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**REPORT OF THE 4TH NATIONAL
WHEAT TRAVELLING SEMINAR
MARCH 16 - MARCH 28 1984**

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**COORDINATED WHEAT PROGRAM
PARC/NARC
ISLAMABAD**

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SUMMARY

Twenty eight wheat scientists participated in the 4th annual travelling wheat seminar. The seminar started in Karachi on March 16, travelled through the wheat areas of Sind, Punjab and NWFP and finished in Swat on March 26. Final discussions were held in Islamabad on March 28. Stops were made at the various research stations, adaptive research farms, extension demonstration plots and farmers fields.

The wheat in the irrigated areas looked good. However, late planting was common and cooler than average temperatures during grain filling will be needed to prevent forced grain formation and to achieve good yields. Rust was absent this year in the irrigated wheat lands.

The waterlogged and saline areas, and the rice-wheat tracts of the Punjab were the only places where wheat looked poor under irrigation. In the rice-wheat area, the poor crop stands were almost entirely in fields following Basmati rice. Here, planting was late, land preparation was poor, plant stands were patchy and crop growth stunted.

In the rainfed areas, wheat suffered badly from an extended drought from October to February. However, rains in mid-February and March helped rejuvenate the crop especially where farmers used fertilizer. Losses are now expected to be 20 - 25% less than that in a normal barani year.

In summary, the wheat production in 1984 could equal last years production if the grain filling period remains cool. Losses in the barani tract will be compensated by gains in the irrigated areas.

The report gives more detail on the crop condition in the 5 provinces of the country. In Sind, late planting will be the major factor in determining final wheat yields. Much of the crop was still in the early stages of heading and high temperatures could cause problems. Rust was absent from the crop. Availability of seed to the farmer was a problem and the reliance of farmers on Pavon and Blue Silver as the two major wheat varieties grown could present problems in the future unless efforts are made to introduce new varieties into the system. In the cotton areas of the Punjab the crop is similar to that in the Sind. However, seed availability and diversity of varieties is less of a problem.

The poor condition of the wheat crop in the rice tract has already been described. Other problems in this area include the high preponderance of Yecora as the preferred variety and the problem of weeds, especially wild oats and Phalaris.

The crop in AJK is very poor this year and has suffered badly from drought. Many fields were not planted and the crop condition in those that were planted is poor. In NWFP, the barani crop also suffered from drought. In the irrigated areas, weeds, especially the broadleaved weeds, are causing substantial losses. However, no stripe rust is seen so far and yields in the irrigated areas should be good. Availability of seed of new varieties is poor in NWFP.

Six recommendations have been made by the members of the seminar:

1. Since rust is absent from wheat fields this year, decisions on procurement of wheat seed and variety release should

be based on previous years data. CDRI will continue to monitor the disease situation for this year.

2. There is a need to find ways to accelerate the supply of good seed of disease resistant varieties to farmers. The use of village level seed multiplication programs is suggested. Farmers should be allowed to charge reasonable premiums for this new seed.

3. More efforts are needed on researching efficient means of testing technology on farmers fields and disseminating results to the farmer for quicker adoption. Extension demonstrations need to be improved and developed together with the researchers. If research is to have a payoff, the results must reach the client by way of fast farmer adoption.

4. CDRI must continue to supply stable sources of resistance against the more prevalent rust races. CDRI facilities also need strengthening and the staff needs training on specific disease problems.

5. Loose smut, flag smut and karnal bunt are seed borne diseases increasing in importance in Pakistan. The use of fresh supplies of Baytan or Vitavax as seed dressings is recommended.

6. Funds for agricultural research both at the federal and provincial level must be stable. A minimum limit should be established below which no further cuts are made. Salaries as well as some operational funds should be available. Replacements for consumable items should be programmed into budgets to maintain continuity of work.

The report goes on to summarize the outcome of the various discussions held during the seminar on Plant Pathology, National

Uniform Yield Trials, the Kaghan Summer Nursery, International Nurseries, Barani Wheat, Wheat based Cropping Patterns, On-Farm Trials/Testing, and Seed Multiplication. Various suggestions for improvement are made concerning each of these topics.

AKNOWLEDGEMENTS

The wheat scientists who participated in the seminar are grateful to Dr. Amir Muhammed, the Chairman, of FARC for his continued support of this important coordinated activity. Through this seminar a much better understanding is developed amongst the wheat scientists of Pakistan. The group are also grateful to USAID for their continued financial support of this tour and the comfortable bus their funds enabled us to use. Many scientists and extension personnel were not able to travel on this tour but still dedicated much of their time and effort during the visit of the group to their stations, fields and trials. We thank the farmers who answered the many questions posed them by the group with patience. We thank all the people who offered us tea, refreshments and free meals during our visits. We would like to thank Mr. Nafees Kisana an SO with the NARC wheat program whose good management meant we never had to wait to get our hotel rooms. Lastly we want to thank all the participants on the tour who were never late for the early starts in the morning and never complained of the endless days and stops.

INTRODUCTION AND OBJECTIVES

The fourth annual wheat travelling seminar organized by the coordinated wheat program of PARC-CIMMYT started in Karachi on March 16, 1984 and passed through the wheat growing areas of Sind, Punjab and NWFP ending at Swat on March 26 (Appendix I). Stops were made at the various research stations, adaptive research farms, extension demonstration plots and farmers' fields (Appendix II).

Twenty eight scientists participated in the seminar either full time or for part of the trip (Appendix III). Many other scientists, extension workers and farmers also participated during the planned stops. Wheat breeders, pathologists and agronomists were included in the group representing all 4 provinces and AJK and most of the wheat research programs of the country. In addition, one representative from Kenya, 3 CIMMYT regional wheat members and the 3 CIMMYT scientists resident in Pakistan joined the group.

The objectives of the seminar were similar to previous tours as follows:

1. To assess the status of the present wheat crop and in particular, the distribution, yield potential of varieties and disease incidence in different agro-ecological zones of the country.
2. To observe the crop in farmers fields and interview farmers and extension workers regarding their local problems.
3. To evaluate the yield potential and disease reaction of the candidate varieties included in the national

uniform wheat yield trials (NUJWYT) planted in different parts of the country

4. To develop a better understanding and exchange of ideas amongst the various wheat scientists of the country during informal discussions and the relaxed atmosphere of the trip.

A GENERAL OVERVIEW OF THE 1984 WHEAT CROP

The wheat crop is generally good except in the waterlogged and saline areas, the rice-wheat tract and parts of the barani tract. However, as observed last year many fields in the cotton and rice growing tracts were planted late and continued cool weather during grain filling will be needed to assure good yields. Timely rains did occur in February and March that not only provided needed moisture but kept temperatures at levels conducive to good grain filling.

