Results of the 11th Helminthosporium Monitoring Nursery 2002-2003

Jointly organized by CIMMYT, NARC and IAAS, and conducted in South Asia Partnership with cooperation from Bangladesh, India and Nepal

Compiled by:

E. Duveiller and R.C. Sharma

Results of the 11th Helminthosporium Monitoring Nursery 2002-2003

Jointly organized by CIMMYT, NARC and IAAS, and conducted in South Asia Partnership with cooperation from Bangladesh, India and Nepal

Compiled by:

E. Duveiller and R.C. Sharma

Table of Contents

Title	Page
List of Cooperators	2
Information on 11th HMN Testing Sites in South Asia	3
Table 1. List of Genotypes in 11th HMN 2002-03	4
Table 2. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Bhairahawa, Nepal	5
Table 3. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Rampur, Nepal	6
Table 4. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Tarahara, Nepal	7
Table 5. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Dinajpur, Bangladesh	8
Table 6. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Jamalpur, Bangladesh	9
Table 7. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Jessore, Bangladesh	10
Table 8. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Varanasi, India	11
Table 9. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Faizabad, India	12
Table 10. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Assam, India	13
Table 11. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Cooch Behar, India	14
Table 12. Average values of some important characters of 30 wheat entries tested in the 11th HMN at Karnal, India	15
Table 13. Average area under the disease progress curve (AUDPC) of HLB for the 30 entries tested at eleven locations in the 11th HMN	16
Table 14. Average disease severity as percent estimates calculated from the highest HLB double-digit score at eleven locations in the 11th HMN	17
Table 15. Average first digit of the highest HLB score for the 30 entries tested at eleven locations in the 11th HMN	18
Table 16. Average second digit of the highest HLB score for the 30 entries tested at eight locations in the 10th HMN	19
Table 17. Average grain yield (kg/ha) of 30 entries (untreated) tested at eleven locations in the 11th HMN	20
Table 18. Average grain yield loss (kg/ha) of 30 entries tested at eleven locations in the 11th HMN	21
Table 19. Average grain yield loss (%) of 30 entries tested at eleven locations in the 11th HMN	22
Table 20. Average thousand-kernel weight (gm) of 30 entries tested at eleven locations in the 11th HMN	23
Table 21. Average loss (gm) in thousand-kernel weight of 30 entries tested at eleven locations in the 11th HMN	24
Table 22. Average loss (%) in thousand-kernel weight for the 30 entries tested at eleven locations in the 11th HMN	25
Table 23. Average number of days to heading of 30 entries tested at eleven locations in the 11th HMN	26
Table 24. Average number of days to maturity of 30 entries tested at eleven locations in the 11th HMN	27
Table 25. Average plant height (cm) of 30 entries tested at eleven locations in the 11th HMN	28
Table 26. Combined analysis of variance for various traits of 30 genotypes tested at eleven locations in South Asia in 2002-03 wheat growing season	29
Figure 1. Biplot showing relationship among 11 environments	30
Figure 2. Biplot showing relationship among 30 wheat entries	31
Figure 3. Biplot showing comparison of 30 wheat entries with an ideal cultivar for AUDPC	32
Figure 4. Biplot showing comparison of 30 entries with an ideal cultivar for grain yield	33
Figure 5. Biplot showing comparison of 30 entries with an ideal cultivar for five traits	34
Annex	

List of Cooperators Participating to 11th HMN Effort in 2002-2003

BANGLADESH

1. **Dr. A.B. Siddique**
   Senior Scientific Officer (Wheat)
   Regional Agricultural Research Station
   Khoyertola Farm, Jessore
   Phone: 880-421-5651

2. **Mr. Anwar Shaheed**
   Principal Scientific Officer
   Wheat Research Center, BARI
   Nashipur, Dinajpur
   Phone: 880-531-3342

3. **Mr. Firoz Ahmed**
   Wheat Research Center
   Regional Agricultural Research Station
   BARI, Jamalpur
   Bangladesh

INDIA

1. **Dr. A.K. Joshi/Dr. Ramesh Chand**
   Dept. Genetics & Plant Breeding
   Varanasi-221005, Uttar Pradesh
   India
   Phone: 316819, 317092

2. **Dr. K.P. Singh**
   G.B. Pantnagar University of
   Agriculture & Technology
   Uddham Singh Nagar,
   Pantnagar 263145, Uttaranchal, India
   Phone: (91-5944) 60243

3. **Dr. R.N. Singh/Dr. A.K. Singh**
   Department of Plant Pathology
   Narendra Dev University of
   Agricultural & Technology
   Kumargunj, Faizabad-224229
   India
   Phone: 62012

4. **Dr. A.K. Sharma/Dr. D.P. Singh**
   Directorate of Wheat Research
   I.C.A.R.
   Regional Wheat Research Station
   Kunjpura Road, Karnal-132001
   Haryana, India
   Phone: 252390

5. **Dr. Tulshi Prasad Saikia**
   Assam Agricultural University
   Regional Agricultural Research Station
   Shillongani, P.O. Box 33,
   Nagaon-782001, Assam, India
   Phone: (03672) 21104

6. **Dr. Apurba Kumar Chowdhury**
   Uttar Banga Krishi Viswavidyalaya
   Pundibari, Cooch Behar-736165
   West Bengal, India
   Phone: (03582) 70586

NEPAL

1. **Mr. M.R. Bhatta/Deepak Bhandari**
   National Wheat Research Program
   Bhairahawa, Rupendehi
   Phone: 071-22196, 20226

2. **Dr. R.C. Sharma**
   Institute of Agriculture and Animal
   Sciences (IAAS)
   Rampur, Chitwan
   Phone: 056-81021

3. **Mr. P.C.P. Chaurasiya**
   Regional Agriculture Research Station
   Tarahara, Sunsari
   Phone: 025-80461

Information on 11th HMN Testing Sites in South Asia

Location	Latitude	Longitude	Altitude (m)	HLB Recording Date (2003)		
				First	Second	Third
Shillongani	26°21'N	92°42'E	50.2	Feb. 22	Mar. 11	Mar. 21
Bhairahawa	27°06'N	82°04'E	105	Mar. 6	Mar. 15	Mar. 23
Coochbehar	26°18'N	89°27'E		Feb. 26	Mar. 10	Mar. 22
Dinajpur	28°38'N	88°41'E	38.2	Feb. 27	Mar. 6	Mar. 17
Faizabad	26°47'N	82°12'E	113	Mar. 5	Mar. 15	Mar. 22
Jamalpur	24°26'N	89°55'E	19	Feb. 17	Feb. 20	Mar. 5
Jessore	23°1'N	89°14'E	6.7	Feb. 5	Feb. 15	Mar. 3
Karnal	29°4'N	76°59'E		Feb. 28	Mar. 13	Mar. 28
Pantnagar	29°00'N	79°00'E	244			
Rampur	27°40'N	80°19'E	228	Feb. 22	Mar. 3	Mar. 17
Tarahara	25°45'N	87°36'E	72	Mar. 9	Mar. 19	Mar. 27
Varanasi	25°18'N	83°03'E	128.93	Mar. 11	Mar. 19	Mar. 25

Cooperator	Location	Data returned
Dr. B. Barman	Assam, India	GY, DH, DM, PHT, TKW, HLB
Mr. M.R. Bhatta	NWRP, Bhairahawa, Nepal	GY, DH, DM, PHT, TKW, HLB
Dr. A.K. Chowdhury	Coochbehar, India	GY, DH, DM, PHT, TKW, HLB
Mr. Anwar Shaheed	Dinajpur, Bangladesh	GY, DH, DM, PHT, TKW, HLB
Drs. R.N. Singh/A.K. Singh	Faizabad, India	GY, DH, DM, PHT, TKW, HLB
Mr. Firoz Ahmed	Jamalpur, Bangladesh	GY, DH, DM, PHT, TKW, HLB
Dr. A.B. Siddique	Jessore, Bangladesh	GY, DH, DM, PHT, TKW, HLB
Drs. A.K. Sharma/D.P. Singh	Karnal, India	GY, DH, DM, PHT, TKW, HLB
Dr. K.P. Singh	Pantnagar, India	Data not available
Dr. R.C. Sharma	Rampur, Nepal	GY, DH, DM, PHT, TKW, HLB
Mr. P.C.P Chaurasiya	Tarahara, Nepal	GY, DH, DM, PHT, TKW, HLB
Drs. A.K. Joshi/R. Chand	Varanasi, India	GY, DH, DM, PHT, TKW, HLB

Table 1: List of Genotypes in 11th HMN 2002-2003

Entry	Genotype/Cross
1	SW 89-5422
2	Chirya 7
3	Kanchan
4	BL 2179 = NL588/HD2307//NL623 (Bhirikuti)
5	Pfau/Vee#5
6	BL2029
7	Yangmai #6
8	Chirya 1
9	Ciano 79
10	PBW373
11	K 7
12	CMH81 38/2*KAUZ//Attila
13	Ning 8201
14	Raj 3765
15	RR21 (=Sonalika)
16	Milan/Shanghai-7
17	Maya/Mon//Kauz/Trm/3/Pvn/Buc//Har-424
18	K 8027
19	Achyut
20	Croc 1/*Ae.squarrosa* (224)//Yaco/3/Munia
21	COQ/F61.70/CNDR/3/OLN/4/PHO
22	PRL/Toni
23	Altar-84/*Ae. squarrosa* (224)//2*Yaco
24	BAW-969 (=Barkat/Kavkaz)
25	BAW-966 (=Kan/6/COQ/F61.701//CNDR/OLN/4/PHOS/MRNG/ALAN/CNO)
26	Gourab (=TURACO/CHIL)
27	IAS 58/3/KAL/BB//ALD/4/OLN/TRM//7C/ALD/5/PEACOCK
28	BL1473
29	BL 2537=CROC 1/AE.SQ(210)//4*YACO/3/GUAM 92/4/SHA7//PRL/3/FASAN
30	BAW 898

Abbreviations for tables to appear in the following pages:

TKW = Thousand Kernel Weight (gm)
PHT = Plant Height (cm)
DH = Days to Heading
DM = Days to Maturity
D1 = First Digit of HLB Double Digit Score
D2 = Second Digit of HLB Double Digit Score
EST = Severity Estimate of Percent Diseased Leaf Area, calculated as (D1/9)*(D2/9)*100.
AUDPC = Area Under the Disease Progress Curve for HLB

Note: (1) Grain yield is the actual yield (kg/ha) observed in non-sprayed (diseased) plots. Similarly, thousand kernel weight, plant height, days to heading, days to maturity and disease data were also analyzed only from non-sprayed plots.

(2) Yield loss indicates the percent loss when non-sprayed (diseased) plots are compared to protected (sprayed) plots.

(3) A missing data column indicates that the data were not reported in the field book

Table 2: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Bhairahawa, Nepal

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	1915	-6.1	-110	33.0	7.0	2.5	72.5	86.0	120	4.0	2.0	9.9	7.5	2.0	18.5	7.5	2.0	18.5	554
2	1570	17.8	340	36.5	8.2	3.3	80.0	89.0	123	5.0	1.5	8.0	7.5	2.5	22.8	7.5	3.0	27.8	721
3	1565	-23.7	-300	37.3	10.2	4.3	82.0	80.5	112	6.0	2.5	19.1	8.0	3.5	34.6	8.0	6.0	59.3	1321
4	1670	-17.6	-250	35.5	21.0	9.5	81.0	85.0	114	5.0	2.0	12.3	8.0	2.0	19.8	8.0	5.5	54.3	996
5	1345	-8.9	-110	31.5	1.6	0.5	81.0	87.5	118	5.0	2.0	12.3	8.0	3.0	29.6	8.0	3.5	34.6	927
6	1255	30.9	560	43.5	10.3	5.0	83.0	85.0	115	7.0	1.5	13.0	8.0	2.5	24.7	8.0	5.5	54.3	1078
7	1530	3.2	50	36.8	3.9	1.5	80.0	85.0	116	5.0	1.5	9.3	8.0	2.0	19.8	8.0	3.0	29.6	698
8	1525	-6.6	-95	33.8	6.3	2.3	71.0	86.5	119	5.0	2.0	12.3	8.0	2.0	19.8	8.0	3.0	29.6	712
9	1450	19.7	355	32.3	9.8	3.5	76.5	84.0	114	7.0	2.5	21.6	8.0	4.0	39.5	8.0	7.5	74.1	1581
10	1175	26.6	425	28.3	24.7	9.3	74.0	87.5	116	4.0	2.0	9.9	8.0	2.5	24.7	8.0	3.5	34.6	837
11	1465	19.3	350	36.8	9.3	3.8	95.0	82.0	115	6.0	2.5	17.9	8.0	2.5	24.7	8.0	4.0	39.5	930
12	1240	26.0	435	29.3	13.3	4.5	72.0	83.0	113	7.0	2.0	17.3	8.0	3.5	34.6	8.0	7.0	69.1	1426
13	1525	7.6	125	38.3	9.5	4.0	77.0	83.0	117	6.0	2.0	14.8	8.0	2.5	24.7	8.0	4.5	44.4	973
14	1900	5.9	120	31.3	13.8	5.0	74.0	82.0	114	7.0	2.5	21.6	8.0	3.5	34.6	8.0	6.5	64.2	1389
15	1385	28.6	555	33.3	18.9	7.8	82.5	79.5	112	7.0	3.0	25.9	8.0	4.5	44.4	8.0	7.0	69.1	1623
16	2000	7.8	170	30.0	13.7	4.8	90.0	86.0	118	5.0	1.0	6.2	8.0	1.5	14.8	8.0	2.5	24.7	549
17	1675	15.4	305	32.8	20.6	8.5	73.5	83.0	116	7.0	2.0	17.3	8.0	3.5	34.6	8.0	4.5	44.4	1142
18	1205	28.5	480	39.5	-1.3	-0.5	83.0	89.0	119	6.0	2.5	19.1	8.0	2.5	24.7	8.0	4.5	44.4	992
19	1070	31.6	495	28.5	14.9	5.0	83.5	86.0	116	7.0	2.0	17.3	8.0	2.5	24.7	8.0	5.0	49.4	1041
20	1245	11.1	155	24.5	25.2	8.3	71.0	86.0	117	7.0	2.0	17.3	8.0	3.0	29.6	8.0	5.5	54.3	1177
21	1280	11.1	160	34.5	13.8	5.5	71.0	82.0	113	7.0	4.0	34.6	8.0	3.5	34.6	8.0	6.5	64.2	1447
22	1180	-0.9	-10	32.5	14.5	5.5	74.0	84.0	117	7.0	3.0	25.9	8.0	3.5	34.6	8.0	7.5	74.1	1522
23	1550	11.9	210	41.0	5.2	2.3	76.5	89.0	118	5.0	2.0	12.3	8.0	2.5	24.7	8.0	3.0	29.6	791
24	1475	30.3	640	37.5	8.0	3.3	74.0	82.0	115	7.0	2.0	17.3	8.0	3.0	29.6	8.0	6.0	59.3	1233
25	1430	12.3	200	30.0	14.3	5.0	77.0	81.0	112	6.0	3.0	22.2	8.0	3.0	29.6	8.0	6.0	59.3	1256
26	1390	36.4	795	33.8	12.9	5.0	75.0	80.0	113	7.0	3.5	30.2	8.0	4.0	39.5	8.0	6.5	64.2	1506
27	1820	16.3	355	30.5	6.2	2.0	78.0	82.0	113	7.0	3.0	25.9	8.0	3.5	34.6	8.0	7.5	74.1	1522
28	1440	-5.9	-80	39.3	1.9	0.8	77.0	79.5	112	7.0	3.5	30.2	8.0	3.5	34.6	8.0	7.0	69.1	1484
29	1410	37.5	845	28.8	12.9	4.3	82.5	84.0	114	6.0	2.5	17.9	8.0	3.5	34.6	8.0	5.0	49.4	1202
30	1225	23.2	370	32.8	15.5	6.0	75.0	80.0	112	7.0	3.5	30.2	8.0	3.5	34.6	8.0	6.5	64.2	1427
Mean	1464	13.0	251	33.8	11.5	4.4	78.1	84.0	115	6.1	2.4	18.3	8.0	3.0	29.2	8.0	5.2	50.9	1135
P-value	0.339	0.606	0.644	<0.001	0.269	0.375	0.003	<0.001	<0.001	0.044	0.0	<0.001	0.5	0.0	0.0	0.500	<0.001	<0.001	<0.001
EMS	93574	513.8	192938	4.0	67.2	11.2	21.980	1.4	2.4	1.1	0.3	28.5	0.0	0.3	32.2	0.0	0.7	66.9	24746
LSD (5%)	626	46.4	898	4.1	16.8	6.8	9.589	2.5	3.1	2.1	1.2	10.9	0.4	1.2	11.6	0.4	1.7	16.7	322
CV%	20.9	202.1	174.8	5.9	72.3	76.0	6.0	1.4	1.3	16.8	24.7	29.2	2.3	19.7	19.4	2.3	16.0	16.1	13.9
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 3: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Rampur, Nepal

