made by Shri R.P.Singh, PI (Sta. & social Sciences). He highlighted that data of about 600 trials under AICWIP were computerised and analysed and the results were reported in the coordinated annual progress report. Two softwares required for the analysis of coordinated data were modified and a new software " Pruit Audit " was also developed. Data and results of crop improvement and resource management programmes were properly documented on electronic media. A handbook on design and analysis of field data for AICW&BIP trials, in the form of a bulletin has been prepared for publication. An electronic album depicting all the activities of DWR in pictorial form has been brought out.

Under the project " Technology Validation and Impact Assessment"

782 frontline demonstrations on wheat for latest wheat production technologies such as improved varieties, zero tillage, weed control etc. were conducted in 17 states. Zone wise productivity was found to be significantly higher in all the demonstration sites. 32 barley frontline demonstrations were also conducted and yield increases from 100 to 200 per cent over the regional averages were obtained. There was significant difference in return over variable costs (RDVC) in the FLD's over check in all the zone. Impact assessment study has indicated that improved varieties and weed control practices had been adopted by all the farmers surveyed in Karnal district. There was an increase in area under zero tillage and 50 % of the farmers surveyed resorted to the practice of line sowing of wheat . None had adopted the FIRB technology. Non-remunerative price of wheat, imbalance used of fertilisers and high cost of inputs were found to be the main constraints in wheat production

Farmers participatory research carried out at farmers field has shown that cost benefit ratio was in favour of zero tillage as compared to FIRB and conventional tillage practices . Growth rate(%) for the period from 1993-94 to 2000-01, has indicated that there was 2.07% increase in NWPZ as compared to NEPZ (1.07%), CZ (-0.64) and PZ (1.92%). A comparative analysis of rice-wheat and cotton-wheat system has revealed that the former is more profitable, though capital intensive. Besides, extension scientists organised Farmers days , Kisan divas and Training camps for the farmers.

Discussions/suggestions offered by the RAC members

Prof D.N.Jha complimented the team of scientists and suggested that the social science group should work out the economics of Rotary tillage in comparison to that of zero tillage in association with the resource management scientists. He also suggested that as far as possible FLDs should be conducted on marginal and small farmers and in case this group does not come forward for undertaking the demonstrations, the impact of conducting FLDs in large farmers fields on small and marginal farmers should be studied. Prof. D.N Jha offered to provide DWR social scientists the data base on 300 districts available with him. He also prevailed upon the social scientists to collect the national demand with respect to bread, biscuits and pasta products in a systematic manner.

Wrap up Discussions/Recommendations of RAC members

Having visited the experimental fields and laboratories, the chairman invited the opinion/ suggestions /comments from each of the RAC members. Dr. Bachan Singh appreciated the work done by the resource management group on different tillage options for updating the wheat cultivation technology and its impact on soil physical properties. He came out with the suggestion that soil profile should be exposed and the depth of hard pan under different tillage systems should be studied. He further suggested that there is need to adjust the sowing time so that fields can be ploughed with zero tillage before weeds appear.

Prof. Randhir Singh suggested that more emphasis should be given on the following points:

1) Studies on mechanism of flag leaf senescence should be taken up by the plant physiologist

2) Starch biosynthesis mechanism should be studied in systematic manner

3) There is need to identify molecular markers for good chapati making quality including the keeping quality .

In view of the limitations of resources, Prof. Chopra advised to take up the third aspect on priority basis and the first two aspects may be looked into as and when necessary infra-structure is created in future.

Prof. D.N.Jha while having all appreciation for the research work carried out in DWR, Karnal, made the following suggestions:

1) Economic analysis of quality parameters need to be strengthened to accrue the commercial benefits .

2) While presenting the results of FLDs , data should be arranged according to status of the farmers (marginal/small/large farmer etc)

3) Through economic surveys, the profitable wheat growing areas , based on the cost of cultivation in the respective region, should be earmarked keeping in view the international price of wheat. States producing wheat above the international cost index will automatically go out of wheat cultivation.

Dr. B.S.Dhillon made the following suggestions :

1) NBPGR will start national germplam nursery from Rabi 2003-04. It will include promising and diverse exotic lines (about 200 lines) selected from the introduction obtained every year which are grown at NBPGR (Every year they get about 4-5 thousand lines from CIMMYT and ICARDA). He proposed to evaluate this nursery through DWR at about 10 centres.

2) Registration of Germplasm should be encouraged. Promising genotypes with at least one outstanding trait may be submitted for registration.

3) To widen the genetic base, pre-breeding work should be started by the national crop improvement programme . In view of slow progress, NBPGR has decided to play proactive role. In wheat NBPGR plans to cross-indigenous varieties with CIMMYT's synthetic wheats and distribute F2 to the All India Co-ordinated Wheat Improvement Project through DWR. He requested for the active support and guidance of DWR in this venture.

Ms Rajesh Kumari suggested that Kisan melas should also be arranged in the western part of Uttar Pradesh so that farmers of that region can benefit from the latest wheat production technologies. She also requested that news letter published by DWR may be sent to her so that she can pass on to interested farmers. Dr. Jag Shoran agreed to send a copy of the DWR News letter to Ms Rajesh Kumari. Dr Randhir Singh informed that Kisan Mela is organised at Agra and the farmers of the nearby

areas will be invited to participate during the next crop season. The exact date of Mela will be informed to Ms Rajesh Kumari and she will arrange to send the farmers there.

Dr. B.M.Singh made the following suggestions:

1) The presence of three-KB populations should be further confirmed.

2) There is a need to identify the diverse sources of powdery mildew resistance

3) Efforts should be made to maintain the isolates of powdery mildew at DWR Karnal or at Flowerdale

4) Infection responses due to *B. sorokiniana* and its toxins be further looked into for confirmation.

5) Biological control measures must get attention in research efforts.

Finally, the chairman concluded the proceedings by summing up different salient points put forward by the RAC members . He suggested that presentations should be in the nature of sharing informations/findings among the scientists and the RAC members so that effective and tangible suggestions can be made. He emphasised that DWR should play a catalytic role in developing technologies for wheat production in the country.

The meeting ended with vote of thanks by the Member Secretary

24/5/02

(Dr A.D.Mongia)
Member Secretary
RAC, DWR, Karnal