Despite the prolonged drought (120 days or more depending on location) the situation of wheat in the barani tracts is much better than previously expected. The timely rains in mid-February and March have allowed the wheat crop to partially recover especially where farmers had applied fertilizer. The total production and acreage in the barani areas will not reach last year's record bumper crop but yields will be greater than expected from earlier crop predictions. A reduction of 15-20% is expected compared to normal barani production.

The rice - wheat area, as in 1983, had the worst wheat crop. These poor crop stands were almost entirely in fields following Basmati rice. Planting was late, land preparation was poor, plant stands were patchy and crop growth was stunted. A

more coordinated team approach is needed on this important cropping system of Pakistan if wheat yields are to be increased in this part of the country.

The pathologists were disappointed and the breeders elated by the almost complete absence of rust in the country up to the end of March. Only the nurseries heavily inoculated at the major wheat stations and a few isolated outbreaks of leaf and stripe rust on highly susceptible check varieties were seen during the tour. This means that very little loss can be expected from disease in the 1984 wheat crop.

Loose smut was found in significant amounts especially in the Punjab and more efforts are needed to control this disease by seed treatment. Flag smut was endemic in the barani tract of the Punjab. Foot rot associated with *Fusarium* and *Helminthosporium* species was also endemic and rampant in this area due in part to early drought.

Fertilizer use increased in 1984 with one bag urea plus one bag DAP a common farmer recipe. Even in the barani tract fertilizer was used, probably because farmers apply fertilizer before planting in these areas, when drought was not expected.

Weeds were present throughout the country but will only significantly affect yields in some areas of the country. The irrigated areas of NWFP and the rice tract of the Punjab will suffer most from weed damage. In the barani tract, weeds also suffered from drought and are not causing losses this year.

In summary, the wheat yield 1984 could equal last years production if the grain filling period remains mild. Any losses

in the barani tract due to drought will be offset by the increase in yield in the irrigated areas caused by the use of more fertilizer, better seed, the absence of rust diseases and a small increase in acreage.

SPECIFIC CROP CONDITION IN THE PROVINCES

SIND

The wheat crop in the Sind is generally good and with continued mild weather during grain filling and lack of disease the prospect of meeting the wheat target is good.

Total area planted was 1,032,310 hectares or 2.34% above the targetted area. The major problem, though, is late planting. The wheat botanist at Tandojam estimated that 30% of the crop was planted within the proper time and 70% was planted late (i.e. December onward). Some fields were even planted in January. If temperatures increase to normal during grain filling some decrease in yield is bound to occur because of shrivelled grain.

Compared to last year the wheat appeared to be later. The high cropping intensity in the province where wheat follows either cotton, rice or sugarcane helps explain the reason for late planting of wheat. Farmers use late maturing cotton varieties or take a late last picking. Even after the harvest of the cotton the farmer needs to remove the cotton sticks from the field since they provide him a valuable source of fuel. This further delays the start of the land preparation for wheat.

Similar delays are caused in rice and sugarcane where

preparation of soil following puddled rice and the need to obtain an indent at the sugar mill for the cane before it is harvested delays wheat planting. Cooler than average temperatures during February also delayed the development of the wheat crop.

As in 1983, Pavon (65%) and Blue Silver (25%) were the major varieties grown by farmers in Sind. Availability of seed of other improved varieties was inadequate. Most farmers used their own seed. Many fields were observed with mixtures of varieties. The Sind seed corporation can hardly meet 4% of the needs of the province. Much more attention is needed to overcome this problem and to increase the diversification of varieties available to farmers in the province in case of future breakdown of Pavon to leaf rust, or an epidemic starting on the susceptible variety Blue Silver.

Irrigation and fertilizer use seemed to be normal in the province. One bag of urea and one bag of DAP was a normal fertilizer dose. Weeds were a major problem in some areas. *Convolvulus arvensis*, *Chenopodium album* and *murale*, *Melilotus alba*, *Avena fatua* and *Phalaris minor* were the major weed problems. Many farmers control weeds by hand weeding or not at all. The scope for chemical weed control is good if practical means can be found to extend the technology at the farmers field level. The research stations in particular had weed problems especially *Convolvulus arvensis*.

There was no natural leaf rust occurrence in the province even on highly susceptible varieties. Some seed obtained from the Punjab seed corporation and grown at the Kot Diji station did have 1% loose smut, but generally this disease was not a problem.

The majority of the crop was in the heading stage. If high temperatures cause forced maturity during grain filling yield could decline by 5 - 10 percent. Total production could equal last years figures if the climate remains favorable.

PUNJAB

Conditions in the cotton growing areas of the Punjab were similar to those in Upper Sind. Crop stands and growth are good although late planting associated with late cotton harvest is a common feature. However, because of the severe pest attack in cotton some farmers ploughed up the cotton and planted wheat early. As in Sind, a mild spring will be needed to achieve maximum yield potential.

Salinity and water logging is a problem but with the start of SCARP 6 and other projects some areas are being reclaimed.

The main varieties grown are WL711, Yecora, Sonalika, Pak 81 and Punjab 81. The first two are the major varieties but because of their susceptibility to rusts they should be discouraged and replaced with Pak 81, Punjab 81 and some of the new varieties recommended by the Variety Evaluation Committee (VEC). Because of the lack of disease, Yecora and WL711 will yield well, creating a dilemma in trying to discourage these varieties. The increase in the incidence of Karnal Bunt in the Punjab is another reason for rejection of WL711 which is highly susceptible to this disease. The Punjab Seed Corporation has done a good job in the cotton belt by providing good quality seed of Pak 81 and Punjab 81.

There was no rust disease found in the cotton area except for some stripe rust at the Khanewal Seed Farm on highly

susceptible varieties in the trap nursery. Loose smut was found from traces to 0.8%.

Fertilizer use was widespread and was reflected in the good growth of the crop. Weeds were less of a problem although *Chenopodium album*, *Convolvulus arvensis*, *Medicago polymorpha*, *Helilotus alba*, *Phalaris minor* and *Avena fatua* were problems in some fields.

The wheat in the rice tract was very late when planted after Basmati rice and only looked good when it followed Kharif maize fodder crops. Wheat following IR6 rice was planted earlier than that following Basmati but problems of good land and seedbed preparation and good plant stands were common for wheat following both rice varieties. Generally wheat following Basmati was still in the tillering and jointing stages of development. Following IR6, wheat was in the heading stage and following maize fodder in the grain filling stages of growth. Since 80-90% of the rice grown in the Punjab is Basmati, temperatures will play an important part in determining final yields.

The major variety in the rice tract was Yecora/Pari 73. This variety is popular with the farmers because of its high yield potential and good chapati making qualities. However, its rust disease susceptibility could create serious problems in a rust epidemic year. Farmers lack this knowledge and other seed alternatives. Blue Silver was the other major variety. Many fields had badly mixed stands consisting of up to 10 different varieties. Most farmers use their own seed. The Punjab Seed Corporation needs to put more emphasis on supplying good quality seed to this area.