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	3885	11.1	485	41.8	-0.6	-0.3	92.5	85	124	2.5	2.0	6.2	4.0	3.0	16.0	7.0	3.5	30.2	424
2	3270	22.8	965	35.3	2.5	0.9	93.5	84	127	4.0	2.0	9.9	6.0	3.0	22.2	8.0	3.0	29.6	507
3	3995	10.2	455	41.3	10.0	4.6	101.0	75	120	5.5	2.5	17.3	7.5	3.5	32.1	8.0	6.5	64.2	896
4	3175	20.6	825	42.2	8.9	4.1	95.5	80	121	6.0	1.5	10.5	7.0	3.5	30.2	8.0	6.5	64.2	844
5	3625	12.7	525	33.1	6.5	2.3	95.5	86	124	3.0	3.0	11.1	5.0	2.5	15.4	8.0	4.0	39.5	504
6	3675	12.1	505	48.8	15.4	8.9	109.5	78	121	4.0	2.0	9.9	6.5	3.0	25.9	8.0	5.0	49.4	688
7	3045	22.1	865	38.7	8.8	3.8	103.0	84	127	4.0	2.5	11.7	5.0	3.0	18.5	8.0	3.5	34.6	508
8	3175	22.9	945	40.2	1.4	0.5	94.5	83	127	5.0	2.5	15.4	7.0	3.0	25.9	7.5	4.0	37.0	627
9	2940	33.2	1460	28.2	29.4	11.8	89.0	78	121	5.5	3.0	20.4	8.0	4.5	44.4	8.0	7.0	69.1	1087
10	3535	21.1	945	41.5	12.4	5.8	90.0	85	123	3.0	2.5	9.3	6.0	2.5	17.9	8.0	4.0	39.5	524
11	4425	6.0	280	38.4	13.8	6.1	112.5	78	122	5.0	3.5	21.6	6.0	5.5	40.1	8.0	5.0	49.4	904
12	3485	4.4	160	27.1	17.1	5.6	90.0	79	121	3.5	2.0	8.6	7.5	3.0	27.8	8.0	5.0	49.4	704
13	3910	9.3	400	38.6	16.1	7.4	90.5	83	124	3.0	2.0	7.4	7.0	3.0	25.9	8.0	5.0	49.4	677
14	2950	31.7	1370	29.1	26.1	10.3	88.5	75	120	4.0	2.0	9.9	7.5	3.5	32.1	8.0	5.5	54.3	794
15	2480	31.4	1135	33.7	26.5	12.2	108.0	70	113	8.0	4.5	44.4	8.0	5.5	54.3	8.0	7.5	74.1	1343
16	4360	18.5	990	33.6	10.5	4.0	110.0	83	122	3.0	2.0	7.4	4.0	3.0	14.8	7.5	4.0	37.0	463
17	3945	10.9	485	35.9	20.9	9.5	91.5	77	121	4.0	1.5	6.8	5.0	3.5	21.6	8.0	5.5	54.3	659
18	2350	27.8	905	45.6	9.4	4.8	103.0	88	128	4.0	2.0	9.9	5.0	4.0	24.7	8.0	4.0	39.5	605
19	2655	30.0	1140	32.6	22.2	9.3	101.0	84	122	5.0	3.0	18.5	7.5	3.5	32.7	8.0	5.0	49.4	805
20	2705	35.7	1500	28.0	18.9	6.5	97.5	82	123	3.0	2.0	7.4	7.5	3.5	32.7	8.0	5.5	54.3	790
21	3600	14.2	595	42.1	9.6	4.5	103.5	74	119	3.0	2.0	7.4	7.5	3.0	27.8	8.0	5.0	49.4	698
22	3835	3.5	140	36.7	18.2	8.2	105.5	76	119	2.5	2.5	8.0	6.5	2.0	16.0	8.0	4.0	39.5	497
23	4230	11.0	525	47.4	4.6	2.3	102.5	83	123	2.5	2.0	6.2	6.0	2.5	19.1	7.5	4.0	37.0	507
24	2550	38.3	1580	30.4	23.7	9.5	87.0	76	119	5.0	2.0	12.3	7.5	4.0	37.7	8.0	6.0	59.3	903
25	3660	12.4	520	36.8	2.5	1.0	104.5	75	120	3.0	2.5	9.3	6.0	3.0	22.2	8.0	5.5	54.3	677
26	3430	6.9	255	39.7	16.3	7.8	102.0	75	119	5.0	2.0	12.3	7.5	3.5	32.7	8.0	6.0	59.3	847
27	3690	12.0	505	36.0	17.1	7.4	105.5	80	122	3.5	3.0	14.8	7.5	3.5	32.7	8.0	6.5	64.2	892
28	3415	8.2	305	48.0	-4.1	-1.9	96.5	67	113	4.0	2.0	9.9	7.0	2.5	21.6	8.0	6.0	59.3	708
29	3210	18.6	735	33.4	14.7	5.7	106.0	82	122	6.0	4.5	32.7	7.0	5.5	47.5	8.0	4.5	44.4	1005
30	3915	18.9	910	40.9	11.2	5.2	103.0	74	118	5.0	2.0	12.3	7.5	3.0	27.8	8.0	6.5	64.2	824
Mean	3437	18.0	747	37.5	13.0	5.6	99.1	79	121	4.2	2.4	13.0	6.6	3.4	28.0	7.9	5.1	50.0	730
P-value	0.005	0.291	0.456	<0.001	0.103	0.137	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.005	<0.001	0.015	<0.001	<0.001	<0.001
EMS	230526	142.3	312396	10.5	89.2	16.9	15.6	1.2	0.5	1.1	0.3	17.8	0.8	0.6	54.0	0.0	0.7	64.8	18657
LSD (5%)	982	24.4	1143	6.6	19.3	8.4	8.1	2.2	1.5	2.2	1.2	8.6	1.8	1.5	15.0	0.4	1.7	16.5	279
CV%	14.0	67.6	74.8	8.6	73.9	73.5	4.0	1.4	0.6	25.6	23.5	32.6	13.4	22.3	26.2	2.7	16.1	16.1	18.7
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 4: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Tarahara, Nepal

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	1495	22.9	445	32.4	23.0	9.7	88.9	73	100	2.5	2.0	6.8	4.0	4.0	24.7	6.5	5.5	43.8	431
2	1860	19.3	445	29.4	27.2	11.0	99.2	72	101	1.5	2.0	4.3	3.0	3.0	11.1	5.0	3.5	22.2	210
3	1845	-7.6	-130	42.2	4.5	2.0	94.9	73	100	4.0	2.8	13.3	5.0	4.5	29.6	8.0	6.0	59.3	570
4	2270	2.8	65	44.6	11.6	5.9	90.7	72	100	3.5	3.5	14.8	6.0	5.0	37.0	7.5	7.0	64.8	667
5	2140	-5.2	-105	30.2	17.3	6.3	93.3	72	100	3.5	3.5	15.4	5.0	5.0	32.1	6.0	6.0	44.4	544
6	2365	3.3	80	52.3	5.6	3.1	86.1	73	102	3.0	3.0	11.1	4.0	4.0	22.2	8.0	6.5	66.0	520
7	2210	-3.3	-70	41.2	1.3	0.5	88.8	72	100	1.5	2.0	4.3	4.0	3.0	16.0	4.5	3.5	19.8	245
8	2055	-8.2	-155	39.9	6.0	2.6	84.9	74	100	2.0	1.5	4.3	3.0	2.5	9.9	4.0	3.0	16.0	175
9	2220	-4.2	-90	31.9	-6.9	-2.1	86.5	73	97	3.5	3.8	16.0	6.0	5.3	38.9	8.0	6.5	64.8	690
10	1935	2.5	50	41.9	-1.1	-0.4	91.9	73	97	2.5	3.5	11.1	4.0	4.0	19.8	6.0	5.5	40.7	396
11	2040	21.8	570	37.9	12.9	5.6	86.9	71	97	3.0	4.0	14.8	5.0	4.5	27.2	7.0	5.5	49.4	516
12	2255	-5.9	-125	33.5	-2.8	-0.9	94.7	72	100	3.5	4.5	19.8	3.5	3.5	14.8	6.0	4.0	29.6	351
13	1710	0.3	5	37.4	12.3	5.3	100.4	74	102	2.5	3.5	11.1	3.5	3.5	16.0	5.5	4.5	33.3	333
14	1865	3.9	75	39.9	2.2	0.9	82.9	72	102	4.0	4.0	19.8	5.5	4.0	27.2	7.5	6.0	59.3	580
15	1380	2.5	35	40.5	-18.2	-6.3	86.9	74	100	4.0	3.5	16.7	6.0	5.0	37.0	8.0	7.0	70.4	698
16	2160	-2.6	-55	37.3	-3.9	-1.4	75.0	71	101	1.0	1.3	1.5	3.0	2.0	7.4	5.0	3.5	21.6	161
17	1690	32.0	795	35.4	7.1	2.7	82.2	74	101	2.5	3.0	9.3	4.5	4.5	25.9	6.5	5.5	48.8	475
18	1565	-19.0	-250	43.2	-0.3	-0.1	86.9	73	105	2.0	3.0	8.6	2.5	2.5	7.4	4.5	4.0	22.2	199
19	1670	18.3	375	36.7	11.4	4.7	83.5	73	97	2.5	3.0	9.3	4.0	3.0	14.8	6.5	4.0	34.0	315
20	1795	5.3	100	33.8	-3.0	-1.0	85.3	73	101	2.5	3.5	11.1	5.0	4.5	27.8	7.0	4.5	38.3	459
21	2190	-21.3	-385	36.9	11.9	5.0	93.5	73	102	3.0	2.3	9.3	3.0	3.0	13.6	6.0	5.0	34.6	307
22	1095	13.4	170	46.8	-13.3	-5.5	86.0	74	100	3.5	4.0	17.3	4.5	4.0	22.2	5.0	4.0	24.7	385
23	2075	-23.1	-390	38.1	23.7	11.8	83.9	74	97	1.5	2.3	4.6	4.0	3.5	19.1	5.5	4.5	30.2	316
24	2410	-4.6	-105	41.5	-15.6	-5.6	99.0	74	100	2.0	2.3	6.5	4.0	3.5	17.9	7.0	5.5	48.1	386
25	2515	-7.2	-170	29.3	24.4	9.5	88.2	72	100	3.0	4.0	14.8	4.5	3.5	19.8	8.0	5.0	48.1	444
26	1845	10.0	205	38.9	7.8	3.3	85.5	72	100	3.0	2.0	8.6	5.5	5.0	34.0	7.5	6.0	57.4	578
27	2125	20.7	555	39.8	2.1	0.9	80.4	72	97	3.0	3.0	11.1	5.5	4.5	30.2	7.5	6.5	63.0	580
28	2065	-4.6	-90	47.8	4.3	2.2	89.7	72	100	3.5	3.0	13.6	4.5	3.5	19.8	7.0	5.5	51.2	451
29	1465	19.5	355	35.1	9.3	3.6	95.1	73	100	3.5	2.5	10.5	5.5	4.5	30.2	6.5	5.0	40.7	488
30	1665	33.0	820	42.3	-0.8	-0.3	85.3	74	102	3.0	3.0	11.1	6.0	5.5	40.7	6.5	5.8	48.5	616
Mean	1933	3.8	101	38.6	5.3	2.4	88.5	73	100	2.8	3.0	11.0	4.5	3.9	23.1	6.5	5.1	43.2	436
P-value	0.73.8	0.594	0.450	0.060	0.546	0.534	0.674	0.370	0.815	0.076	0.063	0.047	0.095	0.582	0.177	0.075	0.123	0.075	0.009
EMS	283719	464.2	190114	33.2	327.5	43.7	80.7	1.4	10.2	0.8	0.7	23.8	1.3	1.8	125.1	1.612	1.61	286.3	19338
LSD (5%)	1089	44.1	436	11.8	37.0	13.5	18.4	2.4	6.5	1.8	1.7	10.0	2.3	2.7	22.9	2.597	2.595	34.61	284
CV%	27.6	772.2	432.4	14.9	382.6	272.9	10.1	1.6	3.2	31.1	27.9	44.2	25.5	33.9	48.3	19.7	24.6	39.2	31.9
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 5: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Dinajpur, Bangladesh

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	3	9.7	554	43.6	10.1	4.9	82.5	87	125	3.0	2.0	7.4	4.0	3.0	14.8	5.5	4.5	30.9	329
2	4771	5.0	252	45.4	6.2	3.0	91.0	77	126	3.0	2.0	7.4	4.0	3.0	14.8	6.0	4.0	29.6	322
3	4707	13.8	751	46.6	11.6	6.1	97.0	73	118	5.0	4.0	24.7	7.0	5.0	43.2	8.0	4.5	44.4	720
4	3585	5.2	196	50.3	6.3	3.4	97.0	77	120	4.5	3.0	16.7	6.5	4.0	31.5	8.0	5.5	54.3	640
5	4165	6.8	302	41.8	10.2	4.8	99.5	87	123	3.5	2.0	8.6	5.0	3.5	21.6	6.5	5.0	40.1	445
6	3767	6.6	265	62.0	5.9	3.9	101.0	80	122	3.0	2.5	9.3	5.5	3.5	23.5	7.0	4.0	34.6	434
7	3894	3.9	157	45.1	7.0	3.4	96.5	81	122	3.0	2.0	7.4	4.0	3.5	17.3	6.0	3.0	22.2	304
8	4390	11.9	595	44.1	4.6	2.1	88.0	79	123	3.0	2.0	5.3	4.0	3.0	9.4	6.0	3.5	14.7	184
9	3000	24.3	965	34.8	16.8	7.0	83.0	76	122	6.0	5.0	37.0	8.0	7.0	69.1	8.0	8.0	79.0	1186
10	3850	2.8	113	47.3	10.2	5.4	89.0	85	124	3.0	2.0	7.4	5.0	3.0	18.5	7.5	4.0	37.0	396
11	4159	9.9	459	50.6	4.0	2.1	105.5	79	122	4.0	3.5	17.3	5.0	5.0	30.9	7.0	4.5	38.9	552
12	3542	6.7	256	33.3	8.0	2.9	85.5	76	120	4.0	3.0	14.8	5.5	3.5	24.1	8.0	5.0	49.4	540
13	3014	21.5	827	51.9	7.0	3.9	85.5	81	122	3.5	2.5	11.1	4.5	3.5	19.1	7.0	4.5	38.9	425
14	2889	26.6	1050	42.4	14.0	6.9	80.5	73	120	5.5	3.5	24.1	7.5	4.5	42.0	8.0	6.5	64.2	815
15	3633	18.6	830	44.5	11.9	6.0	99.0	73	116	6.0	5.5	40.7	8.0	6.0	59.3	8.0	8.0	79.0	1110
16	5078	6.6	358	40.8	6.3	2.8	102.0	81	126	3.0	2.0	7.4	3.5	3.0	13.0	5.5	4.0	27.2	292
17	4694	12.1	647	42.0	10.9	5.1	86.5	74	124	4.0	3.5	17.3	5.0	5.0	30.9	7.5	5.0	46.3	593
18	4950	5.3	276	46.6	13.7	7.4	103.5	84	128	3.5	3.0	13.0	5.0	4.0	24.7	6.5	4.5	36.4	468
19	3605	10.9	441	43.8	8.1	3.9	105.0	83	125	3.0	2.5	9.3	5.0	4.0	24.7	7.0	4.5	38.9	469
20	4028	13.6	632	35.1	11.6	4.6	85.5	81	123	4.0	2.5	12.3	6.5	3.5	27.8	8.0	5.5	54.3	592
21	3054	27.3	1146	48.3	7.7	4.0	93.0	73	117	4.0	3.0	14.8	5.5	3.5	24.1	7.0	5.5	47.5	530
22	3811	14.1	624	45.0	7.5	3.6	91.0	74	119	4.0	3.0	14.8	7.0	4.0	34.6	8.0	5.0	49.4	635
23	4556	5.6	273	55.8	4.5	2.6	97.0	80	122	3.0	2.0	7.4	5.0	3.0	18.5	7.0	3.5	30.2	359
24	3806	23.0	1137	45.3	6.0	2.9	80.5	73	117	4.0	2.5	12.3	6.5	4.0	32.1	7.5	4.5	41.4	560
25	3938	5.9	249	41.4	8.1	3.6	92.5	71	118	4.5	3.5	19.1	6.5	4.5	36.4	7.5	4.0	37.0	598
26	4047	3.0	125	50.6	1.9	1.0	89.5	64	117	5.0	3.0	18.5	7.0	4.0	34.6	7.5	4.5	41.4	603
27	4468	23.0	1332	42.6	11.7	5.6	98.5	74	118	5.0	4.0	24.7	8.0	4.5	44.4	8.0	6.5	64.2	840
28	3026	14.7	523	53.1	5.3	3.0	91.0	65	117	5.0	4.0	24.7	8.0	4.0	39.5	8.0	5.5	54.3	741
29	4195	6.0	267	42.8	2.8	1.3	104.5	79	121	5.0	4.5	27.8	5.5	5.0	34.0	6.5	4.5	35.8	600
30	3887	11.4	501	50.0	8.5	4.6	94.5	67	117	4.0	3.5	17.3	7.0	3.5	30.2	7.0	5.0	43.2	570
Mean	3988	11.9	536	45.6	8.3	4.1	93.2	76.7	121	4.0	3.0	16.0	5.8	4.0	29.6	7.2	4.9	43.5	562
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
EMS	161409	27.0	62698	2.7	6.1	1.5	11.7	5.4	0.4	0.103	0.274	10.750	0.175	0.322	24.660	0.136	0.362	33.370	3590
LSD (5%)	822	10.6	512	3.3	5.0	2.5	6.996	4.7	1.3	0.7	1.1	6.7	0.9	1.2	10.2	0.8	1.2	11.8	123
CV%	10.1	44.1	46.7	3.6	29.8	29.9	3.7	3.0	0.5	8.0	17.2	20.5	7.2	14.1	16.8	5.1	12.3	13.3	10.7
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 6: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Jamalpur, Bangladesh

