

Yellow Rust prevalence in early adapted wheat genotypes for the breadbasket of South Asia

Md. Farhad^{1,5} | Shashi B. Tripathi¹ | Ravi P. Singh² | Arun K. Joshi^{3,4} | Pradeep K. Bhati³ | Suchismita Mondal² | Uttam Kumar^{3,4}

Background:



IGP-South Asian bread basket

- 1°C increase in temperature, cause 6±2.9% wheat yield loss globally (Zhou et al., 2017)
- IGP provide 15% of global wheat
- 51% of this breadbasket is expected to be transformed as heat-stressed, short-season, sub-optimal wheat production zone by 2050 (Ortiz et al., 2008)

Wheat cultivation scenario at IGP:

- Planting wheat on mid-November
- Pre-planting irrigation is the common practice
- Terminal heat stresses
- 3-7% yield loss for every 1°C increase

Early planting provides several advantages

- ✓ Utilize residual soil moisture after the monsoon
- ✓ Get more grain filling time (longer crop duration)
- ✓ Escape terminal heat stress and YR incidence

Objective:

To measure the occurrence of yellow rust disease in early adapted genotypes at IGP

Experiment 1: Identify agro-morphological traits important for adaptation to early planting

Genotypes : 600
Replications : 2
Planting Time (PT): 2 (Early and Timely)
Seasons: 3
Design: 10x2 Alpha lattice design
Plot dimension: 4 meter x 1.32 meter
Row to row spacing : 22 cm



Table 1: Day differences for early planting

Season	Planting		Difference
	Time	Date	
S1	EP	24-Oct-17	17 Days
	TP	10-Nov-17	
S2	EP	17-Oct-18	24 Days
	TP	10-Nov-18	
S3	EP	20-Oct-19	16 Days
	TP	05-Nov-19	

S1= Season 1, S2= Season 2, S3= Season 3, EP= Early planting, TP= Timely planting
↑= Increasing sense, ↓= decreasing sense

Figure 1: Vann diagram of selected genotypes for early and timely planting

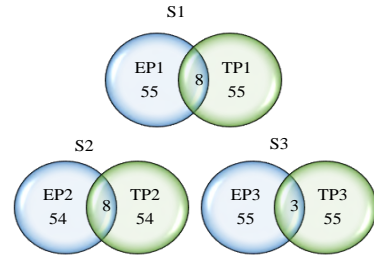


Table 2: Selected traits and their increasing or decreasing impact on stability index in respective planting time for different seasons

Traits	S1 EP	S2 EP	S3 EP	S2 TP	S3 TP
PG_DTB	↑	↑	↑	↑	↑
PG_BTH	↑	↑	↑	↓	↓
PG_GFD	↑	↑	↑	↓	↓
HUS	↑	↑	↑	↓	↓
FLGLFL	↑	↑	↑	↑	↑
FLGLFW	↑	↑	↑	↑	↑
EGC	↑	↑	↑	↑	↑
SR	↑	↑	↑	↓	↓
CTIR	↑	↑	↑	↓	↓
TGW	↑	↑	↑	↑	↑
GRYLD	↑	↑	↑	↑	↑

Experiment 2: The effect of early planting on the prevalence of yellow rust disease