Unfortunately, because of the late planting following Basmati rice few varieties are available . More efforts are needed to develop compatible rice-wheat varietal combinations . The variety V 79391 (Faisalabad 83) was recommended by VEC as a rust resistant short duration variety for this area. The Punjab Provincial Seed Council should quickly approve this variety so that the Punjab Seed Corporation can begin multiplying this variety for the rice tract.

Weeds are becoming a serious problem in the rice tract. *Chenopodium album* and *murale*, *Phalaris minor* and *Avena fatua* were the major weeds. The problem was aggravated by poor stands and the short stature of the predominant variety Yecora.

Some fields appeared to have received no fertilizer. Farmers probably know that poor fertilizer responses are obtained by wheat in these areas. More research is needed on identifying response surfaces to nitrogen and phosphorus in these unfavourable soils for wheat.

Many farmers harvest their rice by the end of November. However, instead of clearing the land and preparing for wheat sowing, the farmer leaves the cut rice in the field to dry 10 days, and threshes in the field before preparing the land for wheat. Three weeks can elapse between the harvest of rice and the planting of wheat. The farmer justifies this procedure by saying the rice shatters and therefore he does not like to move it. He also views the wheat as a subsistence crop. Obviously, if farmers could plant their wheat crop earlier, yields would be higher. Better land preparation and plant stands could also contribute significantly to yields.

One fifth of the Punjab wheat acreage is found on barani (rainfed) land, but only 7% of the total Pakistan wheat production comes from this area. Monsoon rains in 1983 were good and provided sufficient stored moisture to allow timely planting of wheat in the barani tract on fallow land left for wheat. Very little sowing of wheat was done in the fields vacated by summer cereal/legumes due to unavailability of moisture (Nov-Dec rains).

Lyallpur 73 was the major variety and germination of the crop was good except near trees where moisture was poor.

After germination, no rains fell for 3 1/2 - 4 months. Vegetative growth and tillering was poor. Continuous drought was aggravated by high incidence of foot rot which caused up to 25% reduction in stands in seriously infected fields. White ant attack followed the foot rot infection causing further losses. The crop condition by early February was very poor and losses were expected to be high.

Good rains in mid-February, however, reversed this situation. Further rains in March have left the barani crop looking quite respectable considering the early drought. Many farmers put fertilizer on barani wheat prior to planting. This was not available for growth until the rains in February. But when the rain did come the crop greened rapidly and partly compensated in yield. Sufficient moisture is now available for grain filling. The reduction in yield compared to an average year is now estimated to be 15-20% mainly due to less acreage but also lower yields.

Weeds were not a problem since they also suffered from drought. Flag and loose smut were present in traces.

The variety K342 or Barani 83 looked good compared to Lyallpur 73. This variety, recommended by VEC last year, should be recommended by the Provincial Seed Council for release and all attempts by the Punjab Seed Corporation to multiply and infuse this variety into the barani tracts should be made. It is a rust resistant variety with better yield potential than the old Lyp 73. There is a need to increase the diversity of varieties in the Barani tract since Lyallpur 73 is breaking down to disease.

Two agronomic factors deserve attention in this report. First, in the fields where fertilizer was used the wheat recovered quickly following the drought. Those fields where fertilizer was not used did not do as well. Even in very dry years farmers should be encouraged to use N and P fertilizers. Second, the group saw excellent responses to deep tillage in farmers fields. The crop in the deep moldboard ploughed fields had better rooting, and therefore better utilization of nutrients and water, and withstood the drought much better than in fields where conventional shallow tillage was done by cultivator. Yields as high as 45 md/ac can be expected from the deep tilled plots. More emphasis is needed on demonstrating this improved practice in the barani tract and to check responses in other years and soils.

NORTH WEST FRONTIER PROVINCE

More than 800,000 hectares of wheat are grown in this province. Three eighths of it is irrigated and the rest rainfed. The crop condition in the irrigated areas and Swat is excellent except for some late planting following late harvested sugarcane.

Wheat planting following Kharif maize is timely and tillering profuse. With the lack of stripe rust, yields should be higher than last year in the irrigated crop.

The wheat in the rainfed area is very poor especially on sandy soils. Drought in some of these areas extended into March. Approximately 50% reduction in production is expected.

Major wheat varieties were Lyallpur 73, Mexipak and Sonalika with an increase in Pak 81 compared to last year. Farmers still grow old traditional varieties in the barani tract. Seed is still a major problem. Many farmers do not keep their own seed because of storage problems and there is no seed corporation in NWFP to fill the gap. This issue should be further studied to identify ways to provide good quality seed to farmers. More research is also needed on better barani varieties.

Weeds, especially several broadleaf weeds and grassy weeds like *Phalaris minor*, and *Avena fatua* are becoming a serious problem. Simple demonstrations are needed on chemical control of these weeds and the resulting increase in yield measured.

Fertilizer use was good in the irrigated areas but less than needed in the rainfed areas.

Barley stripe disease, *Helminthosporium gramineum* was a severe problem in Swat. This seed borne disease could easily be controlled by replacing farmer seed with clean improved seed. More research is also needed on barley in this province.

AZAD JAMMU and KASHMIR

Although this province was not visited this year a member of the team provided some information on the crop condition.

Wheat in Kashmir is dependent on timely rains. When rains are favorable and farmers use good seed and reasonable amounts of fertilizer yields are high. Unfortunately, in 1984, drought was severe and the wheat crop suffered more than that described for the rainfed parts of the Punjab. Acreage is down by about 50% in southern AJK, and the yield of that planted is poor. Production will be 50 to 70% less than last year.

Only 10% of the wheat seed required was procured from the Punjab Seed Corporation because of financial constraints. This left many farmers with no alternative than to use their own seed of old and often badly mixed varieties. Loose and flag smut are endemic where farmers use their own seed with up to 5% incidence observed in some fields.

Farmers who use fertilizer (both N and P) get 2-3 times more yield as compared to those who apply no fertilizer, but many farmers do not use fertilizer probably because of the poor response curves obtained when old varieties are used and the lack of credit to buy the fertilizer.

Deep tillage trials demonstrated similar results to that in the Punjab and further trials are needed to demonstrate this important factor in barani wheat production.

BALUCHISTAN

The wheat botanist at Sariab will initiate a survey in this province and prepare a separate report. However, in brief the following comments can be made.

The crop in the irrigated areas of Baluchistan is probably similar to that in the Sind.

The crop in the uplands is still in the vegetative phase of growth. Sowing was completed on time in the sailaba areas because of good monsoon rains. There was some drought but not as severe as in the rest of the country.

A small group of senior wheat scientists will be constituted in June to assess the crop condition in the uplands of Baluchistan.

