Pak. J. Sci. Ind. Res. 2005 **48**(5) 366-367

Short Communication

Evaluation of Commercial and Candidate Bread Wheat Varieties for Durable Resistance to Rusts in Pakistan

Syed Jawad Ahmad Shah*, Tila Muhammad and Farooq-e-Azam
Nuclear Institute for Food and Agriculture (NIFA), Tarnab, Peshawar, Pakistan

(received June 22, 2003; revised May 26, 2005; accepted July 26, 2005)

Abstract. Commercial and candidate bread wheat varieties were evaluated for durable resistance to rusts. The candidate varieties included genotype lines from the National Uniform Wheat Yield Trial, including Rainfed, Normal and Short trial programmes. A total of 89 genotype entries were evaluated. The evaluation was done on the basis of well recognized visual phenotype marker, the adult plant leaf tip necrosis. It was noted that 64% of the genotype varieties expressed this phenotype marker.

Keywords: bread wheat, candidate wheat varieties, rust resistance, wheat rusts

Bread wheat (*Triticum aestivum* L.) is the staple food of the population, and an important commodity in the economy of Pakistan. Therefore, every Government agenda during the last 50 years has received the top-most priority for increasing wheat production with the objective of attaining self-sufficiency in this important food crop. Yellow rust (Yr) and leaf rust (Lr) are the major biotic constraints, which have been the cause of putting wheat yields at risks in Pakistan. Genetic resistance is the most effective and environmentally sound method of controlling these diseases (Hussain *et al.,* 1997). Resistance to rusts in improved wheat cultivars, in the past, was solely based on major race-specific genes that often succumbed to virulent pathogenic mutant strains within five to seven years (CIMMYT, 1992). This was experienced in Northern parts of Pakistan in the early 1990s when two popular wheat cultivars, namely, Pirsabak-85 and Pak-81, became susceptible to Yr9 resulting in yield losses of up to 40% (Saari *et al.,* 1995). These losses can be minimized by carefully screening the commercial and future candidate wheat genotypes for slow rusting, before their release for field cultivation. The durability of resistance can be assessed by careful observation of phenotypic traits, and analysis of the area under disease progress curve (AUDPC). With this objective in view, field screening experiments on 54 promising genotypes and 35 commercial wheat varieties, received from the National Wheat Improvement Programme, were carried out at the National Institute for Food and Agriculture (NIFA), Peshawar, Pakistan. The candidate wheat genotypes were taken from the National Uniform Wheat Yield Trial-Normal (NUWYT-N), National Uniform Wheat Yield Trial-Short (NUWYT-S), and National Uniform Wheat Yield Trial-Rainfed (NUWYT-R). The commercial wheat varieties were taken from the Trap Nursery (TN). NUWYT-N, NUWYT-S and NUWYT-R genotypes consisted of 20, 20, and 14 entries, respectively, which were sown in replicated trials, whereas the TN included 35 commercial varieties which were sown next to the candidate genotype trials. Every entry was planted in a single meter row, separated by 0.3 m. Two spreader rows, with a mixture of susceptible genotypes (Local White, Morocco and Sonora), were planted around the trial nurseries. In addition, two rows of susceptible check (Local White) were planted, 20 entries apart, in in the TN entries.

Despite massive inoculation of the spreader rows, after sunset, using Yr and Lr virulent races prevailing in the North-West Frontier Province of Pakistan, it was not possible to obtain satisfactory epidemic disease levels. This may have been due to the unfavourable dry weather that had prevailed during the whole growing season. Under our experimental field conditions, adult plant leaf tip necrosis (APLTN), a recognized visual marker for the presence of durable rust resistance genes (Lr34 and Yr18), was used as the evaluation tool in the absence of disease response to the virulent rust races in the experimental field inoculations (CIMMYT, 1992; Singh, 1992).

Out of the 89 genotypes studied, 57 showed APLTN (Table 1). The number of entries with APLTN varied between 6-22 per experiment. All the promising entries in the NUWYT-R genotypes showed that trait. In the other three experiments, up to 75% of the genotypes showed this useful morphological marker. The commercial varieties and candidate wheat genotypes used in the present study were either direct selections from CIMMYT (International Maize and Wheat Improvement Centre, Mexico), or the CIMMYT

*Author for correspondence; E-mail: nifa@psh.paknet.com.pk

Table 1. Screening of commercial and candidate bread wheat varieties for durable rust resistance by using phenotypic marker of adult plant leaf tip necrosis at National Institute for Food and Agriculture (NIFA), Peshawar, Pakistan during 2000-2001

Trial variety designation*	Total genotype entries	Varieties expressing adult plant leaf tip necrosis (APLTN)	
		number	%
Commerical	35	22	62.0
NUWYT-R	14	14	100.0
NUWYT-N	20	15	75.0
NUWYT-S	20	06	30.0
Total	89	57	64.0

*NUWYT-R = National Uniform Wheat Yield Trial-Rainfed; NUWYT-N = National Uniform Wheat Yield Trial-Normal; NUWYT-S= National Uniform Wheat Yidld Trial-Short

germplasm-derived varieties. APLTN is expressed in several Mexican bread wheat cultivars and numerous breading lines from CIMMYT's bread wheat improvement programme (Singh, 1992). It was noted that 64% of the entries harboured APLTN, which were associated with durable rust resistance genes (Lr34 and Yr18) responsible for slow rusting (Drijeondt and Pretorius, 1989). These entries need to be evaluated again over sites and seasons under artificial rust epidemic conditions for confirmation of APLTN before their release for cultivation in the farms and fields. This is necessary as Inqilab-91 is currently cultivated on about 80% of the wheat growing areas in Pakistan, thus putting wheat growing production in a vulnerable situation and increasing the risk of a major epidemic.

Acknowledgement

The first author acknowledges the help of Dr. Etienne M. Duveiller, Regional CIMMYT Wheat Pathologist for South Asia based in Nepal, for his guidance and suggestions during reviewing this paper.

References

CIMMYT. 1992. Improving the productivity of maize and wheat in developing countries: an assessment of impact. In: *CIMMYT 1991 Annual Report*, pp. 36-38, International Maize and Wheat Improvement Center (CIMMYT), Mexico.

Drijeondt, S.S., Pretorius, Z.A. 1989. Greenhouse evaluation of adult plant resistance conferred by the gene Lr34 to leaf rust of wheat. *Plant Dis.* **73:** 669-671.

Singh, R.P. 1992. Association between gene Lr34 for leaf rust resistance and leaf tip necrosis in wheat. *Crop Sci.* **32:** 874-878.

Saari, E.E., Hashmi, N.I., Kisana, N.S. 1995. Wheat rust and Pakistan: an update (Year 95 doc.), pp. 1-3, National Agricultural Research Council (NARC), Islamabad, Pakistan.

Hussain, T., Bowden, R.L., Gill, B.S., Cox, T.S., Marshall, D.S. 1997. Performance of four new leaf rust resistance genes transferred to common wheat from *Aegilops tauschii* and *Triticum monococcum. Plant Dis.* **81:** 582-586.