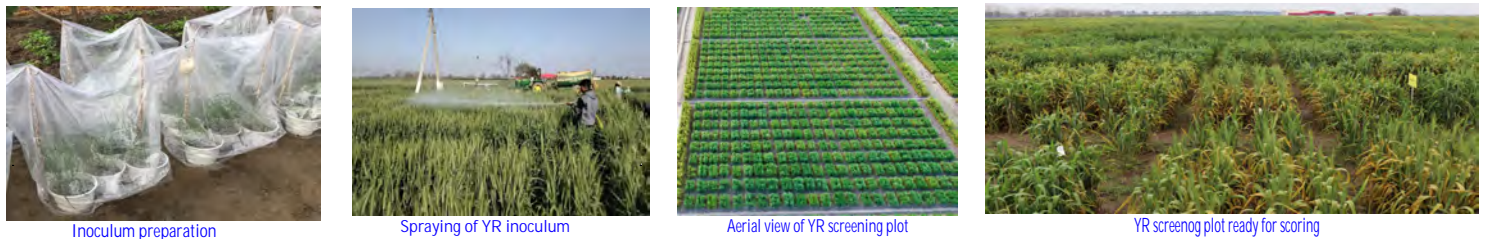


Figure 2: Flow chart of linkage between two experiments

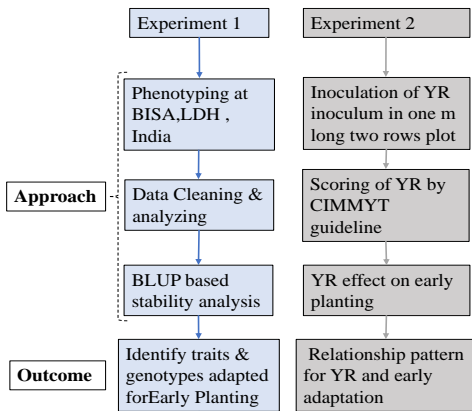
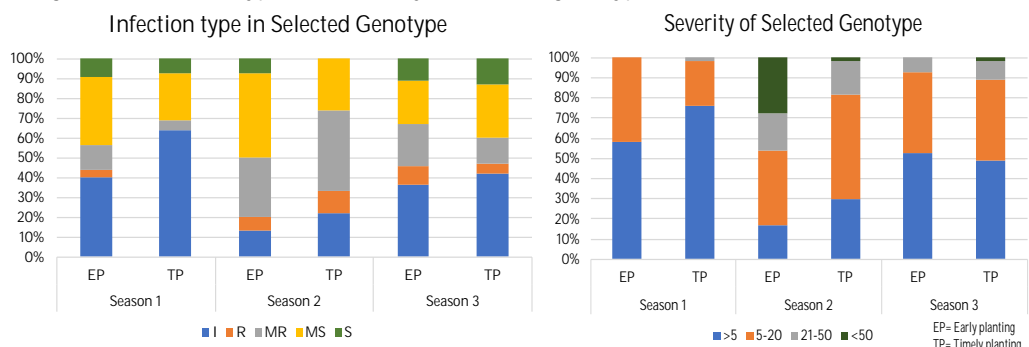


Figure 3: Infection type and Severity of selected genotypes on a scale of CIMMYT Guideline



Conclusion:

1. Early adapted genotypes showed higher level of YR severity.
2. Low immune reactions were noted in early genotypes, while S and MS were relatively higher than late adapted genotypes.
3. Interestingly R and MR type of reaction were higher in early adapted genotypes.
4. Although YR response is generally skipped in early planting wheat, it needs focused research to identify genotypes with desirable YR resistance while breeding for early sowing.

Host reaction	Symptom
I= Immune	No visible infection
R= Resistant	Necrotic areas with or without small pustules, no uredia present
MR= Moderately resistant	Small pustules surrounded by necrotic areas
MS= Moderately susceptible	Medium-sized pustules, no necrosis, some chlorosis
S= Susceptible	Large pustules, generally with little or no necrosis or chlorosis

¹TERI School of Advanced Studies, Vasant Kunj, New Delhi-110070, India
²CIMMYT, Carretera Mexico-Veracruz Km. 45, El Batán, Texcoco, Mexico, C.P. 56237
³Borlaug Institute for South Asia (BISA), New Delhi-110012 India
⁴CIMMYT, NASC Complex, DPS Marg, New Delhi-110012, India
⁵Bangladesh Wheat and Maize Research Institute (BWMRI), Dinajpur-5200, Bangladesh
Presented at 2021 BGRI Virtual Technical Workshop held on October 6-8, 2021, Cornell University, Ithaca, New York, USA.