RECOMMENDATIONS OF THE GROUP

Last year, 30 recommendations consisting of two types were made by the group: those whose implementation depended on the wheat scientists and those that required some higher official decision. In this years report only the following major recommendations will be made that require higher official decision making. Other suggestions will be incorporated into the text.

1 -

Since rust is absent from wheat field this year, up to writing this report, the decision on procurement of wheat seed and release of new varieties should be based on previous data available with CDRI. Susceptible varieties such as Yecora and WL 711 should be discouraged with more emphasis given to Pak 81 and Punjab 81. Procurement of Lyallpur 73 for barani, Pavon for Sind and Blue Silver and Sonalika for late planting should continue until better replacements are found. Several promising triticale lines were observed at the NIAB and AARI stations with good yield and disease resistance. The introduction of triticale would

increase the diversity of germplasm in the country.

The VEC should review the disease results of 1983 if any NUWYT entries have been in the trials for two or more years and wait until next year if 1984 was the first year of entry of a candidate variety. This is possible since 2 years are required in the NUWYT trials before release.

CDRI will continue to monitor and collect data on the current crop in case disease incidence occurs during the later stages of crop development. At present, only limited success in disease development has been obtained in inoculated nurseries at CDRI Karachi, ARI, Bahawalpur, AARI, Faisalabad, NARC, Islamabad and CCRI, Firsabak. In these nurseries rust incidence is low even in the susceptible checks.

2.

The Seed Corporations of Sind and Punjab together with researchers, extension workers and farmers must develop ways of accelerating the supply of good quality seed of improved disease resistant varieties to farmers. The use of village level seed multiplication plots using progressive farmers and farmer to farmer seed exchange programs should be considered. The corporations could provide good quality authenticated basic or certified seed to progressive farmers in each village of the country for maximum effect. Seed rates could be reduced to 50kg seed /ha to achieve maximum multiplication of valuable seed. The progressive farmers would be given all assistance to grow the wheat seed on good land with recommended management. The farmers must be allowed to charge a reasonable premium for the new seed when it is sold within the village. Similar schemes and

strengthening of the seed supply systems in NWFP , Baluchistan and AJK are needed.

3.

More efforts are needed on researching more efficient means of testing technology on farmers fields and disseminating results to the farmer for quicker adoption. Extension demonstrations need to be improved and developed together with the researchers. Trials should be simple and focussed on key problems in specific areas selected for planting the demonstrations. Demonstrations should not only demonstrate potentials but also the principle components needed to determine the final yield. Varieties should be selected based on the recommendations for a selected area and should include the local check and newly released material. Trials should attempt to demonstrate wheat production following the most important cropping patterns in the area. Extension personnel must have a budget, facilities and transport for this activity . In other words if research is to have a payoff, the results must reach the client by way of fast farmer adoption.

4.

The CDRI pathologists should supply the stable sources of resistance against most prevalent virulent rust races either from locally developed or from international nurseries. There is an urgent need to strengthen the facilities at CDRI by way of staff, equipment, green house/growth chambers, land and transport to cope with the national requirements. Scientists from CDRI and provincial institutes should be sent for training in identification of stripe rust races at Wageningen, Holland. The work at the CDRI research station at Karachi was providing

positive results for screening of wheat material against leaf and stem rust and efforts should be made to continue this work at Karachi.

5.

Loose smut and flag smut are problem diseases especially in the Punjab. Karnal bunt is also gaining prominence and was found in NWFP and the Punjab last year. The use of fresh supplies of Vitavax or Baytan as seed dressings would help control these diseases. The use of an old traditional method of control where seed is soaked for 4 hours in water and then sun dried in temperatures above 100 F is also effective. All possible efforts should be made to disseminate this information at the Federal, Provincial and farm level and ensure proper treatment of valuable seed from the seed corporations. Samples of seed should be tested at the CDRI Karachi lab for incidence of smut.

6.

Funds for agricultural research at both the federal and provincial level must be stable. A minimum limit should be established below which no further cuts are made. Basic needs must be available and include sufficient funds not only for salaries but also some operational funds. Equipment and transport needs must be assessed and provided keeping in mind that these are consumable items that have only a limited lifetime. Replacements should be programmed into the budgets so that continuity of work exists and is not constrained by the lack of essential equipment or transport.

SPECIFIC TOPICS

Prior to leaving Karachi, topics of importance to the group were assigned to various scientists for discussion during the tour. The following is a summary of these topics.

PLANT PATHOLOGY

No report of any outbreak of rust in farmers fields have been seen or received throughout the country to date (end of March). Absence of rust is attributed to prolonged dry conditions and above normal temperatures in the months of January and February.

The National Wheat Disease Screening Nursery (NWDSN) comprising of 335 entries including existing commercial varieties, candidate varieties (under NUWYT) and promising advanced lines from the provincial breeders was planted throughout the country. The nursery was inoculated artificially with stripe rust in Northern areas and leaf rust at all of the locations. So far, leaf rust had developed well only at CDRI, Karachi and NARC. At all other locations its development was recorded but restricted. Stripe rust has been observed at ARI Tarnab and NARC on barley material included in the NUBYT and Barley observation nurseries. Stripe rust was also observed on susceptible local wheat varieties at the Khanewal seed farm, and the University, Faisalabad. Continued emphasis on screening of material through the NWDSN under high stress is strongly suggested. Combined collection of data by the breeders and pathologists together and the circulation of the results quickly to other provincial breeders is important.

Pakistan should also continue to utilize the facilities of the plant breeding institute at Njoro, Kenya for selection of sources of resistance from the NWDSN and international material planted at that station. A pathologist and breeder should be identified soon to participate in this exercise. The best time to visit Njoro is from the last week of August to the first week of September.

Loose smut continued to be in evidence in 1984. It was found in traces from Karachi to Sukkur from traces to 0.2% from Sukkur to the Punjab border, from traces to 10% in the Punjab, and traces in NWFP. The highest incidence of the disease was recorded on Sandal and Yecora wheat varieties in the Kamoke and Sheikhupura areas.

Two excellent experiments on loose smut were observed under the control of the plant pathologist at AARI Faisalabad. In one experiment spikes had been inoculated with a collection of smut spores in the previous season. Seed was collected and grown this year with various fungicide treatments and the old traditional soaking and drying solar treatment. The check showed at least 80% infection. The best treatments were Baytan, Panoram and the solar treatment where almost complete control was achieved. Vitavax was less efficient probably because of the use of old stock.

The other trial inoculated wheat lines during the 1983 season and grew the collected inoculated seed this season. Several entries showed no infection to smut. With the increase in use of susceptible varieties to loose smut like WL711 and Yecora the treatment of seed with fresh supplies of Baytan or

Vitavax is important. Farmers should also be encouraged and given demonstrations on how to use the solar method of control. It is suggested that if seed cannot be stored well that farmers treat their seed 48 hours before sowing since treated seed, improperly stored, can have poor germination. Small packets of the correct fresh fungicide should be provided to farmers with proper instructions to enable them to do this.