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	3670	20.0	915	39.3	4.3	1.8	86.5	80	110	1.0	2.0	2.5	2.0	2.0	4.9	3.5	1.0	4.3	71
2	4010	-7.2	-270	43.3	-0.6	-0.3	86.0	77	111	1.5	1.5	2.5	2.0	2.5	6.2	3.5	2.0	9.3	113
3	4400	2.2	100	38.0	14.6	6.5	97.5	66	103	3.0	1.5	5.6	4.0	2.5	12.3	7.0	3.0	27.2	284
4	5235	11.2	660	41.3	6.9	3.1	94.5	67	106	2.0	1.5	3.7	3.0	2.0	7.4	6.0	2.0	14.8	161
5	4260	0.2	10	32.8	13.8	5.3	95.5	74	111	2.0	1.5	3.7	2.5	2.0	6.2	3.5	1.5	6.8	99
6	4550	-4.7	-205	53.5	6.1	3.5	98.5	70	109	1.5	1.5	2.5	2.0	2.0	4.9	3.5	1.5	6.8	87
7	4405	-0.6	-25	41.3	3.5	1.5	97.0	73	106	1.5	1.5	2.5	2.0	2.0	4.9	3.5	2.0	8.6	99
8	4460	-5.4	-230	39.8	4.8	2.0	89.5	75	108	1.5	2.0	2.4	2.5	1.5	3.7	3.0	1.5	6.1	72
9	3080	34.9	1650	26.0	20.6	6.8	77.5	67	107	3.0	2.0	7.4	7.0	3.5	30.2	9.0	2.5	27.8	434
10	3510	20.4	900	37.8	9.0	3.8	89.0	81	112	2.0	2.0	4.9	2.0	2.5	6.2	3.0	1.5	5.6	93
11	4115	23.1	1235	42.5	3.4	1.5	104.5	71	105	2.5	1.5	4.3	3.0	1.5	5.6	4.0	2.5	12.3	131
12	4215	19.3	1010	27.5	9.8	3.0	75.5	69	104	2.0	1.5	3.7	2.5	1.5	4.3	4.5	1.5	8.6	96
13	3185	19.8	785	44.5	8.2	4.0	85.0	77	110	1.0	2.0	2.5	2.5	1.5	4.3	3.0	2.0	7.4	86
14	3515	28.3	1390	34.8	9.2	3.5	75.0	63	103	3.0	1.5	5.6	4.0	1.5	7.4	7.0	2.0	17.3	180
15	2820	32.2	1340	30.8	17.4	6.5	99.0	70	103	4.0	1.5	7.4	6.5	3.0	24.7	7.5	2.0	18.5	329
16	5200	14.1	855	37.8	-3.4	-1.3	106.5	76	110	1.5	1.5	2.5	2.0	2.0	4.9	3.5	1.5	6.2	83
17	3840	0.1	5	37.3	10.8	4.5	81.5	66	105	1.5	2.0	3.7	3.0	1.0	3.7	4.5	2.5	14.2	127
18	4180	-12.5	-465	42.8	6.6	3.0	102.5	82	109	2.0	1.5	3.7	2.0	2.0	4.9	3.0	1.5	5.6	81
19	4255	-3.0	-125	36.5	13.6	5.8	102.5	76	111	1.5	2.0	3.7	2.0	2.0	4.9	3.0	1.0	3.7	69
20	4400	10.8	530	27.8	11.9	3.8	86.5	75	109	1.5	2.0	3.7	2.5	1.5	4.3	4.5	2.0	11.1	112
21	4855	6.3	325	43.5	5.9	2.8	86.0	64	103	2.0	1.5	3.7	3.0	1.5	5.6	6.0	2.0	14.8	146
22	4210	21.5	1155	39.0	5.5	2.3	97.5	68	105	2.0	1.5	3.7	3.0	1.5	5.6	4.5	2.0	11.1	122
23	5230	6.6	370	50.5	5.2	2.8	96.0	72	105	1.5	2.0	3.7	2.0	2.0	4.9	3.0	2.0	7.4	93
24	4660	19.7	1140	35.8	8.9	3.5	79.0	65	104	1.5	1.5	2.5	3.0	1.5	5.6	5.5	2.0	13.6	136
25	4830	5.0	255	35.3	8.4	3.3	91.0	65	103	2.5	1.5	4.3	2.5	2.0	6.2	5.0	2.0	12.3	136
26	4635	7.6	380	42.5	6.6	3.0	84.5	65	103	2.5	1.5	4.3	3.0	2.5	9.3	5.5	2.0	13.6	169
27	5125	17.8	1110	37.0	2.6	1.0	91.0	68	104	2.5	2.0	6.2	3.5	2.0	8.6	6.0	2.0	14.8	175
28	4255	-15.6	-575	43.5	0.6	0.3	94.5	62	101	2.0	2.0	4.9	3.0	2.0	7.4	5.5	1.5	10.5	135
29	5070	4.1	215	39.0	-8.3	-3.0	102.0	75	104	2.5	1.5	4.3	3.5	1.0	4.3	4.0	2.0	9.9	105
30	4615	16.8	935	42.5	5.6	2.5	85.0	64	103	2.0	1.5	3.7	3.5	1.0	4.3	5.0	2.5	14.8	136
Mean	4293	9.8	513	38.8	7.1	2.9	91.2	71	106	2.0	1.7	4.0	3.0	1.9	7.3	4.7	1.9	11.5	139
P-value	0.039	0.137	0.168	<0.001	0.024	0.115	<0.001	<0.001	<0.001	<0.001	0.908	0.006	<0.001	0.157	<0.001	<0.001	0.805	0.006	<0.001
EMS	418420	228.4	519157	6.0	32.7	6.2	25.58	5.0	3.4	0.3	0.2	1.4	0.2	0.4	10.5	0.5	0.5	26.3	2022
LSD (5%)	1323	30.9	1474	5.0	11.7	5.1	10.34	4.6	3.8	1.0	0.9	2.4	0.8	1.3	6.6	1.5	1.5	10.5	92
CV%	15.1	165.0	140.6	6.3	810.4	86.2	5.5	3.2	1.8	25.0	26.5	30.0	13.6	34.7	44.7	15.7	38.8	44.6	32.4
Error df	29	29	29	29		29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 7: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Jessore, Bangladesh

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	3710	9.5	390.0	40.5	5.8	2.5	88.5	81	115	1.5	1.0	1.9	2.5	1.5	4.3	3.5	2.0	8.6	135
2	3775	15.5	695.0	39.5	-1.3	-0.5	94.0	80	114	2.0	1.0	2.5	2.5	2.0	6.2	4.5	2.5	14.2	206
3	3700	11.1	460.0	42.0	-6.3	-2.5	98.5	69	102	2.5	1.0	3.1	3.0	1.0	3.7	6.0	3.0	22.2	241
4	3960	6.8	290.0	44.0	7.4	3.5	96.5	72	102	2.5	1.0	3.1	3.0	1.5	5.6	5.5	4.0	27.2	305
5	3295	16.2	635.0	36.5	9.9	4.0	99.5	82	114	2.0	1.5	3.7	3.0	2.0	7.4	4.0	2.5	13.0	219
6	3120	28.5	1245.0	48.0	5.0	2.5	104.0	79	114	2.0	1.0	2.5	2.5	2.0	6.2	4.5	2.5	14.2	206
7	3175	10.9	390.0	42.5	-2.4	-1.0	102.5	81	111	2.0	2.0	4.9	3.0	1.0	3.7	4.5	1.5	8.0	137
8	4045	3.8	160.0	39.0	3.7	1.5	96.0	76	109	2.0	1.5	3.7	3.0	1.0	3.7	4.5	3.0	16.7	200
9	3350	11.6	440.0	36.5	0.0	0.0	85.5	70	106	2.0	1.0	2.5	3.0	2.0	7.4	6.0	5.0	37.0	405
10	2765	21.3	750.0	37.5	9.6	4.0	97.5	83	118	2.0	1.0	2.5	2.5	1.5	4.3	4.0	2.0	9.9	148
11	3885	14.6	665.0	44.0	-2.3	-1.0	113.5	69	107	2.0	1.0	2.5	3.0	1.0	3.7	5.0	2.0	12.3	159
12	3410	12.2	475.0	31.0	3.1	1.0	87.0	68	106	2.0	1.0	2.5	3.0	1.0	3.7	6.0	2.0	14.8	179
13	3310	10.1	370.0	41.0	5.7	2.5	89.5	81	112	1.5	1.5	3.1	3.0	1.0	3.7	5.5	1.5	9.9	143
14	3680	11.6	485.0	38.5	4.9	2.0	90.0	67	103	3.0	1.5	5.6	5.0	2.0	12.3	6.0	2.0	14.8	307
15	4190	10.6	495.0	41.5	5.7	2.5	102.5	66	101	3.5	2.0	8.6	4.0	2.0	9.9	6.0	2.5	18.5	320
16	4470	7.3	350.0	35.5	2.7	1.0	119.0	84	114	2.0	1.0	2.5	3.0	2.0	7.4	4.5	3.0	16.7	242
17	3510	15.1	625.0	37.5	11.8	5.0	87.0	68	106	3.0	1.5	5.6	3.5	2.5	10.5	6.0	1.5	11.1	253
18	3405	23.9	1070.0	43.0	1.1	0.5	115.0	87	118	2.0	1.0	2.5	3.0	1.5	5.6	5.0	2.0	12.3	183
19	3195	22.4	920.0	41.0	6.8	3.0	96.5	81	115	2.5	1.0	3.1	3.5	1.5	6.2	4.5	2.5	13.6	204
20	3420	4.2	150.0	40.0	3.6	1.5	89.5	79	110	2.0	2.0	4.9	3.0	1.0	3.7	5.5	1.5	10.5	157
21	3770	20.1	950.0	43.5	8.4	4.0	97.0	65	98	2.5	1.5	4.9	4.0	1.0	4.9	6.0	2.5	18.5	237
22	4230	7.2	330.0	41.5	-1.2	-0.5	97.0	71	104	2.0	1.0	2.5	3.0	1.0	3.7	6.0	1.5	11.1	149
23	4680	3.8	185.0	46.5	3.1	1.5	105.5	74	106	2.0	1.0	2.5	3.5	1.0	4.3	3.0	2.0	7.4	128
24	4395	9.8	480.0	37.0	12.9	5.5	92.5	67	102	1.5	1.0	1.9	2.0	1.0	2.5	4.5	2.5	14.8	160
25	4530	-0.7	-30.0	38.5	3.8	1.5	105.0	67	97	3.0	1.5	5.6	4.0	1.5	7.4	5.5	2.5	16.7	257
26	3395	3.3	115.0	42.5	5.6	2.5	94.0	66	97	3.5	1.5	6.2	4.0	2.0	9.9	5.5	2.5	16.7	293
27	4345	11.0	535.0	36.0	13.3	5.5	99.0	69	100	3.0	1.5	5.6	4.0	1.0	4.9	6.0	2.5	18.5	240
28	4015	-2.8	-110.0	41.0	2.4	1.0	101.0	60	97	3.0	1.5	5.6	4.5	1.0	5.6	6.0	2.0	14.8	219
29	3830	7.6	315.0	41.0	1.2	0.5	117.5	78	108	1.5	1.0	1.9	2.0	1.0	2.5	5.0	1.5	9.3	115
30	4355	3.7	165.0	40.5	6.9	3.0	96.0	65	101	1.5	1.0	1.9	2.5	1.0	3.1	5.5	2.0	13.6	158
Mean	3764	11.0	466.5	40.2	4.4	1.9	98.6	73	107	2.3	1.3	3.6	3.2	1.4	5.6	5.1	2.3	14.9	210
P-value	<0.001	0.004	0.008	<0.001	0.199	0.167	<0.001	<0.001	<0.001	<0.001	0.204	0.011	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
EMS	51409	38.0	78222.0	4.1	32.1	5.5	15.0	4.5	3.3	0.2	0.2	2.4	0.1	0.1	1.4	0.5	0.3	16.8	1729
LSD (5%)	464	12.6	572.0	4.1	11.6	4.8	7.9	4.3	3.7	0.9	0.8	3.1	0.7	0.7	2.4	1.4	1.1	8.4	85
CV%	6.0	56.6	60.0	5.0	131.1	124.1	3.9	2.9	1.7	19.1	32.6	42.2	11.2	24.0	21.0	13.5	23.0	27.6	19.8
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 8: Average values of some important characters of 30 wheat entries tested in the 10th HMN at Varanasi, India

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	3185	16.2	615	38.5	-15.8	-5.2	76.6	72	121	2.0	1.0	2.5	3.0	2.0	7.4	3.0	3.0	11.1	95
2	3560	-5.5	-185	33.4	3.8	1.3	82.6	73	122	2.0	1.5	3.7	3.0	2.0	7.4	3.0	2.5	9.3	94
3	3445	-11.1	-345	37.0	4.9	1.9	84.0	69	118	2.5	2.5	8.0	4.0	2.5	11.7	6.0	3.0	22.2	181
4	4190	-8.7	-335	43.1	-25.5	-8.7	88.1	69	118	2.0	1.5	3.7	3.0	2.5	9.3	4.0	3.0	14.8	124
5	3215	19.7	790	30.9	0.9	0.3	82.5	75	126	2.0	1.0	2.5	3.0	1.5	5.6	3.0	2.5	9.3	77
6	2715	28.1	1060	51.1	-0.5	-0.2	88.4	71	121	2.0	1.0	2.5	3.0	3.0	11.1	5.0	3.0	18.5	143
7	3395	-23.7	-650	39.5	-6.8	-2.5	84.7	72	122	1.5	1.0	1.9	3.0	2.0	7.4	3.0	3.0	11.1	93
8	3235	-7.5	-225	35.8	2.2	0.8	84.2	72	121	1.5	1.0	1.9	3.0	1.0	3.7	3.0	2.0	7.4	56
9	4570	-10.0	-415	30.5	0.7	0.2	77.8	70	121	2.5	1.5	4.9	4.0	3.0	14.8	6.0	3.0	22.2	190
10	3620	11.9	490	35.7	1.1	0.4	82.7	75	127	2.5	2.0	6.2	5.0	2.5	15.4	7.0	2.5	21.6	198
11	2805	39.0	1790	39.7	-6.3	-2.4	96.1	70	122	2.0	1.5	3.7	3.0	2.0	7.4	3.0	2.5	9.3	94
12	4205	-17.5	-625	27.6	2.9	0.8	79.6	70	122	1.0	1.0	1.2	3.0	1.0	3.7	3.0	2.0	7.4	53
13	3025	26.1	1070	40.0	3.0	1.2	77.3	69	119	2.0	2.0	4.9	3.0	3.0	11.1	5.0	3.0	18.5	153
14	3195	9.0	315	37.8	-5.3	-1.9	76.2	68	120	2.0	1.5	3.7	3.0	2.0	7.4	3.0	3.0	11.1	100
15	3900	-19.1	-625	39.3	3.4	1.4	86.5	69	122	2.0	1.5	3.7	3.0	2.0	7.4	3.0	3.0	11.1	100
16	4180	-23.5	-795	32.8	2.9	1.0	94.7	71	121	1.5	1.5	3.1	3.0	2.5	9.3	5.0	3.0	18.5	133
17	4970	-12.6	-555	35.7	1.8	0.7	83.0	68	120	2.0	2.0	4.9	3.0	2.5	9.3	5.0	2.5	15.4	131
18	3015	11.3	385	34.5	3.4	1.2	94.8	74	126	1.5	1.5	3.1	3.0	2.0	7.4	3.0	3.0	11.1	98
19	3830	-33.2	-955	32.7	3.4	1.1	88.0	73	124	2.0	1.5	3.7	3.0	1.5	5.6	3.0	2.5	9.3	81
20	3665	-41.8	-1080	29.0	4.8	1.5	79.9	73	122	1.0	1.0	1.2	3.0	2.0	7.4	3.0	3.0	11.1	90
21	4535	-17.5	-675	38.7	5.5	2.3	86.1	67	117	1.5	1.0	1.9	3.0	2.0	7.4	3.0	3.0	11.1	93
22	3255	3.0	100	38.7	-0.3	-0.1	89.3	69	120	1.5	1.5	3.1	3.0	2.0	7.4	4.0	3.0	14.8	109
23	3695	12.8	540	42.4	3.1	1.4	88.8	71	121	1.5	1.0	1.9	2.5	2.0	6.2	3.0	3.0	11.1	84
24	3745	12.1	515	36.6	2.6	1.0	85.1	68	118	2.0	1.5	3.7	3.0	2.5	9.3	5.0	3.0	18.5	135
25	3565	18.5	810	34.8	1.0	0.3	88.2	69	120	2.0	1.5	3.7	3.0	2.0	7.4	5.0	2.5	15.4	113
26	4035	3.4	140	41.2	6.0	2.6	87.4	69	121	1.5	1.0	1.9	2.5	2.0	6.2	3.0	2.5	9.3	78
27	3850	1.4	55	37.0	-0.1	0.0	77.7	70	121	1.5	1.0	1.9	2.5	2.0	6.2	3.0	3.0	11.1	84
28	3075	1.6	50	42.9	-8.3	-3.3	82.7	67	118	1.0	1.0	1.2	2.5	2.0	6.2	3.0	3.0	11.1	81
29	3320	-12.2	-360	34.8	4.7	1.7	90.8	69	121	1.5	1.0	1.9	2.5	2.0	6.2	3.0	3.0	11.1	84
30	4665	4.0	195	39.6	1.8	4.3	79.9	70	121	1.5	1.0	1.9	2.5	2.0	6.2	3.0	3.0	11.1	84
Mean	3655	-0.9	37	37.0	-0.2	0.1	84.8	70	121	1.8	1.4	3.1	3.0	2.1	7.9	3.8	2.8	13.2	108
P-value	0.516	0.643	0.629	<0.001	0.141	0.146	<0.001	<0.001	0.051	0.132	0.064	0.067	0.021	0.009	<0.001	<0.001	0.043	<0.001	<0.001
EMS	662325	1164.0	1053907	2.6	71.2	7.8	12.7	0.9	6.4	0.2	0.2	2.8	0.2	0.2	4.2	0.3	0.1	6.7	665
LSD (5%)	1665	69.8	2100	3.3	17.3	5.7	7.3	2.0	5.2	1.0	0.9	3.4	1.0	0.9	4.2	1.1	0.7	5.3	53
CV%	22.3	614.4	2812.6	4.3	2637.6	16785.0	4.2	1.4	2.1	26.6	31.2	53.3	16.1	20.5	25.9	13.8	11.4	19.6	24.0
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 9: Average values of some important characters of 30 wheat entries tested in the 10th HMN at Faizabad, India

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	4375	5.4	250	29.2	2.8	0.9	78.0	80	111	5.5	3.5	24.1	6.5	5.0	40.1	7.5	6.0	55.6	656
2	4250	2.9	125	30.8	1.3	0.4	85.0	80	111	5.0	4.0	24.7	6.0	5.5	40.7	7.0	6.5	56.2	666
3	4125	8.3	375	30.3	1.9	0.6	90.5	78	109	6.0	3.5	25.9	7.0	7.0	60.5	8.0	7.5	74.1	903
4	3875	8.8	375	30.7	2.2	0.7	105.0	83	114	4.0	2.5	12.3	5.5	4.5	30.9	6.5	5.0	40.7	467
5	4375	10.3	500	28.3	3.7	1.1	94.0	83	113	4.0	2.5	13.0	5.0	4.0	24.7	6.0	6.0	44.4	430
6	4625	5.1	250	42.8	0.9	0.4	101.5	79	114	4.0	3.5	17.3	6.0	5.0	37.0	6.0	6.0	44.4	557
7	4250	8.1	375	33.2	2.1	0.7	89.0	80	111	4.0	3.5	17.3	5.0	4.0	24.7	6.0	5.5	40.7	439
8	4250	2.9	125	33.9	1.7	0.6	80.5	83	116	3.5	2.0	8.6	5.0	4.5	27.8	6.5	6.0	48.1	448
9	2625	12.5	375	20.8	3.3	0.7	88.0	79	114	5.0	4.0	24.7	7.0	6.5	56.2	8.0	6.5	64.2	826
10	5125	4.7	250	32.8	0.6	0.2	82.5	76	114	4.0	3.0	14.8	6.0	4.5	33.3	7.0	6.0	51.9	539
11	5625	4.3	250	33.9	1.5	0.5	106.0	80	114	4.5	3.5	19.8	5.5	5.5	37.7	6.5	6.5	52.5	602
12	3875	8.8	375	21.7	4.0	0.9	83.0	84	117	3.5	3.0	13.0	6.0	5.5	40.7	7.0	6.0	51.9	593
13	4250	5.6	250	35.6	0.8	0.3	81.5	79	111	4.5	4.0	22.2	7.0	5.5	47.5	7.0	6.5	56.2	712
14	4125	10.8	500	29.9	3.5	1.1	86.5	73	113	5.0	4.0	24.7	6.0	5.5	40.7	7.0	6.0	51.9	651
15	4625	0.0	0	34.2	0.6	0.2	102.0	73	113	6.0	4.5	33.3	7.0	6.5	56.2	7.5	7.0	64.8	871
16	5375	-2.4	-125	30.8	3.4	1.1	103.5	82	117	3.0	2.5	9.3	5.0	4.0	24.7	6.0	5.0	37.0	386
17	5250	2.3	125	30.1	3.2	1.0	94.0	81	113	4.5	3.5	19.8	6.0	5.0	37.0	7.0	6.0	51.9	595
18	5375	8.5	500	32.2	2.7	0.9	104.5	80	114	3.5	2.5	11.1	5.5	4.5	30.9	6.5	5.5	44.4	473
19	4125	2.9	125	28.9	1.7	0.5	102.0	80	112	5.0	3.5	21.6	6.0	4.5	33.3	6.5	6.0	48.1	560
20	5125	6.8	375	33.3	1.5	0.5	81.0	81	113	4.5	4.0	22.2	7.0	5.0	43.2	7.0	6.5	56.2	675
21	6500	3.7	250	40.6	1.9	0.8	96.0	79	113	3.5	2.5	11.1	6.0	5.0	37.0	6.5	6.5	52.5	554
22	4125	13.2	625	33.7	2.6	0.9	103.0	80	113	4.5	3.0	17.3	6.0	4.5	33.3	7.0	5.5	47.5	536
23	4125	2.9	125	35.6	0.4	0.2	103.5	79	114	3.5	2.0	8.6	5.0	4.0	24.7	6.0	5.5	40.7	396
24	5625	6.3	375	38.3	2.0	0.8	86.0	77	112	4.5	3.0	16.7	5.5	4.0	27.2	6.5	5.0	40.1	455
25	4875	11.4	625	30.5	3.5	1.1	100.5	78	111	4.5	3.0	16.7	7.0	5.5	47.5	8.0	6.0	59.3	695
26	4375	10.3	500	37.4	2.9	1.1	94.0	76	111	5.0	4.0	24.7	6.0	5.5	40.7	7.0	6.5	56.2	666
27	4250	5.6	250	31.0	1.3	0.4	86.5	79	109	5.5	5.5	37.7	6.5	6.0	48.8	7.5	7.0	64.8	830
28	4125	5.7	250	36.6	0.8	0.3	96.5	76	108	5.0	4.0	24.7	6.0	5.0	37.0	7.0	5.5	47.5	605
29	5375	6.5	375	30.8	3.1	1.0	88.5	80	113	4.5	2.5	14.2	6.5	4.0	32.1	8.0	5.5	54.3	534
30	4875	7.1	375	37.7	1.6	0.6	93.5	79	113	4.0	3.0	14.8	6.0	5.0	37.0	7.0	6.0	51.9	570
Mean	4596	6.3	304	32.5	2.1	0.7	92.9	79	112	4.5	3.3	18.9	6.0	5.0	37.8	6.9	6.0	51.7	596
P-value	<0.001	0.032	0.043	<0.001	0.399	0.618	<0.001	<0.001	<0.001	<0.001	0.014	<0.001	<0.001	0.002	<0.001	<0.001	0.036	0.001	<0.001
EMS	41990	13.7	31214	0.2	2.0	0.2	2.0	0.7	1.7	0.3	0.5	29.7	0.1	0.4	37.8	0.2	0.4	44.1	6860
LSD (5%)	419	7.6	361	1.0	2.9	0.9	2.9	1.8	2.6	1.2	1.5	11.1	0.7	1.4	12.7	0.9	1.2	13.6	169
CV%	4.5	59.2	58.1	1.5	66.5	66.8	1.5	1.1	1.1	12.8	20.9	28.9	5.6	13.2	16.5	6.0	10.0	12.9	13.9
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 10: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Assam, India

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	825	10.8	100	42.0	-6.3	-2.5	68.8	96	131	0.0	0.0	0.0	3.5	3.0	12.3	5.5	3.5	24.7	290
2	1050	-5.0	-50	44.0	4.3	2.0	78.8	89	131	0.0	0.0	0.0	6.0	1.0	7.4	6.0	2.5	17.9	190
3	725	31.0	325	43.5	3.3	1.5	78.2	81	129	1.5	1.0	3.7	3.5	4.0	16.7	7.0	3.5	30.2	408
4	950	9.5	100	45.0	6.3	3.0	83.4	91	131	0.0	0.0	0.0	3.5	6.5	29.6	7.0	3.5	30.2	551
5	1075	-16.2	-150	40.5	-8.0	-3.0	85.3	96	131	4.0	5.0	24.7	4.5	4.5	22.8	6.0	2.5	17.9	608
6	875	7.9	75	56.5	2.6	1.5	83.0	95	131	0.0	0.0	0.0	4.0	3.5	17.3	7.0	2.5	21.6	341
7	675	-17.4	-100	41.0	-6.5	-2.5	90.1	89	131	1.0	0.5	1.2	3.5	2.0	6.8	7.0	1.5	13.0	167
8	975	-8.3	-75	41.0	-1.2	-0.5	83.4	87	128	0.0	0.0	0.8	2.0	1.0	9.2	7.0	3.5	18.4	223
9	550	12.0	75	36.5	9.9	4.0	74.1	83	130	1.0	1.0	2.5	5.0	3.0	16.0	7.0	3.5	30.2	389
10	600	-33.3	-150	42.0	11.6	5.5	81.1	93	131	0.0	0.0	0.0	4.0	2.5	10.5	6.0	5.0	38.3	333
11	800	11.1	100	43.0	-3.6	-1.5	93.3	85	131	0.0	0.0	0.0	5.0	3.0	21.0	7.0	4.0	34.6	456
12	500	44.4	400	31.5	0.0	0.0	72.4	81	128	0.0	0.0	0.0	3.0	2.5	9.3	7.0	4.5	38.9	319
13	675	27.0	250	47.0	-13.3	-5.5	76.4	92	130	0.0	0.0	0.0	2.0	4.0	9.9	7.0	3.5	30.2	285
14	650	21.2	175	39.0	-1.3	-0.5	73.7	81	131	4.5	3.0	17.3	7.0	2.5	21.6	7.0	5.5	47.5	676
15	900	29.4	375	44.0	6.4	3.0	84.4	78	128	4.0	3.5	19.1	5.5	3.5	24.7	7.0	6.5	56.2	777
16	425	15.0	75	37.0	5.1	2.0	93.4	84	131	0.0	0.0	0.0	2.5	4.0	12.3	6.0	2.0	14.8	241
17	875	-2.9	-25	46.5	-8.1	-3.5	76.6	85	132	0.0	0.0	0.0	3.5	3.0	11.7	7.0	2.5	21.6	266
18	975	-5.4	-50	44.0	3.3	1.5	102.0	95	132	3.5	2.0	8.6	4.0	2.0	8.6	7.0	3.0	25.9	320
19	775	8.8	75	39.5	9.2	4.0	80.7	96	132	2.0	0.5	2.5	4.0	2.0	9.9	6.0	2.0	13.6	222
20	1400	-43.6	-425	35.5	2.7	1.0	76.9	83	128	0.0	0.0	0.0	4.0	2.5	13.0	7.0	5.5	47.5	413
21	625	28.6	250	45.0	10.9	5.5	77.3	83	128	0.0	0.0	0.0	4.5	4.0	21.0	7.0	4.5	38.9	478
22	1000	-2.6	-25	41.5	16.2	8.0	85.7	83	131	0.0	0.0	0.0	3.5	4.5	17.9	7.0	4.0	34.6	415
23	1125	34.8	600	55.5	-26.1	-11.5	87.0	83	130	0.0	0.0	0.0	3.0	4.5	16.7	5.0	3.5	21.6	333
24	925	17.8	200	41.0	8.9	4.0	76.8	83	131	0.0	0.0	0.0	6.0	3.0	21.0	7.0	3.5	30.2	435
25	950	-46.2	-300	39.5	2.5	1.0	88.4	81	130	2.0	2.0	3.7	3.0	6.0	22.2	7.0	4.5	38.9	526
26	1000	-66.7	-400	46.5	2.1	1.0	83.2	81	128	2.5	2.5	8.6	4.5	5.0	27.2	7.0	5.5	47.5	678
27	850	8.1	75	41.0	5.7	2.5	81.8	83	128	2.5	3.0	9.3	2.5	5.0	16.7	7.0	4.0	34.6	477
28	500	-25.0	-100	45.0	5.3	2.5	81.3	78	129	3.0	2.5	9.3	5.5	4.0	23.5	7.0	4.0	34.6	568
29	1575	-28.6	-350	40.5	-12.5	-4.5	88.6	85	130	3.5	3.5	14.2	3.5	4.5	18.5	5.0	5.0	30.9	525
30	1225	-11.4	-125	45.5	2.2	1.0	81.6	78	128	2.5	1.5	4.9	3.0	6.0	22.2	7.0	4.0	34.6	515
Mean	868	0.2	31	42.7	1.0	0.6	82.2	86	130	1.3	1.1	4.3	4.0	3.6	16.6	6.7	3.8	30.7	414
P-value	<0.001	0.182	0.316	<0.001	0.341	0.293	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	0.049	0.556	0.607	0.106	0.222	0.092	0.075
EMS	18184	1046	94352	5.1	173.0	24.1	12.3	6.5	1.4	0.8	1.1	25.9	1.6	4.0	86.8	0.5	2.1	145.8	28118
LSD (5%)	275	66.2	628	4.6	26.9	10.0	7.2	5.2	2.4	1.8	2.1	10.4	2.6	4.1	19.1	1.4	3.0	24.7	343
CV%	15.5	806.5	996.0	5.3	2721.0	775.5	4.3	3.0	0.9	69.9	98.6	117.1	31.5	56.7	56.2	10.6	38.4	39.4	40.5
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 11: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Cooch Behar, India

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	2365	36.0	1330	44.6	-2.9	-1.3	85.5	66	110	2.0	1.0	2.5	4.0	1.5	8.0	6.0	2.5	17.9	219
2	1765	14.9	310	44.1	-1.1	-0.5	90.5	67	115	2.0	1.0	2.5	3.0	1.5	5.6	5.0	2.5	15.4	174
3	2075	34.3	1085	40.2	-3.7	-1.5	91.0	66	115	3.0	1.5	5.6	6.0	5.0	37.0	9.0	8.5	94.4	1044
4	2185	25.9	765	43.9	0.9	0.4	94.0	67	115	2.0	1.0	2.5	3.0	1.0	3.7	5.0	3.5	21.6	189
5	1735	24.7	570	35.7	1.2	0.4	94.0	66	110	2.0	1.0	2.5	3.0	1.0	3.7	5.0	3.5	21.6	189
6	2615	19.8	645	49.1	-2.9	-1.4	89.0	68	114	2.0	1.0	2.5	3.0	1.0	3.7	5.0	3.0	18.5	170
7	2165	22.1	615	44.4	-3.0	-1.3	94.0	66	110	2.0	1.0	2.5	3.0	1.5	5.6	5.0	3.0	18.5	193
8	2560	20.0	640	42.6	0.1	0.1	87.0	65	113	2.0	1.0	2.5	3.0	1.0	3.7	4.0	2.0	11.1	126
9	1150	53.8	1340	36.9	-0.1	-0.1	91.5	69	120	3.0	2.0	7.4	5.0	6.5	40.1	9.0	8.5	94.4	1093
10	2460	28.6	985	49.2	-3.9	-1.9	87.5	67	113	2.0	1.0	2.5	2.0	1.5	3.1	5.0	4.0	24.7	200
11	2530	14.1	415	44.2	-1.5	-0.7	99.0	65	113	2.0	1.0	2.5	2.0	2.0	4.9	6.0	4.0	30.9	259
12	2615	8.9	255	43.6	-2.4	-1.0	95.5	65	110	2.0	1.5	3.1	3.0	2.0	7.4	5.0	6.0	37.0	330
13	2730	9.6	290	44.2	-2.4	-1.1	90.5	69	118	2.0	1.0	2.5	3.0	2.0	7.4	5.0	4.0	24.7	252
14	1660	43.3	1270	36.0	-2.0	-0.7	97.0	67	118	3.0	1.0	3.7	6.0	5.0	37.0	9.0	7.5	83.3	967
15	1770	33.3	885	39.7	13.3	6.1	93.5	65	108	3.0	1.5	5.6	5.0	5.5	34.0	9.0	8.0	88.9	974
16	2820	16.6	560	35.6	2.1	0.8	89.5	69	118	2.0	1.0	2.5	2.0	1.5	4.3	4.0	2.5	13.0	144
17	2015	6.5	140	50.2	-3.8	-1.9	89.0	64	110	2.0	1.0	2.5	3.0	1.5	5.6	5.0	3.5	21.6	211
18	1480	19.1	350	39.5	0.3	0.1	97.5	65	115	2.0	1.0	2.5	4.0	2.0	8.6	7.0	4.0	34.6	326
19	2195	11.8	295	36.5	-3.5	-1.3	100.0	68	118	2.0	1.0	2.5	3.0	2.0	7.4	6.0	3.0	22.2	237
20	1965	20.6	510	45.7	-3.6	-1.6	94.0	69	118	2.0	1.0	2.5	4.0	3.0	17.3	6.0	5.0	40.7	467
21	2505	22.0	705	51.7	-2.9	-1.5	93.5	64	110	2.0	1.5	3.1	4.0	2.5	10.5	7.0	4.5	38.9	378
22	2005	13.6	315	52.1	-1.2	-0.6	90.5	68	115	2.0	1.0	2.5	4.0	4.0	21.0	7.0	5.5	47.5	552
23	2360	25.6	810	51.6	1.6	0.9	91.5	65	111	2.0	1.0	2.5	3.0	1.0	3.7	5.0	2.5	15.4	152
24	2715	24.9	900	40.8	16.2	7.9	98.5	65	110	2.0	1.0	2.5	4.0	3.0	14.8	7.0	4.5	38.9	426
25	2265	16.7	455	41.1	-12.1	-4.5	91.5	64	108	2.0	1.0	2.5	4.0	4.0	21.0	7.0	6.0	51.9	578
26	1290	45.7	1085	46.4	-6.4	-2.8	90.0	65	110	2.0	1.0	2.5	4.0	2.0	9.9	7.0	4.0	34.6	341
27	2785	20.9	735	46.1	-0.8	-0.4	95.5	64	108	2.0	1.0	2.5	4.0	2.5	13.0	7.0	6.5	56.2	507
28	1620	40.4	1100	43.8	-0.8	-0.3	100.0	69	118	3.0	1.5	5.6	5.0	5.5	34.0	8.0	8.0	79.0	915
29	2240	37.3	1330	48.9	2.6	1.3	92.5	68	118	2.0	1.0	2.5	2.0	1.0	2.5	3.0	2.5	9.3	100
30	1905	37.5	1145	48.8	-10.5	-4.7	89.5	67	113	3.0	1.5	5.6	4.0	2.5	11.7	6.0	4.5	32.7	370
Mean	2152	25.0	728	43.9	-1.1	-0.4	92.8	66	113	2.2	1.1	3.1	3.6	2.5	13.0	6.1	4.6	38.0	403
P-value	0.005	0.284	0.536	0.193	0.538	0.450	0.219	0.962	0.881	0.500	0.500	0.500	0.020	<.001	<.001	<.001	<.001	<.001	<.001
EMS	151553	231.5	272959	35.8	57.4	11.3	22.4	10.0	41.4	0.3	0.1	3.6	1.0	1.3	48.5	0.5	1.6	127.2	20192
LSD (5%)	796	31.1	1069	12.2	15.5	6.9	9.7	6.5	13.2	1.2	0.8	3.9	2.1	2.3	14.2	1.5	2.6	23.1	291
CV%	18.1	62.6	71.8	13.6	590.5	795.8	5.1	4.8	5.7	26.2	32.5	60.9	28.4	44.8	53.6	12.0	27.9	29.7	35.3
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 12: Average values of some important characters of 30 wheat entries tested in the 11th HMN at Karnal, India