Flag smut is endemic in the barani tract of the Punjab and in AJK. This seed and soil borne organism causes up to 5% loss in tillers. Heavy infestation was noted at the Barani station, Rawalpindi. It is suggested that CDRI grow the NWDSN at this location to help identify resistance to flag smut in the national germplasm.

Foot rot was severe in the drought affected areas of the barani tract. More effort is needed to identify sources of resistance or suitable seed treatments to control the plant stand losses caused by this disease. Deep tillage with a moldboard plough seemed to offer some relief from this disease.

Helminthosporium leaf spot was noted in some fields. Yellow ear rot, a bacterial disease was found on WL711 from Rahim Yar Khan to Bahawalpur. Barley stripe disease *Helminthosporium gramineum*, was found to be heavily infesting barley in Faisalabad and the Swat valley. This is a seed borne disease easily controlled with systemic fungicides.

Although not directly the concern of pathologists, the group observed high incidence of aphids on barley and wheat at AARI and the University at Faisalabad. Some varieties of breadwheat like LU26 and barley were highly susceptible, while others seemed to

be less attractive to aphids. More research is needed on this topic especially since many plant viruses are transmitted by aphids, such as barley yellow dwarf.

NATIONAL UNIFORM YIELD TRIALS

The group felt that there had been a great improvement in the NUWYT this year following adoption of the suggestions made in the 1983 wheat travelling seminar report. Plots were well managed and will provide useful data.

Seed sent by breeders for inclusion in these trials were cleaner with less mixtures. Only one breeder provided seed of poor quality. This seed gave poor germination at all sites. However, the group members felt that the supply of seed could be further improved and made the following recommendations:

1. 2-4 kg of seed of advanced lines of the breeders should be sent to the wheat coordinator for multiplication at NARC one year before inclusion in the NUWYT. Seed would then be available for the wheat coordinator to prepare the NUWYT packets on time. He would be responsible for proper seed treatment and storage of all the entries supplied.

2. Complete information on the advanced lines sent should accompany the seed. Only entries that are in the provincial C-level yield and microplot trials should be sent. A preference should be given to entries on the list so that priority can be given to multiplying the most important lines. The breeders would indicate which of the entries he supplied are to be included in the NUWYT for the next year by preference. The seed

multiplication plots at NARC would be visited by the breeders either during the travelling seminar or later to authenticate the material and note the performance.

This procedure would not only help provide timely good quality seed for inclusion in the NUWYT but also provide seed to CDRI for inclusion in the NWDSN. However, more entries than that provided for NUWYT will be needed by CDRI for NWDSN.

3. For this year, 60 kg of seed of the entries for the 1984-85 NUWYT trials should be sent to the coordinator as soon as possible but no later than September 15. This includes 4 kg of extra seed for seed multiplication at NARC. 4 kg of advanced lines for the 1985-86 crop year should also be sent. Breeders should send seed for the NWDSN to CDRI as done previously.

4. The use of unreplicated trials in farmers fields was successful. These trials were easier to handle and better managed than in previous years. However, one scientist from the provincial institutes should be present during harvest to advise on the sampling of the plots. Three samples from the middle 4 rows at least 2 meter long each should be taken for yield assessment. Data on row spacing should accompany the yield data along with comments on the uniformity of the strip. The samples should be sun dried before weighing. If the strips are not uniform because of soil problems samples should only be taken from areas representative of the general performance of all varieties.

5. All data should be submitted to the coordinator as early as possible. Computer analysis of the data will be done this year to speed up the process and utilise more of the

information provided. All data should be by replication.

6. For next year all seed in the NUWYT will be treated with fresh Vitavax or Baytan. The seed supplied to CDRI will not be treated.

7. A good Durum and Triticale line will be included as a check in the NUWYT normal nursery. A universal check will also be included. The breeders should add the best local check. He can include other commercial lines if space permits.

8. Attempts should be made to include the proper varieties in the proper nurseries otherwise performance may be less than expected.

9. NUWYT normal should be planted no later than November, NUWYT short in December and NUWYT Rainfed from Oct to Nov.

KAGHAN SUMMER NURSERY

The 1983 wheat crop was the best ever. Most breeders were able to harvest good quantities of good quality seed. The use of a fertilizer spreader, 1, 3 and 6 row seed drills and reasonable control of weeds with herbicides helped the performance of the crop. The following suggestions were made:

1. There are still problems with the funding of the program. Release of funds last year was late and given to the officer in charge long after harvest. If the nursery is going to be successful funds must be provided on time to pay for the labor needed to manage the plots and pay for all operational costs.

2. The vehicle situation is very poor. One jeep and

pickup are to be auctioned at Tarnab. The other jeep has been shifted to Tarnab and is not in operation because of defective breaks and steering. The only vehicle presently available is that loaned by CIMMYT for the coming season.

3. More beds and rest house facilities are needed to accommodate the large number of scientists that descend on the station during planting and harvesting.

4. There is an important need to keep some of the labor or chowkidars as permanent labor. This is because labor is scarce and expensive in this region and many temporary laborers disappear within a day of experiencing the hard work required of them. A minimum number of permanent people are needed to maintain the good program of last year.

A meeting of the management committee should be called by the Member Plant Science, PARC as soon as possible to review and take action on these 4 points.

Land has been allocated by the officer incharge of the station for this year. Just over 8.5 acres will be available for wheat, just under 6 acres for potato and 2 acres for chickpea. Land will be ready for planting by the last week of May. The following schedule is suggested to prevent congestion of the facilities during planting;

Punjab - 25-30 May

NWFP - 1st week June

CDRI, Karachi and Sind - 25 May

NARC - 1st week June

The actual timing will depend on rainfall and the officer incharge will confirm by cable the exact timings.

The wheat and chickpea coordinators will visit Kaghan in mid May with the officer incharge to allocate specific plots to programs. The AARI Wheat Institute at Faisalabad should be provided seed from all their sub-stations and only one group come to plant at Kaghan. The sub-stations should visit their plots later in the season. The same procedure can be used for harvest. All programs must leave a copy of their plot layout at the station for use by the wheat botanist and visitors.

Attempts will be made to procure a simple rain guage and Max Min thermometer for the station.

The NARC will provide a fertilizer spreader, and seeding equipment to the station as in 1983. This will be transported by the CIMMYT office to Kaghan.

INTERNATIONAL NURSERIES

65 Nurseries were sent to collaborators by CIMMYT and about an equal number by ICARDA in 1983. Some of the nurseries were duplicated or had duplicate entries. This problem will be improved after this year when CIMMYT will develop the nurseries for bread wheat, durum wheat and triticale and ICARDA those for barley. However, to reduce the number of imported nurseries, it is suggested that most of the nurseries are planted at the main wheat stations and only a few specific nurseries are sent to sub-stations. Breeders at the sub-stations can visit, note, and obtain samples of seed from their main stations.