Entry	Grain Yield (kg/ha)	Yield Loss %	Actual Loss (kg/ha)	TKW (gm)	TKW Loss%	TKW Loss	PHT	DH	DM	HLB 1st Date			HLB 2nd Date			HLB 3rd Date			AUDPC
										D1	D2	EST%	D1	D2	EST%	D1	D2	EST%	
1	3605	46.0	3065	31.5	21.0	8.4	98.0	98	132	1.0	0.5	1.2	4.0	4.0	19.8	6.0	6.0	44.4	618
2	4400	13.9	710	30.1	14.2	5.0	102.5	97	133	0.5	0.5	0.6	2.5	4.5	14.2	4.5	4.0	20.4	356
3	4150	15.5	760	35.5	2.5	0.9	104.0	91	134	0.5	1.0	1.2	4.5	3.5	19.1	6.0	5.0	37.0	554
4	5480	4.9	280	35.8	4.5	1.7	128.0	97	136	2.0	1.5	4.3	4.5	3.5	18.5	6.0	3.5	25.3	477
5	4365	26.3	1560	32.3	13.1	4.8	111.0	99	134	1.5	1.5	3.1	4.5	3.5	20.4	6.0	5.0	37.0	583
6	2420	53.8	2820	35.5	27.0	13.1	110.0	98	134	1.0	1.0	1.2	5.0	2.0	9.9	6.5	3.0	22.2	313
7	4215	16.0	800	35.3	8.4	3.3	113.5	98	133	0.5	0.5	0.6	3.5	3.5	16.0	6.0	4.5	34.0	483
8	4750	11.4	610	33.6	11.5	4.4	108.5	96	132	3.0	4.5	12.9	5.0	3.5	12.7	7.0	4.5	20.3	414
9	4750	20.0	1185	27.0	8.2	2.4	106.5	97	135	2.5	2.0	6.2	6.5	5.0	40.1	8.0	6.0	59.3	1046
10	5485	17.0	1120	35.1	6.5	2.5	113.5	98	133	0.0	0.0	0.0	5.0	2.5	14.8	7.0	3.5	28.4	420
11	5470	15.9	1035	36.3	13.8	5.8	115.0	94	132	2.0	2.0	6.2	3.5	4.0	17.3	4.5	4.5	24.1	463
12	5135	6.8	375	28.4	10.0	3.2	100.0	93	134	0.0	0.0	0.0	5.0	4.0	24.7	7.0	5.5	47.5	702
13	4025	26.7	1465	33.0	20.1	8.3	102.0	95	131	1.0	1.0	2.5	2.5	3.0	9.3	4.0	3.5	17.3	275
14	4870	31.6	2255	32.5	13.8	5.2	106.0	91	134	1.5	2.5	5.6	5.0	5.0	30.9	7.5	6.5	59.3	913
15	3595	42.4	2645	33.4	20.0	8.4	113.0	91	133	3.5	3.0	13.0	4.0	3.5	17.3	5.0	3.0	18.5	465
16	6270	12.3	880	31.7	0.2	0.1	123.5	93	134	0.0	0.0	0.0	4.0	2.5	11.7	5.5	3.5	21.0	322
17	4360	15.7	810	27.0	14.7	4.7	92.5	96	135	0.5	0.5	0.6	5.5	3.5	24.1	7.5	5.5	51.2	725
18	4325	29.2	1785	31.5	15.0	5.6	128.5	100	135	2.0	1.5	3.7	4.0	4.5	21.6	6.0	6.0	43.2	651
19	4060	19.5	985	30.5	25.2	10.3	105.0	96	135	1.5	1.5	5.6	3.5	3.5	14.8	4.5	4.5	24.1	424
20	4035	35.3	2200	28.1	22.7	8.3	97.5	93	135	0.0	0.0	0.0	4.5	4.5	25.3	6.5	6.0	48.1	715
21	5270	11.6	690	42.4	4.0	1.7	112.5	93	132	1.5	1.5	5.6	3.0	3.5	12.3	4.5	4.0	21.6	371
22	4720	17.5	1000	34.5	10.9	4.2	112.5	93	134	1.0	1.0	1.2	3.5	3.5	14.8	5.0	5.0	30.9	447
23	5180	16.5	1020	42.5	10.0	4.7	117.5	99	134	0.0	0.0	0.0	2.5	2.5	8.0	4.0	3.0	16.0	233
24	5700	15.1	1010	29.1	24.4	9.4	115.0	93	133	1.0	1.0	1.2	3.5	3.5	15.4	5.0	4.5	27.8	432
25	6360	8.1	560	35.0	6.7	2.5	108.0	94	129	0.5	0.5	0.6	3.0	3.0	11.1	5.0	4.5	27.8	368
26	6440	13.3	985	38.0	2.3	0.9	111.0	93	130	2.0	2.0	4.9	4.0	2.5	12.3	5.5	3.5	24.1	385
27	5230	16.6	1040	31.9	20.9	8.4	102.5	93	135	3.0	2.5	9.3	6.5	4.0	33.3	7.0	5.0	48.1	888
28	5015	13.5	785	40.7	6.9	3.0	105.0	88	132	1.0	0.5	1.2	3.0	2.5	8.6	4.5	3.0	16.7	254
29	5600	10.8	675	30.4	10.2	3.5	116.0	93	132	0.5	0.5	0.6	4.5	4.0	23.5	6.5	5.5	45.1	670
30	6125	13.5	960	39.9	13.7	6.4	109.0	93	134	1.0	1.0	1.2	4.0	5.0	25.9	5.5	5.0	35.8	640
Mean	4847	19.9	1202	33.6	12.7	5.0	109.6	95	133	1.2	1.2	3.1	4.1	3.6	18.3	5.8	4.6	32.6	520
P-value	0.004	0.003	0.007	0.002	0.626	0.671	0.002	<0.001	0.453	<0.001	<0.001	0.044	0.025	0.331	0.060	0.005	0.326	0.015	0.034
EMS	609239	96.1	408447	11.7	126.2	23.2	47.5	2.8	4.5	0.5	0.6	13.6	1.0	1.1	65.3	0.9	1.8	148.1	41099
LSD (5%)	1596	20.1	1307	7.0	23.0	9.8	14.1	3.4	4.3	1.5	1.6	7.6	2.1	2.1	16.5	2.0	2.8	24.9	415
CV%	16.1	49.5	53.2	10.2	90.4	95.9	6.3	1.8	1.6	59.8	64.1	117.8	24.6	29.1	44.3	16.5	29.8	37.4	39.0
Error df	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 13: Average area under the disease progress curve (AUDPC) of HLB for 30 wheat entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	554	424	431	329	71	135	95	656	290	219	618	347
2	721	507	210	322	113	206	94	666	190	174	356	324
3	1321	896	570	720	284	241	181	903	408	1044	554	647
4	996	844	667	640	161	305	124	467	551	189	477	493
5	927	504	544	445	99	219	77	430	608	189	583	420
6	1078	688	520	434	87	206	143	557	341	170	313	413
7	698	508	245	304	99	137	93	439	167	193	483	306
8	712	627	175	184	72	200	56	448	223	126	414	294
9	1581	1087	690	1186	434	405	190	826	389	1093	1046	811
10	837	524	396	396	93	148	198	539	333	200	420	371
11	930	904	516	552	131	159	94	602	456	259	463	461
12	1426	704	351	540	96	179	53	593	319	330	702	481
13	973	677	333	425	86	143	153	712	285	252	275	392
14	1389	794	580	815	180	307	100	651	676	967	913	670
15	1623	1343	698	1110	329	320	100	871	777	974	465	783
16	549	463	161	292	83	242	133	386	241	144	322	274
17	1142	659	475	593	127	253	131	595	266	211	725	471
18	992	605	199	468	81	183	98	473	320	326	651	400
19	1041	805	315	469	69	204	81	560	222	237	424	403
20	1177	790	459	592	112	157	90	675	413	467	715	513
21	1447	698	307	530	146	237	93	554	478	378	371	476
22	1522	497	385	635	122	149	109	536	415	552	447	488
23	791	507	316	359	93	128	84	396	333	152	233	308
24	1233	903	386	560	136	160	135	455	435	426	432	478
25	1256	677	444	598	136	257	113	695	526	578	368	514
26	1506	847	578	603	169	293	78	666	678	341	385	559
27	1522	892	580	840	175	240	84	830	477	507	888	639
28	1484	708	451	741	135	219	81	605	568	915	254	560
29	1202	1005	488	600	105	115	84	534	525	100	670	493
30	1427	824	616	570	136	158	84	570	515	370	640	537
Location Mean	1135	730	436	562	139	210	108	596	414	403	520	478
P-value	<0.001	<0.001	0.009	<.001	<0.001	<0.001	<0.001	<0.001	0.075	<.001	0.034	<0.001
EMS	24746	18657	19338	3590	2022	1729	665	6860	28118	20192	41099	15184
lsd (5%)	322	279	284	123	92	85	53	169	343	291	415	73
CV%	13.9	18.7	31.9	10.7	32.4	19.8	24.0	13.9	40.5	35.3	39.0	25.8
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 14: Average disease severity as percent estimates calculated from the highest HLB double digit score for 30 wheat entries at eleven locations in the 11th HMN.

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	18.5	30.2	43.8	30.9	4.3	8.6	11.1	55.6	24.7	17.9	44.4	26.4
2	27.8	29.6	22.2	29.6	9.3	14.2	9.3	56.2	17.9	15.4	20.4	22.9
3	59.3	64.2	59.3	44.4	27.2	22.2	22.2	74.1	30.2	94.4	37.0	48.6
4	54.3	64.2	64.8	54.3	14.8	27.2	14.8	40.7	30.2	21.6	25.3	37.5
5	34.6	39.5	44.4	40.1	6.8	13.0	9.3	44.4	17.9	21.6	37.0	28.1
6	54.3	49.4	66.0	34.6	6.8	14.2	18.5	44.4	21.6	18.5	22.2	31.9
7	29.6	34.6	19.8	22.2	8.6	8.0	11.1	40.7	13.0	18.5	34.0	21.8
8	29.6	37.0	16.0	14.7	6.1	16.7	7.4	48.1	18.4	11.1	20.3	20.5
9	74.1	69.1	64.8	79.0	27.8	37.0	22.2	64.2	30.2	94.4	59.3	56.6
10	34.6	39.5	40.7	37.0	5.6	9.9	21.6	51.9	38.3	24.7	28.4	30.2
11	39.5	49.4	49.4	38.9	12.3	12.3	9.3	52.5	34.6	30.9	24.1	32.1
12	69.1	49.4	29.6	49.4	8.6	14.8	7.4	51.9	38.9	37.0	47.5	36.7
13	44.4	49.4	33.3	38.9	7.4	9.9	18.5	56.2	30.2	24.7	17.3	30.0
14	64.2	54.3	59.3	64.2	17.3	14.8	11.1	51.9	47.5	83.3	59.3	47.9
15	69.1	74.1	70.4	79.0	18.5	18.5	11.1	64.8	56.2	88.9	18.5	51.7
16	24.7	37.0	21.6	27.2	6.2	16.7	18.5	37.0	14.8	13.0	21.0	21.6
17	44.4	54.3	48.8	46.3	14.2	11.1	15.4	51.9	21.6	21.6	51.2	34.6
18	44.4	39.5	22.2	36.4	5.6	12.3	11.1	44.4	25.9	34.6	43.2	29.1
19	49.4	49.4	34.0	38.9	3.7	13.6	9.3	48.1	13.6	22.2	24.1	27.8
20	54.3	54.3	38.3	54.3	11.1	10.5	11.1	56.2	47.5	40.7	48.1	38.8
21	64.2	49.4	34.6	47.5	14.8	18.5	11.1	52.5	38.9	38.9	21.6	35.6
22	74.1	39.5	24.7	49.4	11.1	11.1	14.8	47.5	34.6	47.5	30.9	35.0
23	29.6	37.0	30.2	30.2	7.4	7.4	11.1	40.7	21.6	15.4	16.0	22.4
24	59.3	59.3	48.1	41.4	13.6	14.8	18.5	40.1	30.2	38.9	27.8	35.6
25	59.3	54.3	48.1	37.0	12.3	16.7	15.4	59.3	38.9	51.9	27.8	38.3
26	64.2	59.3	57.4	41.4	13.6	16.7	9.3	56.2	47.5	34.6	24.1	38.6
27	74.1	64.2	63.0	64.2	14.8	18.5	11.1	64.8	34.6	56.2	48.1	46.7
28	69.1	59.3	51.2	54.3	10.5	14.8	11.1	47.5	34.6	79.0	16.7	40.7
29	49.4	44.4	40.7	35.8	9.9	9.3	11.1	54.3	30.9	9.3	45.1	30.9
30	64.2	64.2	48.5	43.2	14.8	13.6	11.1	51.9	34.6	32.7	35.8	37.7
Location Mean	50.9	50.0	43.2	43.5	11.5	14.9	13.2	51.7	30.7	38.0	32.6	34.5
P-value	<0.001	<0.001	0.075	<.001	0.006	<0.001	<0.001	0.001	0.092	<.001	0.015	<0.001
EMS	66.9	64.8	286.3	33.4	26.3	16.8	6.7	44.1	145.8	127.2	148.1	87.88
lsd (5%)	16.7	16.5	34.6	11.8	10.5	8.4	5.3	13.6	24.7	23.1	24.9	5.56
CV%	16.1	16.1	39.2	13.3	44.6	27.6	19.6	12.9	39.4	29.7	37.4	27.1
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 15: Average first digit of the highest HLB score for 30 wheat entries tested at eleven locations in the 11th HMN.

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	7.5	7.0	6.5	5.5	3.5	3.5	3.0	7.5	5.5	6.0	6.0	5.6
2	7.5	8.0	5.0	6.0	3.5	4.5	3.0	7.0	6.0	5.0	4.5	5.5
3	8.0	8.0	8.0	8.0	7.0	6.0	6.0	8.0	7.0	9.0	6.0	7.4
4	8.0	8.0	7.5	8.0	6.0	5.5	4.0	6.5	7.0	5.0	6.0	6.5
5	8.0	8.0	6.0	6.5	3.5	4.0	3.0	6.0	6.0	5.0	6.0	5.6
6	8.0	8.0	8.0	7.0	3.5	4.5	5.0	6.0	7.0	5.0	6.5	6.2
7	8.0	8.0	4.5	6.0	3.5	4.5	3.0	6.0	7.0	5.0	6.0	5.6
8	8.0	7.5	4.0	6.0	3.0	4.5	3.0	6.5	7.0	4.0	7.0	5.5
9	8.0	8.0	8.0	8.0	9.0	6.0	6.0	8.0	7.0	9.0	8.0	7.7
10	8.0	8.0	6.0	7.5	3.0	4.0	7.0	7.0	6.0	5.0	7.0	6.2
11	8.0	8.0	7.0	7.0	4.0	5.0	3.0	6.5	7.0	6.0	4.5	6.0
12	8.0	8.0	6.0	8.0	4.5	6.0	3.0	7.0	7.0	5.0	7.0	6.3
13	8.0	8.0	5.5	7.0	3.0	5.5	5.0	7.0	7.0	5.0	4.0	5.9
14	8.0	8.0	7.5	8.0	7.0	6.0	3.0	7.0	7.0	9.0	7.5	7.1
15	8.0	8.0	8.0	8.0	7.5	6.0	3.0	7.5	7.0	9.0	5.0	7.0
16	8.0	7.5	5.0	5.5	3.5	4.5	5.0	6.0	6.0	4.0	5.5	5.5
17	8.0	8.0	6.5	7.5	4.5	6.0	5.0	7.0	7.0	5.0	7.5	6.5
18	8.0	8.0	4.5	6.5	3.0	5.0	3.0	6.5	7.0	7.0	6.0	5.9
19	8.0	8.0	6.5	7.0	3.0	4.5	3.0	6.5	6.0	6.0	4.5	5.7
20	8.0	8.0	7.0	8.0	4.5	5.5	3.0	7.0	7.0	6.0	6.5	6.4
21	8.0	8.0	6.0	7.0	6.0	6.0	3.0	6.5	7.0	7.0	4.5	6.3
22	8.0	8.0	5.0	8.0	4.5	6.0	4.0	7.0	7.0	7.0	5.0	6.3
23	8.0	7.5	5.5	7.0	3.0	3.0	3.0	6.0	5.0	5.0	4.0	5.2
24	8.0	8.0	7.0	7.5	5.5	4.5	5.0	6.5	7.0	7.0	5.0	6.5
25	8.0	8.0	8.0	7.5	5.0	5.5	5.0	8.0	7.0	7.0	5.0	6.7
26	8.0	8.0	7.5	7.5	5.5	5.5	3.0	7.0	7.0	7.0	5.5	6.5
27	8.0	8.0	7.5	8.0	6.0	6.0	3.0	7.5	7.0	7.0	7.0	6.8
28	8.0	8.0	7.0	8.0	5.5	6.0	3.0	7.0	7.0	8.0	4.5	6.5
29	8.0	8.0	6.5	6.5	4.0	5.0	3.0	8.0	5.0	3.0	6.5	5.8
30	8.0	8.0	6.5	7.0	5.0	5.5	3.0	7.0	7.0	6.0	5.5	6.2
Location Mean	8.0	7.9	6.5	7.2	4.7	5.1	3.8	6.9	6.7	6.1	5.8	6.2
P-value	0.500	0.015	0.075	<.001	<0.001	0.002	<0.001	<0.001	0.106	<.001	0.005	<0.001
EMS	0.0	0.0	1.6	0.1	0.5	0.5	0.3	0.2	0.5	0.5	0.9	0.4771
lsd (5%)	0.4	0.4	2.6	0.8	1.5	1.4	1.1	0.9	1.4	1.5	2.0	0.409
CV%	2.3	2.7	19.7	5.1	15.7	13.5	13.8	6.0	10.6	12.0	16.5	11.1
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 16: Average second digit of the highest HLB score for 30 wheat entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	2.0	3.5	5.5	4.5	1.0	2.0	3.0	6.0	3.5	2.5	6.0	3.6
2	3.0	3.0	3.5	4.0	2.0	2.5	2.5	6.5	2.5	2.5	4.0	3.3
3	6.0	6.5	6.0	4.5	3.0	3.0	3.0	7.5	3.5	8.5	5.0	5.1
4	5.5	6.5	7.0	5.5	2.0	4.0	3.0	5.0	3.5	3.5	3.5	4.5
5	3.5	4.0	6.0	5.0	1.5	2.5	2.5	6.0	2.5	3.5	5.0	3.8
6	5.5	5.0	6.5	4.0	1.5	2.5	3.0	6.0	2.5	3.0	3.0	3.9
7	3.0	3.5	3.5	3.0	2.0	1.5	3.0	5.5	1.5	3.0	4.5	3.1
8	3.0	4.0	3.0	3.5	1.5	3.0	2.0	6.0	3.5	2.0	4.5	3.3
9	7.5	7.0	6.5	8.0	2.5	5.0	3.0	6.5	3.5	8.5	6.0	5.8
10	3.5	4.0	5.5	4.0	1.5	2.0	2.5	6.0	5.0	4.0	3.5	3.8
11	4.0	5.0	5.5	4.5	2.5	2.0	2.5	6.5	4.0	4.0	4.5	4.1
12	7.0	5.0	4.0	5.0	1.5	2.0	2.0	6.0	4.5	6.0	5.5	4.4
13	4.5	5.0	4.5	4.5	2.0	1.5	3.0	6.5	3.5	4.0	3.5	3.9
14	6.5	5.5	6.0	6.5	2.0	2.0	3.0	6.0	5.5	7.5	6.5	5.2
15	7.0	7.5	7.0	8.0	2.0	2.5	3.0	7.0	6.5	8.0	3.0	5.6
16	2.5	4.0	3.5	4.0	1.5	3.0	3.0	5.0	2.0	2.5	3.5	3.1
17	4.5	5.5	5.5	5.0	2.5	1.5	2.5	6.0	2.5	3.5	5.5	4.0
18	4.5	4.0	4.0	4.5	1.5	2.0	3.0	5.5	3.0	4.0	6.0	3.8
19	5.0	5.0	4.0	4.5	1.0	2.5	2.5	6.0	2.0	3.0	4.5	3.6
20	5.5	5.5	4.5	5.5	2.0	1.5	3.0	6.5	5.5	5.0	6.0	4.6
21	6.5	5.0	5.0	5.5	2.0	2.5	3.0	6.5	4.5	4.5	4.0	4.5
22	7.5	4.0	4.0	5.0	2.0	1.5	3.0	5.5	4.0	5.5	5.0	4.3
23	3.0	4.0	4.5	3.5	2.0	2.0	3.0	5.5	3.5	2.5	3.0	3.3
24	6.0	6.0	5.5	4.5	2.0	2.5	3.0	5.0	3.5	4.5	4.5	4.3
25	6.0	5.5	5.0	4.0	2.0	2.5	2.5	6.0	4.5	6.0	4.5	4.4
26	6.5	6.0	6.0	4.5	2.0	2.5	2.5	6.5	5.5	4.0	3.5	4.5
27	7.5	6.5	6.5	6.5	2.0	2.5	3.0	7.0	4.0	6.5	5.0	5.2
28	7.0	6.0	5.5	5.5	1.5	2.0	3.0	5.5	4.0	8.0	3.0	4.6
29	5.0	4.5	5.0	4.5	2.0	1.5	3.0	5.5	5.0	2.5	5.5	4.0
30	6.5	6.5	5.8	5.0	2.5	2.0	3.0	6.0	4.0	4.5	5.0	4.6
Location Mean	5.2	5.1	5.1	4.9	1.9	2.3	2.8	6.0	3.8	4.6	4.6	4.2
P-value	<0.001	<0.001	0.123	<.001	0.805	<0.001	0.043	0.036	0.222	<.001	0.326	<0.001
EMS	0.7	0.7	1.6	0.4	0.5	0.3	0.1	0.4	2.1	1.6	1.8	0.9251
lsd (5%)	1.7	1.7	2.6	1.2	1.5	1.1	0.7	1.2	3.0	2.6	2.8	0.57
CV%	16.0	16.1	24.6	12.3	38.8	23.0	11.4	10.0	38.4	27.9	29.8	22.9
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 17: Average grain yield (kg/ha) of 30 entries (untreated) tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	1915	3885	1495	5151	3670	3710	3185	4375	825	2365	3605	3107
2	1570	3270	1860	4771	4010	3775	3560	4250	1050	1765	4400	3116
3	1565	3995	1845	4707	4400	3700	3445	4125	725	2075	4150	3157
4	1670	3175	2270	3585	5235	3960	4190	3875	950	2185	5480	3325
5	1345	3625	2140	4165	4260	3295	3215	4375	1075	1735	4365	3054
6	1255	3675	2365	3767	4550	3120	2715	4625	875	2615	2420	2907
7	1530	3045	2210	3894	4405	3175	3395	4250	675	2165	4215	2996
8	1525	3175	2055	4390	4460	4045	3235	4250	975	2560	4750	3220
9	1450	2940	2220	3000	3080	3350	4570	2625	550	1150	4750	2699
10	1175	3535	1935	3850	3510	2765	3620	5125	600	2460	5485	3096
11	1465	4425	2040	4159	4115	3885	2805	5625	800	2530	5470	3393
12	1240	3485	2255	3542	4215	3410	4205	3875	500	2615	5135	3134
13	1525	3910	1710	3014	3185	3310	3025	4250	675	2730	4025	2851
14	1900	2950	1865	2889	3515	3680	3195	4125	650	1660	4870	2845
15	1385	2480	1380	3633	2820	4190	3900	4625	900	1770	3595	2789
16	2000	4360	2160	5078	5200	4470	4180	5375	425	2820	6270	3849
17	1675	3945	1690	4694	3840	3510	4970	5250	875	2015	4360	3348
18	1205	2350	1565	4950	4180	3405	3015	5375	975	1480	4325	2984
19	1070	2655	1670	3605	4255	3195	3830	4125	775	2195	4060	2858
20	1245	2705	1795	4028	4400	3420	3665	5125	1400	1965	4035	3071
21	1280	3600	2190	3054	4855	3770	4535	6500	625	2505	5270	3471
22	1180	3835	1095	3811	4210	4230	3255	4125	1000	2005	4720	3042
23	1550	4230	2075	4556	5230	4680	3695	4125	1125	2360	5180	3528
24	1475	2550	2410	3806	4660	4395	3745	5625	925	2715	5700	3455
25	1430	3660	2515	3938	4830	4530	3565	4875	950	2265	6360	3538
26	1390	3430	1845	4047	4635	3395	4035	4375	1000	1290	6440	3262
27	1820	3690	2125	4468	5125	4345	3850	4250	850	2785	5230	3503
28	1440	3415	2065	3026	4255	4015	3075	4125	500	1620	5015	2959
29	1410	3210	1465	4195	5070	3830	3320	5375	1575	2240	5600	3390
30	1225	3915	1665	3887	4615	4355	4665	4875	1225	1905	6125	3496
Location Mean	1464	3437	1933	3988	4293	3764	3655	4596	868	2152	4847	3182
P-value	0.339	0.005	0.73.8	<0.001	0.039	<0.001	0.516	<0.001	<0.001	0.005	0.004	<0.001
EMS	93574.0	230526	283719	161409	418420	51409	662325	41990	18184	151553	609239	247500
lsd (5%)	625.6	982	1089	822	1323	464	1665	419	275	796	1596	295
CV%	20.9	14.0	27.6	10.1	15.1	6.0	22.3	4.5	15.5	18.1	16.1	15.6
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 18: Average grain yield loss (kg/ha) of 30 entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	-110	485	445	554	915	390	615	250	100	1330	3065	731
2	340	965	445	252	-270	695	-185	125	-50	310	710	303
3	-300	455	-130	751	100	460	-345	375	325	1085	760	321
4	-250	825	65	196	660	290	-335	375	100	765	280	270
5	-110	525	-105	302	10	635	790	500	-150	570	1560	412
6	560	505	80	265	-205	1245	1060	250	75	645	2820	664
7	50	865	-70	157	-25	390	-650	375	-100	615	800	219
8	-95	945	-155	595	-230	160	-225	125	-75	640	610	209
9	355	1460	-90	965	1650	440	-415	375	75	1340	1185	667
10	425	945	50	113	900	750	490	250	-150	985	1120	534
11	350	280	570	459	1235	665	1790	250	100	415	1035	650
12	435	160	-125	256	1010	475	-625	375	400	255	375	272
13	125	400	5	827	785	370	1070	250	250	290	1465	531
14	120	1370	75	1050	1390	485	315	500	175	1270	2255	819
15	555	1135	35	830	1340	495	-625	0	375	885	2645	697
16	170	990	-55	358	855	350	-795	-125	75	560	880	297
17	305	485	795	647	5	625	-555	125	-25	140	810	305
18	480	905	-250	276	-465	1070	385	500	-50	350	1785	453
19	495	1140	375	441	-125	920	-955	125	75	295	985	343
20	155	1500	100	632	530	150	-1080	375	-425	510	2200	422
21	160	595	-385	1146	325	950	-675	250	250	705	690	365
22	-10	140	170	624	1155	330	100	625	-25	315	1000	402
23	210	525	-390	273	370	185	540	125	600	810	1020	388
24	640	1580	-105	1137	1140	480	515	375	200	900	1010	716
25	200	520	-170	249	255	-30	810	625	-300	455	560	289
26	795	255	205	125	380	115	140	500	-400	1085	985	380
27	355	505	555	1332	1110	535	55	250	75	735	1040	595
28	-80	305	-90	523	-575	-110	50	250	-100	1100	785	187
29	845	735	355	267	215	315	-360	375	-350	1330	675	400
30	370	910	820	501	935	165	195	375	-125	1145	960	568
Location Mean	251	747	101	536	513	467	37	304	31	728	1202	447
P-value	0.644	0.456	0.450	<0.001	0.168	0.008	0.629	0.043	0.316	0.536	0.007	
EMS	192938	312396	190114	62698	519157	78222	1053907	31214	94352	272959	408447	
lsd (5%)	898	1143	436	512	1474	572	2100	361	628	1069	1307	
CV%	175	75	432	47	141	60	2813	58	996	72	53	
Error df	29	29	29	29	29	29	29	29	29	29	29	

Table 19: Average grain yield loss % of 30 wheat entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	-6.1	11.1	22.9	9.7	20.0	9.5	16.2	5.4	10.8	36.0	46.0	16
2	17.8	22.8	19.3	5.0	-7.2	15.5	-5.5	2.9	-5.0	14.9	13.9	9
3	-23.7	10.2	-7.6	13.8	2.2	11.1	-11.1	8.3	31.0	34.3	15.5	8
4	-17.6	20.6	2.8	5.2	11.2	6.8	-8.7	8.8	9.5	25.9	4.9	6
5	-8.9	12.7	-5.2	6.8	0.2	16.2	19.7	10.3	-16.2	24.7	26.3	8
6	30.9	12.1	3.3	6.6	-4.7	28.5	28.1	5.1	7.9	19.8	53.8	17
7	3.2	22.1	-3.3	3.9	-0.6	10.9	-23.7	8.1	-17.4	22.1	16.0	4
8	-6.6	22.9	-8.2	11.9	-5.4	3.8	-7.5	2.9	-8.3	20.0	11.4	3
9	19.7	33.2	-4.2	24.3	34.9	11.6	-10.0	12.5	12.0	53.8	20.0	19
10	26.6	21.1	2.5	2.8	20.4	21.3	11.9	4.7	-33.3	28.6	17.0	11
11	19.3	6.0	21.8	9.9	23.1	14.6	39.0	4.3	11.1	14.1	15.9	16
12	26.0	4.4	-5.9	6.7	19.3	12.2	-17.5	8.8	44.4	8.9	6.8	10
13	7.6	9.3	0.3	21.5	19.8	10.1	26.1	5.6	27.0	9.6	26.7	15
14	5.9	31.7	3.9	26.6	28.3	11.6	9.0	10.8	21.2	43.3	31.6	20
15	28.6	31.4	2.5	18.6	32.2	10.6	-19.1	0.0	29.4	33.3	42.4	19
16	7.8	18.5	-2.6	6.6	14.1	7.3	-23.5	-2.4	15.0	16.6	12.3	6
17	15.4	10.9	32.0	12.1	0.1	15.1	-12.6	2.3	-2.9	6.5	15.7	9
18	28.5	27.8	-19.0	5.3	-12.5	23.9	11.3	8.5	-5.4	19.1	29.2	11
19	31.6	30.0	18.3	10.9	-3.0	22.4	-33.2	2.9	8.8	11.8	19.5	11
20	11.1	35.7	5.3	13.6	10.8	4.2	-41.8	6.8	-43.6	20.6	35.3	5
21	11.1	14.2	-21.3	27.3	6.3	20.1	-17.5	3.7	28.6	22.0	11.6	10
22	-0.9	3.5	13.4	14.1	21.5	7.2	3.0	13.2	-2.6	13.6	17.5	9
23	11.9	11.0	-23.1	5.6	6.6	3.8	12.8	2.9	34.8	25.6	16.5	10
24	30.3	38.3	-4.6	23.0	19.7	9.8	12.1	6.3	17.8	24.9	15.1	18
25	12.3	12.4	-7.2	5.9	5.0	-0.7	18.5	11.4	-46.2	16.7	8.1	3
26	36.4	6.9	10.0	3.0	7.6	3.3	3.4	10.3	-66.7	45.7	13.3	7
27	16.3	12.0	20.7	23.0	17.8	11.0	1.4	5.6	8.1	20.9	16.6	14
28	-5.9	8.2	-4.6	14.7	-15.6	-2.8	1.6	5.7	-25.0	40.4	13.5	3
29	37.5	18.6	19.5	6.0	4.1	7.6	-12.2	6.5	-28.6	37.3	10.8	10
30	23.2	18.9	33.0	11.4	16.8	3.7	4.0	7.1	-11.4	37.5	13.5	14
Location Mean	13.0	18.0	3.8	11.9	9.8	11.0	-0.9	6.3	0.2	25.0	19.9	11
P-value	0.606	0.291	0.594	<0.001	0.137	0.004	0.643	0.032	0.182	0.284	0.003	
EMS	513.8	142.3	464.2	27.0	228.4	38.0	1164.0	13.7	1046.0	231.5	96.1	
lsd (5%)	46.4	24.4	44.1	10.6	30.9	12.6	69.8	7.6	66.2	31.1	20.1	
CV%	202.1	67.6	772.2	44.1	165.0	56.6	614.4	59.2	806.5	62.6	49.5	
Error df	29	29	29	29	29	29	29	29	29	29	29	

Table 20: Average thousand kernel weight (gm) of 30 wheat entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	33.0	41.8	32.4	43.6	39.3	40.5	38.5	29.2	42.0	44.6	31.5	37.8
2	36.5	35.3	29.4	45.4	43.3	39.5	33.4	30.8	44.0	44.1	30.1	37.4
3	37.3	41.3	42.2	46.6	38.0	42.0	37.0	30.3	43.5	40.2	35.5	39.4
4	35.5	42.2	44.6	50.3	41.3	44.0	43.1	30.7	45.0	43.9	35.8	41.5
5	31.5	33.1	30.2	41.8	32.8	36.5	30.9	28.3	40.5	35.7	32.3	33.9
6	43.5	48.8	52.3	62.0	53.5	48.0	51.1	42.8	56.5	49.1	35.5	49.4
7	36.8	38.7	41.2	45.1	41.3	42.5	39.5	33.2	41.0	44.4	35.3	39.9
8	33.8	40.2	39.9	44.1	39.8	39.0	35.8	33.9	41.0	42.6	33.6	38.5
9	32.3	28.2	31.9	34.8	26.0	36.5	30.5	20.8	36.5	36.9	27.0	31.0
10	28.3	41.5	41.9	47.3	37.8	37.5	35.7	32.8	42.0	49.2	35.1	39.0
11	36.8	38.4	37.9	50.6	42.5	44.0	39.7	33.9	43.0	44.2	36.3	40.7
12	29.3	27.1	33.5	33.3	27.5	31.0	27.6	21.7	31.5	43.6	28.4	30.4
13	38.3	38.6	37.4	51.9	44.5	41.0	40.0	35.6	47.0	44.2	33.0	41.0
14	31.3	29.1	39.9	42.4	34.8	38.5	37.8	29.9	39.0	36.0	32.5	35.5
15	33.3	33.7	40.5	44.5	30.8	41.5	39.3	34.2	44.0	39.7	33.4	37.7
16	30.0	33.6	37.3	40.8	37.8	35.5	32.8	30.8	37.0	35.6	31.7	34.8
17	32.8	35.9	35.4	42.0	37.3	37.5	35.7	30.1	46.5	50.2	27.0	37.3
18	39.5	45.6	43.2	46.6	42.8	43.0	34.5	32.2	44.0	39.5	31.5	40.2
19	28.5	32.6	36.7	43.8	36.5	41.0	32.7	28.9	39.5	36.5	30.5	35.2
20	24.5	28.0	33.8	35.1	27.8	40.0	29.0	33.3	35.5	45.7	28.1	32.8
21	34.5	42.1	36.9	48.3	43.5	43.5	38.7	40.6	45.0	51.7	42.4	42.5
22	32.5	36.7	46.8	45.0	39.0	41.5	38.7	33.7	41.5	52.1	34.5	40.2
23	41.0	47.4	38.1	55.8	50.5	46.5	42.4	35.6	55.5	51.6	42.5	46.1
24	37.5	30.4	41.5	45.3	35.8	37.0	36.6	38.3	41.0	40.8	29.1	37.6
25	30.0	36.8	29.3	41.4	35.3	38.5	34.8	30.5	39.5	41.1	35.0	35.6
26	33.8	39.7	38.9	50.6	42.5	42.5	41.2	37.4	46.5	46.4	38.0	41.6
27	30.5	36.0	39.8	42.6	37.0	36.0	37.0	31.0	41.0	46.1	31.9	37.2
28	39.3	48.0	47.8	53.1	43.5	41.0	42.9	36.6	45.0	43.8	40.7	43.8
29	28.8	33.4	35.1	42.8	39.0	41.0	34.8	30.8	40.5	48.9	30.4	36.8
30	32.8	40.9	42.3	50.0	42.5	40.5	39.6	37.7	45.5	48.8	39.9	41.9
Location Mean	33.8	37.5	38.6	45.6	38.8	40.2	37.0	32.5	42.7	43.9	33.6	38.6
P-value	<0.001	<0.001	0.060	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.193	0.002	<0.001
EMS	4.0	10.5	33.2	2.7	6.0	4.1	2.6	0.2	5.1	35.8	11.7	1053.0
lsd (5%)	4.1	6.6	11.8	3.3	5.0	4.1	3.3	1.0	4.6	12.2	7.0	1.9
CV%	5.9	8.6	14.9	3.6	6.3	5.0	4.3	1.5	5.3	13.6	10.2	8.4
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 21: Average loss (gm) in thousand kernel weight of 30 wheat entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	2.5	-0.3	9.7	4.9	1.8	2.5	-5.2	0.9	-2.5	-1.3	8.4	1.9
2	3.3	0.9	11.0	3.0	-0.3	-0.5	1.3	0.4	2.0	-0.5	5.0	2.3
3	4.3	4.6	2.0	6.1	6.5	-2.5	1.9	0.6	1.5	-1.5	0.9	2.2
4	9.5	4.1	5.9	3.4	3.1	3.5	-8.7	0.7	3.0	0.4	1.7	2.4
5	0.5	2.3	6.3	4.8	5.3	4.0	0.3	1.1	-3.0	0.4	4.8	2.4
6	5.0	8.9	3.1	3.9	3.5	2.5	-0.2	0.4	1.5	-1.4	13.1	3.7
7	1.5	3.8	0.5	3.4	1.5	-1.0	-2.5	0.7	-2.5	-1.3	3.3	0.7
8	2.3	0.5	2.6	2.1	2.0	1.5	0.8	0.6	-0.5	0.1	4.4	1.5
9	3.5	11.8	-2.1	7.0	6.8	0.0	0.2	0.7	4.0	-0.1	2.4	3.1
10	9.3	5.8	-0.4	5.4	3.8	4.0	0.4	0.2	5.5	-1.9	2.5	3.1
11	3.8	6.1	5.6	2.1	1.5	-1.0	-2.4	0.5	-1.5	-0.7	5.8	1.8
12	4.5	5.6	-0.9	2.9	3.0	1.0	0.8	0.9	0.0	-1.0	3.2	1.8
13	4.0	7.4	5.3	3.9	4.0	2.5	1.2	0.3	-5.5	-1.1	8.3	2.8
14	5.0	10.3	0.9	6.9	3.5	2.0	-1.9	1.1	-0.5	-0.7	5.2	2.9
15	7.8	12.2	-6.3	6.0	6.5	2.5	1.4	0.2	3.0	6.1	8.4	4.3
16	4.8	4.0	-1.4	2.8	-1.3	1.0	1.0	1.1	2.0	0.8	0.1	1.3
17	8.5	9.5	2.7	5.1	4.5	5.0	0.7	1.0	-3.5	-1.9	4.7	3.3
18	-0.5	4.8	-0.1	7.4	3.0	0.5	1.2	0.9	1.5	0.1	5.6	2.2
19	5.0	9.3	4.7	3.9	5.8	3.0	1.1	0.5	4.0	-1.3	10.3	4.2
20	8.3	6.5	-1.0	4.6	3.8	1.5	1.5	0.5	1.0	-1.6	8.3	3.0
21	5.5	4.5	5.0	4.0	2.8	4.0	2.3	0.8	5.5	-1.5	1.7	3.1
22	5.5	8.2	-5.5	3.6	2.3	-0.5	-0.1	0.9	8.0	-0.6	4.2	2.4
23	2.3	2.3	11.8	2.6	2.8	1.5	1.4	0.2	-11.5	0.9	4.7	1.7
24	3.3	9.5	-5.6	2.9	3.5	5.5	1.0	0.8	4.0	7.9	9.4	3.8
25	5.0	1.0	9.5	3.6	3.3	1.5	0.3	1.1	1.0	-4.5	2.5	2.2
26	5.0	7.8	3.3	1.0	3.0	2.5	2.6	1.1	1.0	-2.8	0.9	2.3
27	2.0	7.4	0.9	5.6	1.0	5.5	0.0	0.4	2.5	-0.4	8.4	3.0
28	0.8	-1.9	2.2	3.0	0.3	1.0	-3.3	0.3	2.5	-0.3	3.0	0.7
29	4.3	5.7	3.6	1.3	-3.0	0.5	1.7	1.0	-4.5	1.3	3.5	1.4
30	6.0	5.2	-0.3	4.6	2.5	3.0	4.3	0.6	1.0	-4.7	6.4	2.6
Location Mean	4.4	5.6	2.4	4.1	2.9	1.9	0.1	0.7	0.6	-0.4	5.0	2.5
P-value	0.375	0.137	0.534	<0.001	0.115	0.167	0.146	0.618	0.293	0.450	0.671	
EMS	11.2	16.9	43.7	1.5	6.2	5.5	7.8	0.2	24.1	11.3	23.2	
lsd (5%)	6.8	8.4	13.5	2.5	5.1	4.8	5.7	0.9	10.0	6.9	9.8	
CV%	76.0	73.5	272.9	29.9	86.2	124.1	16785.0	66.8	775.5	795.8	95.9	
Error df	29	29	29	29	29	29	29	29.0	29.0	29.0	29.0	