All nursery requests should be sent to the CIMMYT wheat advisor as soon as possible. All nurseries should be sent by the International Centres to USAID, American Embassy, Islamabad,

Pakistan for the attention of CIMMYT for fast clearance. All nurseries received will be sent through the wheat coordinator to the individual scientists. The wheat coordinator and the CIMMYT wheat advisor will make the final decision on where each nursery will be planted.

BARANI WHEAT

This report has already described the situation of wheat in the barani tract. The following are some suggestions for improvement in this area.

1. Moisture conservation is a necessary component of dryland agriculture. Farmers presently accomplish this by keeping their land fallow for one year before planting wheat. During this time, the better farmers, cultivate their fields to reduce weed growth and reduce moisture losses by transpiration. If a farmer grows a kharif crop after the wheat crop, during the monsoon period, moisture conservation is not good, and unless timely rains occur, there is usually insufficient moisture in October to plant wheat.

One way to improve this situation is to introduce deep tillage to the farmers. The group visited two deep tillage experiments conducted by the wheat program at NARC. At these sites, deep tillage with a moldboard plough had significantly improved wheat growth. Yields of 4 /ha will be obtained even in this dry year.

The major difference between the moldboard and

conventionally cultivated plots was rooting. The moldboard ploughed plots had rooted much deeper and had tapped a larger area of available moisture and nutrients. The moldboard ploughing was done in the June before planting in October to conserve as much monsoon rain as possible. The better rooting is postulated to be the result of breaking a compact layer or plough pan. The group suggests that priority be given to this type of research across soils and across rainfall zones.

2. Lyallpur 73 is the major variety used by farmers in the barani tract apart from some old traditional varieties. No other variety is presently recommended specifically for the barani tract. K 342 or Barani 83 has been recommended for approval by VEC. This variety compared very favorably with Lyallpur 73 in the plots seen by the group. It has good disease resistance and should be released quickly so that the varieties grown in the barani tract are diversified. The Punjab Seed Corporation should put emphasis on multiplication of this variety and distribution into the barani tracts.

3. More emphasis is needed on breeding new varieties for the barani area. These varieties should have vigorous root systems, have the ability to emerge from fairly deep seeding with vigor, and have tolerance to drought. The emergence from deep seeding is important because farmers have to plant fairly deep to place the seed in contact with moisture. Breeders need to develop specific dryland screening nurseries to be planted under barani conditions to identify better varieties. Seedling vigor can be selected by undertaking seeding depth screening of materials.

4. Seeding wheat quickly into moisture is essential for obtaining good plant stands. The traditional 'Pora' method is efficient, but slow, at placing the seed in the moisture zone and not covering the seed too deeply. Contract machine planting would be quicker and in fact many farmers are adopting this procedure along with contract ploughing. More research is needed on improving the existing tractor mounted drill. The present drill is relatively cheap, has a three point hitch, and plants wheat seed uniformly deep without covering the seed too much. Improvements should be made in the seed distribution system, the addition of a fertilizer placement device and the use of harder more durable materials for its construction.

5. It has been demonstrated that both nitrogen and phosphorus are essential for high barani wheat yields. Even in the dry year of 1984, fertilizers improved yields. Simple demonstrations are needed on how these elements are needed in combination to give maximum benefits. The soils of Pakistan are also strong fixers of phosphorus. More research is needed on banding of phosphorus for more efficient use of this element.

6. Weeds are a problem in the barani tract when rains occur. The major weed problems are broadleaf weeds. Several cheap herbicides are available for effective control of these weeds. More effort is needed to demonstrate the effectiveness and proper application of broadleaf herbicides in the barani tract. Weed control is complicated by the farmer practice of growing mustard for fodder in the wheat crop. More studies are needed on this very important practice.

WHEAT BASED CROPPING PATTERNS

The cultivation of wheat in Pakistan can be divided into the following distinct cropping patterns:

Cotton - Wheat

Rice - Wheat

Sugarcane - Wheat

Maize - Wheat

Summer Vegetable - Wheat

and barani wheat where wheat usually follows fallow and the wheat is followed by a Kharif fodder crop.

Very little of the irrigated land is grown to wheat following fallow. This adds to the complexity of growing wheat since prior cropping influences the management decisions that have to be made in the wheat crop.

1. Planting date is affected by cropping pattern. The effect is minimal in the barani tract (except where wheat follows kharif fodder or peanut), and after maize or vegetables. These latter two crops are usually harvested by October to allow proper planting times for wheat. Wheat following sugarcane can delay planting depending on the date of harvest of the cane. The harvesting of cane also being dependent on the indent given by the mills. In the irrigated areas of NWFP wheat is usually late following sugarcane because of slower development of the crop in this area and the incapacity of the mills to handle all the cane if it was to be harvested early.

Wheat following cotton can delay wheat planting especially if farmers use late maturing cotton varieties and choose to keep the crop for a late picking. The removal of the cotton sticks

before land preparation for wheat also delays planting.

Wheat following rice has probably the greatest delay on wheat planting. In the Punjab, the major rice variety is Basmati, which matures in late November. Because of shattering farmers prefer to dry and thresh the crop directly in the field before preparing the soil for wheat. This causes a two week delay on average. Even where IR6, which matures earlier, is grown, delays are experienced because of the unfavorable condition of the soil after rice. Much time and effort are needed to prepare a good seed bed for wheat.

More research is needed on fitting crops together in patterns and to develop shorter maturity varieties. Production should be expressed on an annual basis in weight or rupees rather than for each crop. A team approach is needed that combines scientists across crop commodities.

More research is also needed to quantify the effect of late planting on wheat. To do this it is proposed that the wheat coordinator develop a national variety by time of planting trial that can be placed at the different research stations in the country. The data from these experiments should be analysed by computer. Other data presently available at research stations and seed farms should be collected and analysed. The major benefit of a national trial will be the uniform inclusion of standard varieties over time. Any differences in annual temperatures and disease incidence can then be monitored through the effect on yield in these standard varieties.

2. Fertilizer requirements of wheat following fallow are different from those following rice or cotton or any crop. Soil

scientists need to identify response surfaces for N and P in the major cropping patterns involving wheat. We can then make economic recommendations that are more likely to be adopted by farmers. These trials should follow the cropping pattern under study with a typical planting date for wheat in the pattern.

3. Wheat following maize, vegetables, sugarcane and cotton pose few soil preparation problems except handling of crop residues. After rice the situation is different. Not only are crop residues a problem but soil structure is poor and it is difficult to obtain a good seed bed. A plough pan also exists in some soils because of puddling. This impedes water movement, resulting in water logging of the wheat. Wheat is particularly sensitive to waterlogging in the initial stages of growth and this factor may account for the poor stands normally seen in these fields. Poor land preparation and poor seed to soil contact also reduces germination. The plough pan reduces the rooting of wheat and the availability of water and nutrients found below the pan.