Table 22: Average loss (%) in thousand kernel weight of 30 wheat entries tested at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	7.0	-0.6	23.0	10.1	4.3	5.8	-15.8	2.8	-6.3	-2.9	21.0	4.4
2	8.2	2.5	27.2	6.2	-0.6	-1.3	3.8	1.3	4.3	-1.1	14.2	5.9
3	10.2	10.0	4.5	11.6	14.6	-6.3	4.9	1.9	3.3	-3.7	2.5	4.9
4	21.0	8.9	11.6	6.3	6.9	7.4	-25.5	2.2	6.3	0.9	4.5	4.6
5	1.6	6.5	17.3	10.2	13.8	9.9	0.9	3.7	-8.0	1.2	13.1	6.4
6	10.3	15.4	5.6	5.9	6.1	5.0	-0.5	0.9	2.6	-2.9	27.0	6.9
7	3.9	8.8	1.3	7.0	3.5	-2.4	-6.8	2.1	-6.5	-3.0	8.4	1.5
8	6.3	1.4	6.0	4.6	4.8	3.7	2.2	1.7	-1.2	0.1	11.5	3.7
9	9.8	29.4	-6.9	16.8	20.6	0.0	0.7	3.3	9.9	-0.1	8.2	8.3
10	24.7	12.4	-1.1	10.2	9.0	9.6	1.1	0.6	11.6	-3.9	6.5	7.3
11	9.3	13.8	12.9	4.0	3.4	-2.3	-6.3	1.5	-3.6	-1.5	13.8	4.1
12	13.3	17.1	-2.8	8.0	9.8	3.1	2.9	4.0	0.0	-2.4	10.0	5.7
13	9.5	16.1	12.3	7.0	8.2	5.7	3.0	0.8	-13.3	-2.4	20.1	6.1
14	13.8	26.1	2.2	14.0	9.2	4.9	-5.3	3.5	-1.3	-2.0	13.8	7.2
15	18.9	26.5	-18.2	11.9	17.4	5.7	3.4	0.6	6.4	13.3	20.0	9.6
16	13.7	10.5	-3.9	6.3	-3.4	2.7	2.9	3.4	5.1	2.1	0.2	3.6
17	20.6	20.9	7.1	10.9	10.8	11.8	1.8	3.2	-8.1	-3.8	14.7	8.2
18	-1.3	9.4	-0.3	13.7	6.6	1.1	3.4	2.7	3.3	0.3	15.0	4.9
19	14.9	22.2	11.4	8.1	13.6	6.8	3.4	1.7	9.2	-3.5	25.2	10.3
20	25.2	18.9	-3.0	11.6	11.9	3.6	4.8	1.5	2.7	-3.6	22.7	8.8
21	13.8	9.6	11.9	7.7	5.9	8.4	5.5	1.9	10.9	-2.9	4.0	7.0
22	14.5	18.2	-13.3	7.5	5.5	-1.2	-0.3	2.6	16.2	-1.2	10.9	5.4
23	5.2	4.6	23.7	4.5	5.2	3.1	3.1	0.4	-26.1	1.6	10.0	3.2
24	8.0	23.7	-15.6	6.0	8.9	12.9	2.6	2.0	8.9	16.2	24.4	8.9
25	14.3	2.5	24.4	8.1	8.4	3.8	1.0	3.5	2.5	-12.1	6.7	5.7
26	12.9	16.3	7.8	1.9	6.6	5.6	6.0	2.9	2.1	-6.4	2.3	5.3
27	6.2	17.1	2.1	11.7	2.6	13.3	-0.1	1.3	5.7	-0.8	20.9	7.3
28	1.9	-4.1	4.3	5.3	0.6	2.4	-8.3	0.8	5.3	-0.8	6.9	1.3
29	12.9	14.7	9.3	2.8	-8.3	1.2	4.7	3.1	-12.5	2.6	10.2	3.7
30	15.5	11.2	-0.8	8.5	5.6	6.9	1.8	1.6	2.2	-10.5	13.7	5.0
Location Mean	11.5	13.0	5.3	8.3	7.1	4.4	-0.2	2.1	1.0	-1.1	12.7	5.8
P-value	0.269	0.103	0.546	<0.001	0.024	0.199	0.141	0.399	0.341	0.538	0.626	
EMS	67.2	89.2	327.5	6.1	32.7	32.1	71.2	2.0	173.0	57.4	126.2	
lsd (5%)	16.8	19.3	37.0	5.0	11.7	11.6	17.3	2.9	26.9	15.5	23.0	
CV%	72.3	73.9	382.6	29.8	810.4	131.1	2637.6	66.5	2721.0	590.5	90.4	
Error df	29	29	29	29		29	29	29.0	29.0	29.0	29.0	

Table 23: Average number of days to heading of 30 wheat entries at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	86.0	85.0	72.5	86.5	80.0	81.0	71.5	80.0	96.0	66.0	97.5	82.0
2	89.0	84.0	72.0	77.0	77.0	80.0	72.5	80.0	88.5	66.5	97.0	80.3
3	80.5	75.0	73.0	72.5	65.5	69.0	68.5	77.5	80.5	66.0	91.0	74.5
4	85.0	80.0	72.0	77.0	66.5	71.5	68.5	82.5	90.5	67.0	96.5	77.9
5	87.5	85.5	72.0	87.0	73.5	82.0	75.0	82.5	96.0	66.0	99.0	82.4
6	85.0	78.0	73.0	79.5	70.0	78.5	71.0	79.0	95.0	67.5	97.5	79.5
7	85.0	84.0	71.5	81.0	73.0	81.0	71.5	79.5	88.5	66.0	97.5	79.9
8	86.5	83.0	73.5	79.0	75.0	76.0	71.5	82.5	86.5	65.0	96.0	79.5
9	84.0	78.0	73.0	75.5	67.0	69.5	69.5	79.0	82.5	68.5	96.5	76.6
10	87.5	85.0	72.5	85.0	81.0	83.0	74.5	75.5	93.0	66.5	97.5	81.9
11	82.0	78.0	71.0	79.0	71.0	68.5	69.5	80.0	85.0	65.0	94.0	76.6
12	83.0	78.5	72.0	76.0	68.5	67.5	69.5	84.0	81.0	64.5	92.5	76.1
13	83.0	83.0	74.0	81.0	76.5	80.5	69.0	79.0	91.5	68.5	94.5	80.0
14	82.0	75.0	71.5	73.0	63.0	67.0	68.0	73.0	80.5	66.5	91.0	73.7
15	79.5	70.0	73.5	73.0	69.5	66.0	69.0	73.0	78.0	64.5	91.0	73.4
16	86.0	83.0	71.0	80.5	76.0	83.5	70.5	82.0	84.0	69.0	93.0	79.9
17	83.0	76.5	73.5	74.0	66.0	67.5	68.0	80.5	85.0	64.0	95.5	75.8
18	89.0	87.5	73.0	84.0	82.0	87.0	74.0	79.5	95.0	65.0	100.0	83.3
19	86.0	84.0	72.5	83.0	76.0	81.0	72.5	80.0	96.0	67.5	95.5	81.3
20	86.0	82.0	72.5	80.5	74.5	79.0	72.5	80.5	83.0	69.0	93.0	79.3
21	82.0	73.5	72.5	73.0	63.5	65.0	67.0	78.5	82.5	64.0	93.0	74.0
22	84.0	75.5	74.0	73.5	67.5	71.0	69.0	80.0	82.5	67.5	93.0	76.1
23	89.0	83.0	73.5	80.0	72.0	73.5	70.5	79.0	82.5	65.0	99.0	78.8
24	82.0	75.5	73.5	72.5	65.0	67.0	67.5	76.5	82.5	65.0	93.0	74.5
25	81.0	75.0	72.0	71.0	64.5	67.0	69.0	78.0	80.5	64.0	93.5	74.1
26	80.0	74.5	72.0	64.0	64.5	66.0	68.5	75.5	80.5	65.0	93.0	73.0
27	82.0	79.5	71.5	73.5	67.5	68.5	70.0	79.0	83.0	64.0	92.5	75.5
28	79.5	67.0	71.5	64.5	62.0	60.0	67.0	75.5	78.0	68.5	87.5	71.0
29	84.0	81.5	73.0	79.0	74.5	78.0	69.0	80.0	85.0	67.5	93.0	78.6
30	80.0	74.0	74.0	67.0	64.0	64.5	69.5	78.5	78.0	67.0	92.5	73.5
Location Mean	84.0	79.1	72.6	76.7	70.6	73.3	70.1	79.0	85.7	66.2	94.5	77.4
P-value	<0.001	<0.001	0.370	<.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.962	<0.001	<0.001
EMS	1.4	1.2	1.4	5.4	5.0	4.5	0.9	0.7	6.5	10.0	2.8	3.616
lsd (5%)	2.5	2.2	2.4	4.7	4.6	4.3	2.0	1.8	5.2	6.5	3.4	1.1
CV%	1.4	1.4	1.6	3.0	3.2	2.9	1.4	1.1	3.0	4.8	1.8	2.5
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 24: Average number of days to maturity of 30 wheat entries at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	120	124	100	125	110	115	121	111	131	110	132	118
2	123	127	101	126	111	114	122	111	131	115	133	119
3	112	120	100	118	103	102	118	109	129	115	134	114
4	114	121	100	120	106	102	118	114	131	115	136	116
5	118	124	100	123	111	114	126	113	131	110	134	118
6	115	121	102	122	109	114	121	114	131	114	134	118
7	116	127	100	122	106	111	122	111	131	110	133	117
8	119	127	100	123	108	109	121	116	128	113	132	118
9	114	121	97	122	107	106	121	114	130	120	135	117
10	116	123	97	124	112	118	127	114	131	113	133	119
11	115	122	97	122	105	107	122	114	131	113	132	116
12	113	121	100	120	104	106	122	117	128	110	134	116
13	117	124	102	122	110	112	119	111	130	118	131	118
14	114	120	102	120	103	103	120	113	131	118	134	116
15	112	113	100	116	103	101	122	113	128	108	133	113
16	118	122	101	126	110	114	121	117	131	118	134	119
17	116	121	101	124	105	106	120	113	132	110	135	116
18	119	128	105	128	109	118	126	114	132	115	135	121
19	116	122	97	125	111	115	124	112	132	118	135	119
20	117	123	101	123	109	110	122	113	128	118	135	118
21	113	119	102	117	103	98	117	113	128	110	132	114
22	117	119	100	119	105	104	120	113	131	115	134	116
23	118	123	97	122	105	106	121	114	130	111	134	116
24	115	119	100	117	104	102	118	112	131	110	133	114
25	112	120	100	118	103	97	120	111	130	108	129	113
26	113	119	100	117	103	97	121	111	128	110	130	113
27	113	122	97	118	104	100	121	109	128	108	135	114
28	112	113	100	117	101	97	118	108	129	118	132	113
29	114	122	100	121	104	108	121	113	130	118	132	116
30	112	118	102	117	103	101	121	113	128	113	134	115
Location Mean	115	121	100	121	106	107	121	112	130	113	133	116
P-value	<0.001	<0.001	0.815	<.001	<0.001	<0.001	0.051	<0.001	0.004	0.881	0.453	<0.001
EMS	2.4	0.5	10.2	0.4	3.4	3.3	6.4	1.7	1.4	41.4	4.5	6.856
lsd (5%)	3.1	1.5	6.5	1.3	3.8	3.7	5.2	2.6	2.4	13.2	4.3	1.6
CV%	1.3	0.6	3.2	0.5	1.8	1.7	2.1	1.1	0.9	5.7	1.6	2.3
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 25: Average plant height (cm) of 30 entries at eleven locations in the 11th HMN

Entry	Bhairahawa Nepal	Rampur Nepal	Tarahara Nepal	Dinajpur Bangladesh	Jamalpur Bangladesh	Jessore Bangladesh	Varanasi India	Faizabad India	Assam India	Coochbehar India	Karnal India	Entry Mean
1	73	93	89	83	87	89	77	78	69	86	98	83
2	80	94	99	91	86	94	83	85	79	91	103	89
3	82	101	95	97	98	99	84	91	78	91	104	93
4	81	96	91	97	95	97	88	105	83	94	128	96
5	81	96	93	100	96	100	83	94	85	94	111	94
6	83	110	86	101	99	104	88	102	83	89	110	96
7	80	103	89	97	97	103	85	89	90	94	114	94
8	71	95	85	88	90	96	84	81	83	87	109	88
9	77	89	87	83	78	86	78	88	74	92	107	85
10	74	90	92	89	89	98	83	83	81	88	114	89
11	95	113	87	106	105	114	96	106	93	99	115	102
12	72	90	95	86	76	87	80	83	72	96	100	85
13	77	91	100	86	85	90	77	82	76	91	102	87
14	74	89	83	81	75	90	76	87	74	97	106	85
15	83	108	87	99	99	103	87	102	84	94	113	96
16	90	110	75	102	107	119	95	104	93	90	124	101
17	74	92	82	87	82	87	83	94	77	89	93	85
18	83	103	87	104	103	115	95	105	102	98	129	102
19	84	101	84	105	103	97	88	102	81	100	105	95
20	71	98	85	86	87	90	80	81	77	94	98	86
21	71	104	94	93	86	97	86	96	77	94	113	92
22	74	106	86	91	98	97	89	103	86	91	113	94
23	77	103	84	97	96	106	89	104	87	92	118	95
24	74	87	99	81	79	93	85	86	77	99	115	88
25	77	105	88	93	91	105	88	101	88	92	108	94
26	75	102	86	90	85	94	87	94	83	90	111	91
27	78	106	80	99	91	99	78	87	82	96	103	91
28	77	97	90	91	95	101	83	97	81	100	105	92
29	83	106	95	105	102	118	91	89	89	93	116	99
30	75	103	85	95	85	96	80	94	82	90	109	90
Location Mean	78	99	89	93	91	99	85	93	82	93	110	92
P-value	0.003	<0.001	0.674	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.219	0.002	<0.001
EMS	22	16	81	12	26	15	13	2	12	22	48	24.31
lsd (5%)	10	8	18	7	10	8	7	3	7	10	14	2.9
CV%	6.0	4.0	10.1	3.7	5.5	3.9	4.2	1.5	4.3	5.1	6.3	5.4
Error df	29	29	29	29	29	29	29	29	29	29	29	319

Table 26. Combined ANOVA for various traits of 30 wheat genotypes tested at 11 locations in South Asia in 2002-2003 wheat growing season.

Source	d.f.	Grain yield	TKW	Third D1	Third D2	Severity	AUDPC	Height	Heading	Maturity
Location (Loc)	10	109,300,000 **	1110 **	103.03 **	105.92 **	14168 **	5124327 **	4543 **	4062.0 **	6179.8 **
Replication / Loc	11	751,500	49	6.35	4.13	690	88239	155	35.6	9.5
Genotype	29	1,652,000 **	375 **	8.03 **	11.02 **	1878 **	401139 **	604 **	237.8 **	95.5 **
Genotype * Loc	290	534,800 **	19 **	1.44 **	1.75 **	211 **	40926 **	54 **	18.5 **	13.3 **
Error	319	247,500	11	0.48	0.93	88	15184	24	3.6	6.9

** Significant at P=0.01

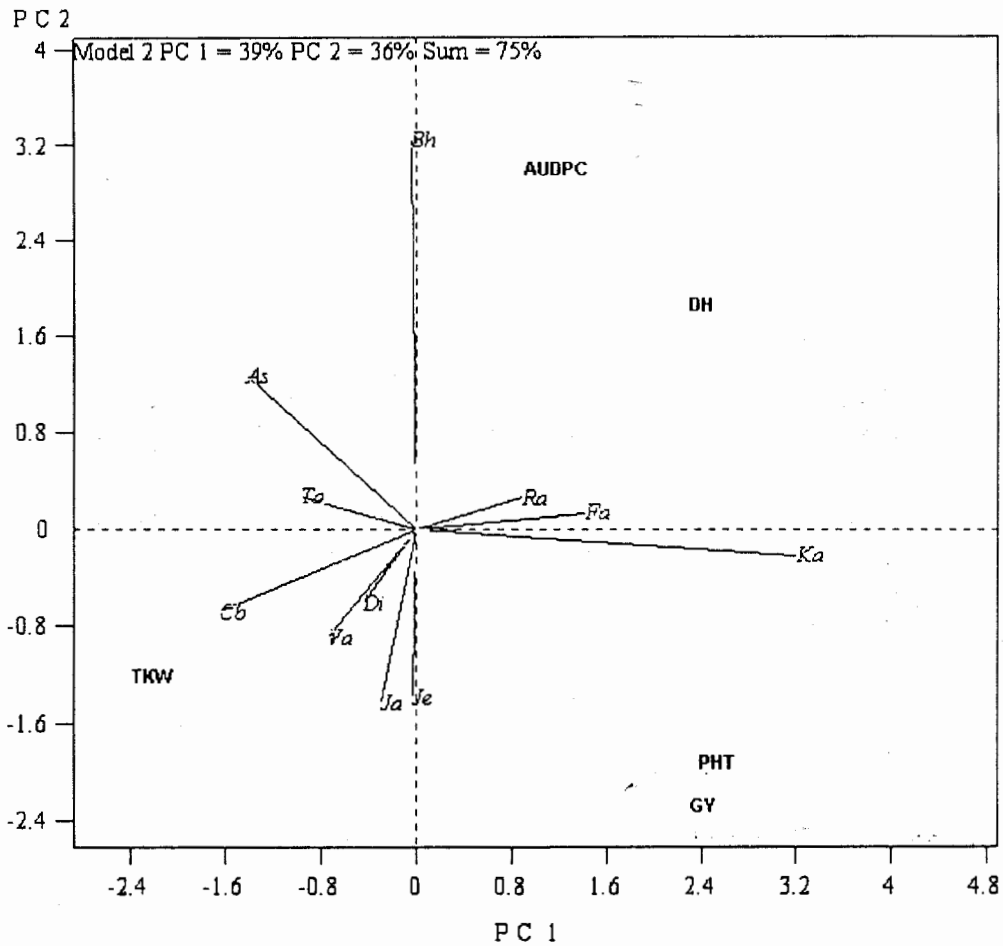


Figure 1. Biplot[1] showing relationship among 11 experimental sites in South Asia based on five variables (testers): AUDPC, grain yield, TKW, days to heading and maturity, recorded on 30 wheat entries in the 11th HMN tested in 2002-2003.