More research is needed to develop the best combination of land preparation operations with different available implements to provide a good seed bed in a rice-wheat cropping pattern. The need to study the effect of deep tillage on the rice and wheat crop and the subsequent effect on water requirements is also suggested. Speedier land preparation would enable faster and more timely planting and therefore better yields. Minimum tillage should be tried where suitable drills are available.

4. Weeds are controlled by farmers by changing cropping patterns. More work is needed in identifying the effects of different cropping patterns on the weed spectra in wheat.

ON-FARM TRIALS/TESTING

This topic is defined as any trial which is placed in farmers fields to either demonstrate, verify or research a component of the agricultural production system. During the seminar, research and extension trials were observed.

In the Sind, extension trials were seen at the adaptive research farm at Oderolal and in farmers fields. At the adaptive research farm, trials mainly consisted of NUWYT and microplot plots of breeding material. The station was being used as a substation of research. Good demonstrations on the importance of nitrogen and phosphorus fertilization, good weed control and other basic components of a good wheat management package were not evident. Two stops in farmers fields also had microplot trials and a fertilizer trial. These trials were well managed but the fertilizer treatments only confirmed that fertilizer increased yield and allowed very little further analysis. At the other site a herbicide company demonstrated the efficiency of chemical weed control.

In the Punjab many more extension demonstrations were seen. It seemed that a general set of experiments were designed in consultation with the researchers and then placed in the fields throughout the province. Five sets of trials were assigned to each field assistant. Trials included spacing, seedrate, variety, fertilizer, weed control and seed treatment irrespective of the problems at each site. Most of the trials were well managed and much effort had gone into them. However, the group felt that these trials need to be designed to demonstrate practical ways of increasing production in a specific site. Not

all sites have the same problems. A simple interview around each site to identify key researchable issues would help focus efforts better. The staff should then sit down and plan simple experiments to demonstrate how these problems can be solved. There is no need to demonstrate line sowing of wheat at different spacing if all the farmers broadcast their seed. A more useful trial would compare line sowing using available equipment against broadcasting. If plant stands are not a problem then none of these trials is necessary.

The adaptive research farm at Sheikhupura was visited and appeared to be a duplicate of the provincial research stations. The group felt that these stations should be used to demonstrate important principles to farmers, seed multiplication or for training. Much time is required to keep these trials looking good. This valuable time would be better used by placing trials in farmers fields. However, the group was impressed with the quality of the trials and the enthusiasm of the staff at this farm.

The extension staff of the Punjab have had no funds or facilities for laying out trials since 1972 but have relied on the farmer to supply the inputs. The adaptive research cell and the Sind extension staff do have funds for purchase of inputs. Obviously, this problem needs to be looked into.

In NWFP the group visited a seed farm and one extension demonstration. These trials only grew one variety, Pak 81. It would be more useful to at least compare available varieties with Pak 81. The management of the plots was good. The extension staff did have funds for layout of trials.

The group also visited many of the small onfarm trials laid out by the wheat program of NARC. These trials were developed after an initial preliminary survey had been made and identified key problems in each area. Trials were simple and well managed and designed to quantify some aspect in the management package. The data will be analysed statistically and economically to provide recommendations more likely to be adopted by farmers. Trials consisted of:

1. Varietal comparisons including the local check.
2. A fertilizer experiment with 8 treatments to quantify N and P response surfaces and the presence or absence of a N x P interaction.
3. A simple 3 level potash trial
4. A comparative superimposed chemical weed control trial and in some locations,
5. A deep tillage trial using various implements.

The NARC wheat team did have the advantage of having excellent facilities in terms of equipment and vehicles to conduct this type of research. However, if these trials provide useful information to farmers then investment in this sector of agricultural research will have high payoffs. The group recommends that the research and extension staff be strengthened in terms of these logistic requirements to expand this type of research.

The other criticisms of the NARC onfarm wheat trials were the lack of involvement of other programs in the activity and that the majority of trials were researcher managed. More work amongst commodity and discipline research programs is needed.

There should also be more collaboration and interaction with other agencies, both research and extension, who are also working in the area.

Researcher managed plots do provide data on potential yields in an area, but researchers should also be interested in how the technology performs when the farmer manages the plots. To do this one or two components of the management package should be researched at improved levels with the rest of the package managed by the farmer. For example, the researcher should give seed of a new variety to a farmer and ask him to grow it in the same way as normal and alongside his traditional variety. If it performs poorly it means either the variety is not better than the farmers (feed back to breeder) or some other component in the management package needs further study. The farmer managed plots can be compared with the researcher managed plots to see if potential yields are being achieved.

Superimposed trials are particularly useful for fertilizer experiments, especially if efficient response surface designs are used. The trial can be superimposed over the farmer management and give valuable information on responses under farmers management. Economics can then determine the best economic returns. Obviously if a farmer plants late, and uses an old variety, the response curve and economics to N or P will be different than if he planted on time and used an improved variety.

SEED MULTIPLICATION

The travelling seminar visited Sind, Punjab and NWFP of which only the first two have a provincial seed corporation.

NWFP relies on import of seed from the Punjab Seed Corporation and multiplies its seed through contract seed growers. Prebasic seed is being produced at CCRI Firsabak but in limited quantities. One of the major problems for wheat in NWFP is seed. The extension people say that farmers are reluctant to keep their own seed because of storage problems. He prefers to buy seed each year from his neighbor or store. The group recommends that:

1. NWFP develop a seed multiplication system either within the private or government sector to help alleviate the shortfall in quality seed available to farmers. This quality seed could be distributed at village level to interested farmers for further multiplication. A premium should be placed on this seed to stimulate farmer participation and help him offset the cost of proper storage. Seed would then be available at the village level for farmers to buy.

2. Extension develop training and materials on how to store seed efficiently for next years crop. The province cannot possibly supply each farmer new seed every year, but must rely on some seed stored by farmers.

In the Sind we visited the Pai Seed Farm at Sakrand. The land at this station is heavy in texture and waterlogging and salinity exists in many fields. It was explained that the only way to seed was to flood the soil and then broadcast seed into the standing water. The soil was too heavy to allow other methods of seeding. As such, plant stands were poor and weeds a

big problem. Facilities, such as tractor mounted sprayers for herbicide application, seed drills of appropriate design and a good combine were not available. Several farmers also complained that seed from the Sind Seed Corporation was mixed and not as good as their own seed. The group suggests that:

1. An alternative to the Pai Farm be sought which has a better soil for this important function. An alternative would be to contract out to bigger progressive growers.

2. Investment in modern facilities for planting, weed control and harvest must be made if the quality and quantity of seed is to improve.

3. Seed imported from the Punjab should be treated with Vitavax or Baytan to prevent the spread of loose smut and karnal bunt.

The Punjab seed corporation farm at Khanewal was well managed and did an excellent job of supplying good quality seed last year. The farm emphasized the multiplication of Pak 81, Punjab 81, and Blue Silver the 3 varieties with the greatest demand. The group makes the following suggestions.

1. All seed should be treated with fresh supplies of Vitavax or Baytan to prevent the spread of loose smut and karnal bunt. A package of fungicide should accompany the seed. If seed is stored improperly but is treated, germination is sometimes impaired. It is proposed that seed treatment should occur 48 hours before seeding to avoid this problem. Literature should accompany the fungicide on how to treat the seed.

2. Emphasis should be given to the new barani variety Barani 83 for distribution in the rainfed tracts. Multiplication

of the other advanced lines recommended by VEC should also be given priority especially the short duration variety Faisalabad 83 for the rice tract.

APPENDIX I

SCHEDULE OF THE WHEAT TRAVELLING SEMINAR

- March 16 - Assemble Karachi
- March 17 - Karachi - Tandojam - Hyderabad
- March 18 - Hyderabad - Sakrand - Kotdiji - Sukkur
- March 19 - Sukkur - Rahim Yar Khan - Bahawalpur
- March 20 - Bahawalpur - Khanewal - Jhang - Faisalabad
- March 21 - Faisalabad
- March 22 - Faisalabad - Sheikhupura - Lahore
- March 23 - Lahore - Gujranwala - Gujrat - Dina -
Gujar Khan - Sukh Mor - Islamabad
- March 24 - Islamabad - Firsabak - Tarnab - Peshawar
- March 25 - Peshawar University - Charsadda - Mardan -
Malakand - Saidu
- March 26 - Saidu - Swabi - Tarbela - Islamabad
- March 27 - Islamabad - Murree - Islamabad
- March 28 - Islamabad - Rawalpindi

APPENDIX - II

LIST OF RESEARCH INSTITUTES/STATIONS/GOVT FARMS VISITED BY PARTICIPANTS OF WHEAT TRAVELLING SEMINAR FROM 16-3-84 TO 29-3-84

1. Cereal Disease Research Institute, Karachi
2. Nematological Research Centre, Karachi
3. Agricultural Research Institute, Tandojam
4. Atomic Energy Agricultural Research Centre, Tandojam
5. Sind Adaptive Research Farm, Oderolal
6. Sind Seed Corporation, Sakrand
7. Agricultural Research Station, Kotdiji
8. Cotton Research Station, Rahim Yar Khan
9. Agricultural Research Station, Bahawalpur
10. Punjab Seed Corporation Farm, Khanewal
11. Ayub Agricultural Research Institute, Faisalabad
12. University of Agriculture, Faisalabad
13. Nuclear Institute for Agriculture & Biology, Faisalabad
14. Adaptive Research Farm, Sheikhupura
15. Government Agriculture Farm, Gujranwala
16. Cereal Crops Research Institute, Pirsabak
17. Agricultural Research Institute, Tarnab, Peshawar
18. Adaptive Research Farm, Mardan
19. Agriculture Research Station, (North) Mingora, Swat
20. Cereal Disease Research Institute, Murree
21. National Agricultural Research Centre, Islamabad
22. Barani Research Station, Rawalpindi

APPENDIX - III

LIST OF PARTICIPANTS

NAME	SPECIALIZATION	DATES PARTICIPATED
CIMMYT-PAKISTAN		
1. Dr. Peter R. Hobbs	Wheat Agronomist	16-3-84 to 29-3-84
2. Dr. Derek Byerlee	Agric Economist	20-3-84 to 21-3-84
3. Dr. Tom Hart	Maize Agronomist	24-3-84 to 26-3-84
INTERNATIONAL SCIENTISTS		
3. Dr. M. Ogemma	Plant Breeder Kenya	16-3-84 to 29-3-84
4. Dr. C. Mann	Plant Breeder Thailand	17-3-84 to 29-3-84
5. Dr. E. Saari	Plant Path Thailand	24-3-84 to 29-3-84
6. Dr. Saunders	Agronomist Thailand	24-3-84 to 29-3-84
NARC		
7. Dr. N. I. Hashmi	Plant Breeder	16-3-84 to 21-3-84
8. Dr. B. Roidar Khan	Agronomist	21-3-84 to 29-3-84
9. Mr. M. Munir	Agronomist	20-3-84 to 23-3-84
10. Mr. Nafees Kisana	Plant Breeder	16-3-84 to 29-3-84
AARI FAISALABAD		
11. Dr. M. A. Bajwa	Plant Breeder	20-3-84 to 22-3-84
12. Mr. Ghulam Sabir	Plant Breeder	16-3-84 to 29-3-84
13. Mr. M. Arshad Khan	Plant Pathologist	16-3-84 to 29-3-84
NIAB - FAISALABAD		
14. Mr. Siddique Sadiq	Plant Breeder	16-3-84 to 29-3-84
BARANI INSTITUTE CHAKWAL		
15. Ch. Ghulam Ahmed	Agronomist	16-3-84 to 29-3-84
CDRI		
16. Dr. M. Aslam	Plant Pathologist	16-3-84 to 29-3-84
17. Dr. A. K. Khanzada	Plant Pathologist	16-3-84 to 29-3-84

18. Mr. M.A.S. Kirmani	Plant Pathologist	16-3-84 to 29-3-84
19. Mr. A.A. Hakro	Plant Pathologist	21-3-84 to 29-3-84
ARI - TANDOJAM		
20. Mr. A.H. Natali	Wheat Breeder	16-3-84 to 29-3-84
21. Mr. Wahid Baksh Baloch	Plant Pathologist	16-3-84 to 29-3-84
22. Mr. Ghulam Qadir Abbasi	Agric Extension Specialist	16-3-84 to 29-3-84
A.E.A.R.C. - TANDOJAM		
23. Dr. K.A. Siddiqui	Wheat Breeder	17-3-84 to 18-3-84
ARI SARIAB, QUETTA		
24. Mr. Sher Mohammad	Wheat Breeder	16-3-84 to 29-3-84
C.C.R.I. PIRSABAK		
25. Mr. Aslam Khan Khattak	Wheat Breeder	16-3-84 to 29-3-84
26. Mr. Khaista Gul	Wheat Breeder	16-3-84 to 29-3-84
ARI TARNAB		
27. Mr. S. Sajidin Hussain	Ag Economist	25-3-84 to 26-3-84
S.W.N. KAGHAN		
28. Allauddin Khan	Wheat Breeder	16-3-84 to 29-3-84
AZAD KASHMIR		
29. Mr. Afzal Turk	Soil Chemist/ Agronomist	16-3-84 to 29-3-84