Locations:

Nepal	India	Bangladesh
Bh = Bhairahawa	As = Assam	Di = Dinajpur
Ra = Rampur	Cb = Cooch Behar	Ja = Jamalpur
Ta = Tarahara	Fa = Faizabad	Je = Jessore
	Ka = Karnal	
	Va = Varanasi	

[1] Yan, W., and M.S. Kang. 2002. GGE biplot analysis : a graphical tool for breeders, geneticists, and agronomists. CRC Press, New York, USA.

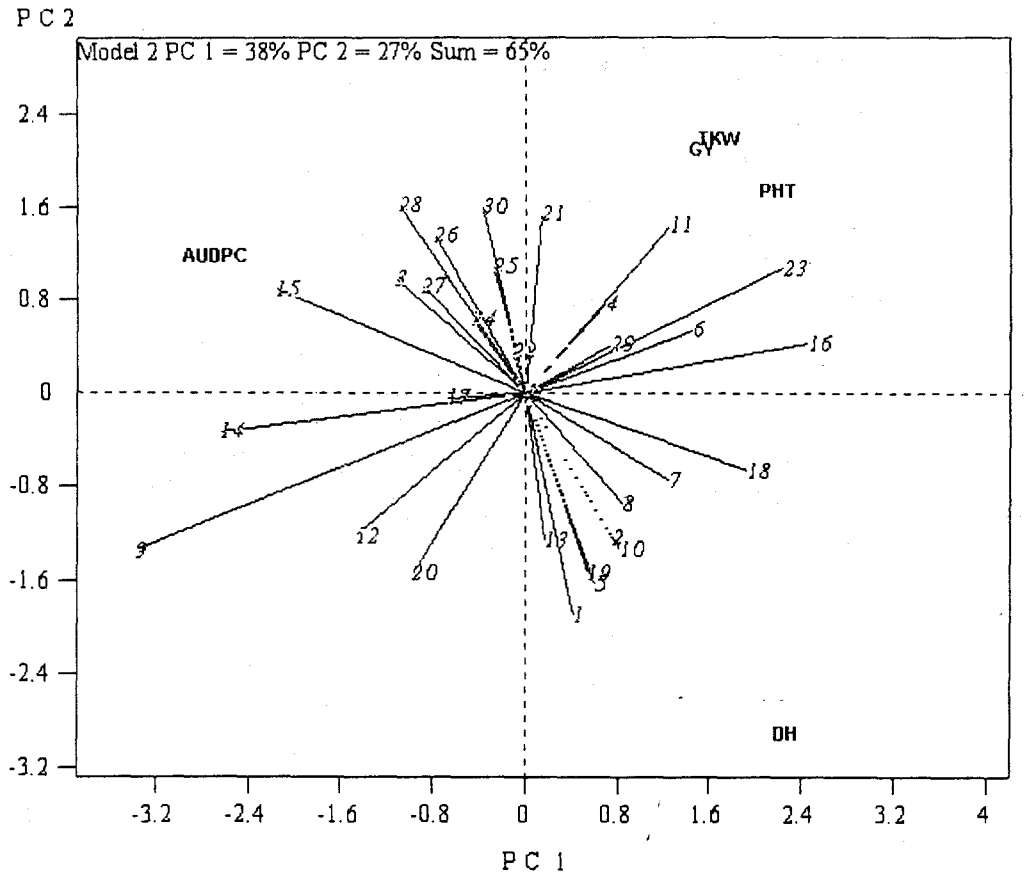


Figure 2. Biplot[1] showing relationship among 30 wheat genotypes (see Table 1, page 3) based on five variables (testers): AUDPC, grain yield, TKW, days to heading and plant height in the 11th HMN tested at 11 sites in South Asia in 2002-2003.

[1] Yan, W., and M.S. Kang. 2002. GGE biplot analysis : a graphical tool for breeders, geneticists, and agronomists. CRC Press, New York, USA.

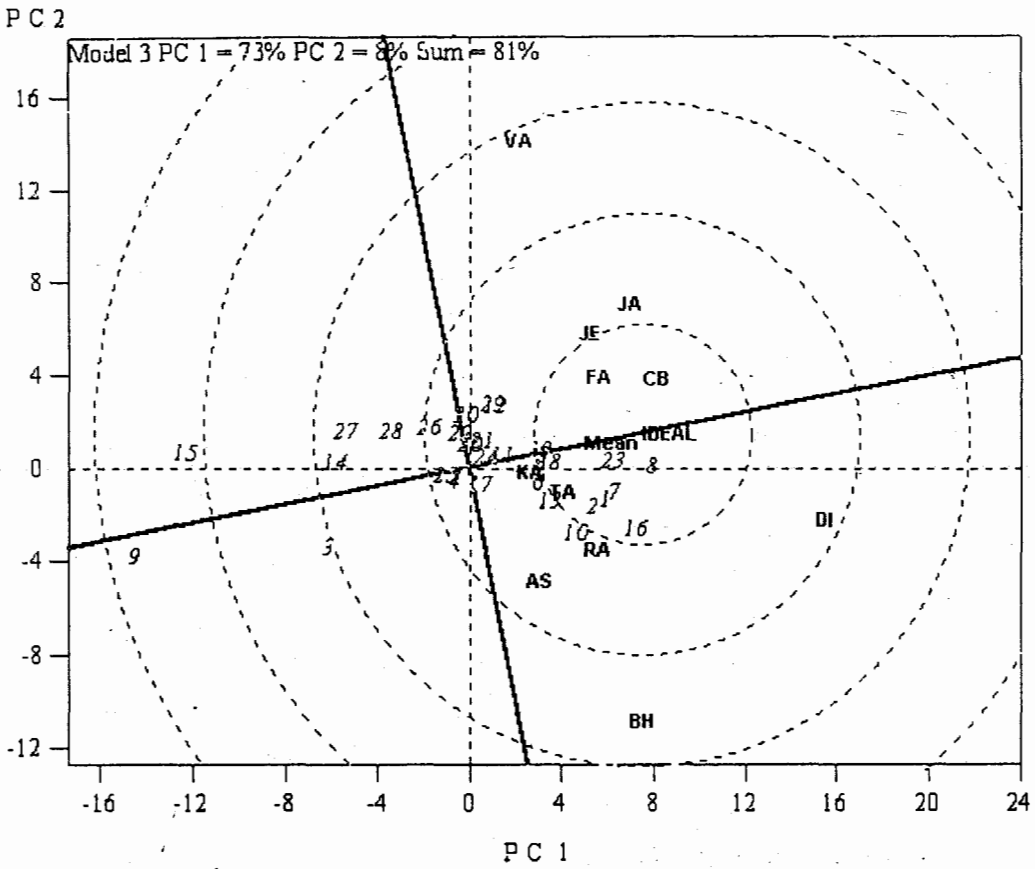


Figure 3. Biplot[1] showing a comparison of the 30 wheat genotypes (see Table 1, page 3) in the 11th HMN with an ideal cultivar for AUDPC across 11 locations in South Asia: genotypes are ranked based on their distance from an ideal cultivar.

Locations:

Nepal	India	Bangladesh
BA = Bhairahawa	AS = Assam	DI = Dinajpur
RP = Rampur	CB = Cooch Behar	JA = Jamalpur
TA = Tarahara	FA = Faizabad	JE = Jessore
	KA = Karnal	
	VA = Varanasi	

[1] Yan, W., and M.S. Kang. 2002. GGE biplot analysis : a graphical tool for breeders, geneticists, and agronomists. CRC Press, New York, USA

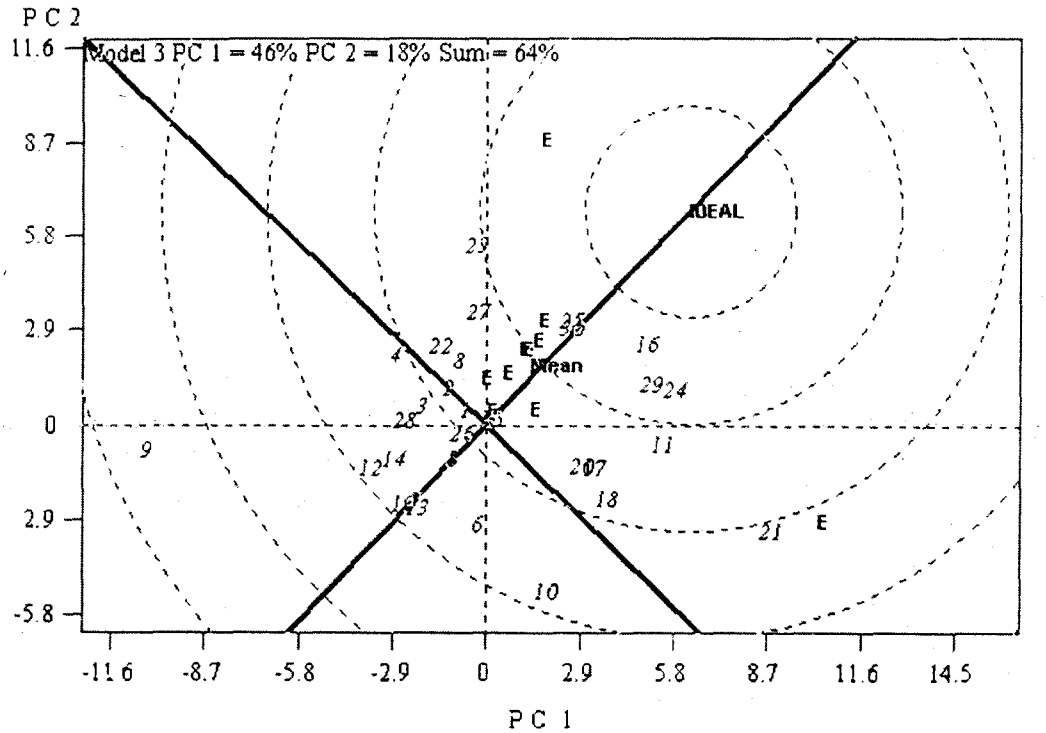


Figure 4. Biplot[1] showing a comparison of the 30 wheat genotypes (see Table 1, page 3) in the 11th HMN with an ideal cultivar for grain yield across 11 locations in South Asia: genotypes are ranked based on their distance from an ideal cultivar.

[1] Yan, W., and M.S. Kang. 2002. GGE biplot analysis : a graphical tool for breeders, geneticists, and agronomists. CRC Press, New York, USA

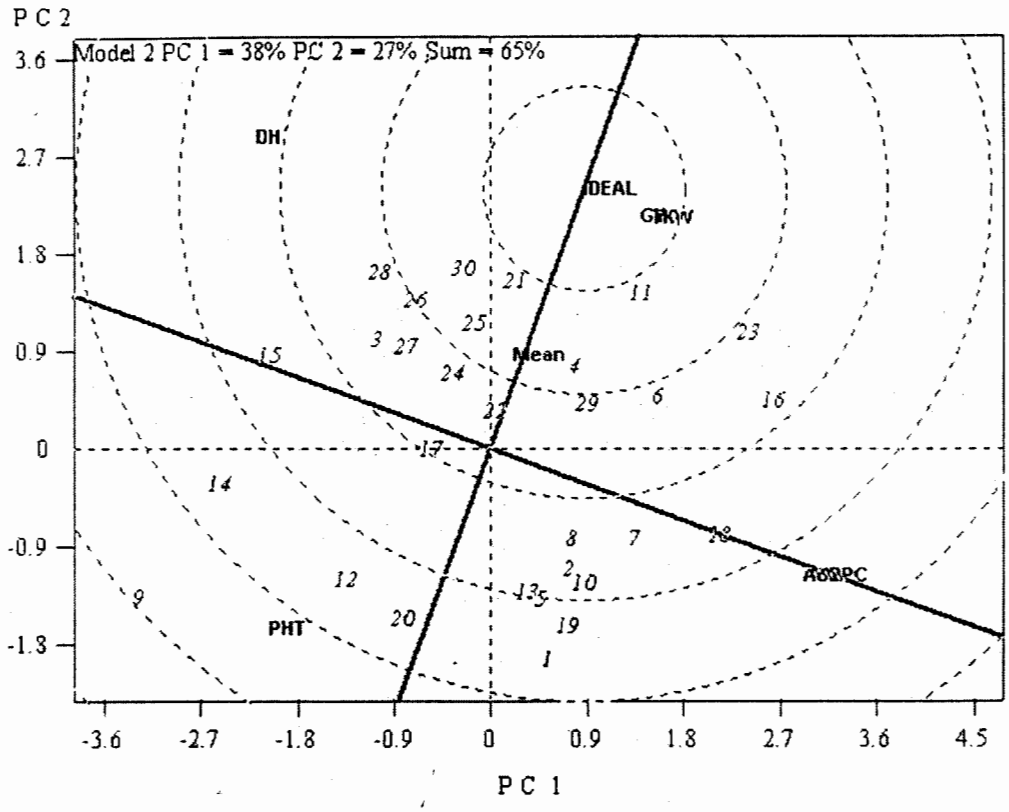


Figure 5. Biplot[1] showing a comparison of the 30 wheat genotypes (see Table 1, page 3) in the 11th HMN with an ideal cultivar for based on five traits (AUDPC, grain yield, TKW, days to heading and plant height) across 11 locations in South Asia: genotypes are ranked based on their distance from an ideal cultivar.

[1] Yan, W., and M.S. Kang. 2002. GGE biplot analysis : a graphical tool for breeders, geneticists, and agronomists. CRC Press, New York, USA

ANNEX

CIMMYT®

International Maize and Wheat Improvement Center

INSTRUCTIONS FOR CIMMYT-Nepal 11th HMN (2002-2003)

Prepared by CIMMYT South Asia and wheat scientists from Nepal Agricultural Research Council (NARC), Bhairahawa, Nepal and IAAS, Rampur, Nepal

The Seed

The box contains 120 envelopes of 10 grams which is suitable for 2-meter plots of two rows. Genotype number and plot number appear on the label on each envelope. Please also refer to the included trial layout. The seed was produced in 2002.

The Design

Spot blotch is highly influenced by the environment (climate, soil fertility...) and the fungus is apparently variable although no clear physiological specialization has been shown. Micro-environmental factors such as soil fertility may increase disease severity. A randomized complete block design with two replicates was chosen for this trial. In the first replicate, the plots are ordered following entry number. In the second replicate, entries are randomized.

In each replicate, each genotype is represented twice, and is sown in two plots in front of each other. Each replicate has thus two parallel strips of 30 plots as shown in the attached layout. This subdivision of replicates into two strips makes it possible to spray one strip with a fungicide as shown by the shaded area on the layout. It allows a better assessment of genotype performance after comparison of the protected plot with the plot under natural disease pressure. Since the trial has two replicates, an arithmetic mean across replicates is produced for each variety making comparison over locations and GXE analysis possible.

Sowing

Each envelope contains 10-gr. seed which allows a 2-meter plot of two rows with 25 cm spacing to be sown. Please note that it is **very important** to **plant plot 31 in front of plot 1**, and similarly, plot **61 in front plot 91** as indicated on the map since the same entries are planted in front of each other, in both strips of the same replicate. Do not use a serpentine when sowing and make sure that the strips are planted in solid continuous blocks. Each envelope is identified with variety and plot number. The complete pedigree corresponding to each variety can be found on the attached list. Please note that the first replicate is arranged in order of variety number.

We hope that the diagram below will facilitate sowing the 11th HMN. This diagram represents an ideal sowing. It is absolutely essential that individual strips (2 in each replicate) consisting of 30 plots, should not been broken in the field. Always sow in the one direction (as in the diagram presented below). Leave 1 meter between strips.

A detailed map with both plot number and entry number is given at the end. Shaded areas indicated both strips that will be sprayed with fungicide.

Rep. 2	Plot 91	Natural Disease Epidemic	Plot 120
		1 meter space	
Rep. 2	Plot 61	Protected with Fungicide	Plot 90
		1 meter space	
Rep. 1	Plot 31	Protected with Fungicide	Plot 60
		1 meter space	
Rep. 1	Plot 1	Natural Disease Epidemic	Plot 30

Fungicide

We recommend to spray the two central strips of the trial with a fungicide as indicated by the shaded area on the detailed attached map. We recommend to use Tilt which is normally easily available but if this is not the case another fungicide can also be used. In case of difficulty in obtaining the fungicide, do not hesitate to contact us for assistance. Since we want a maximum protection in plots 31 to 90, we suggest to spray up to three times during the growing season, approximately at **full tillering, heading** and **flowering** stage. Please indicate dates of application. Use the recommended dosis of commercial product (125 a.i./ha). If you use a commmercial product at 25% like available in South Asia, you need to use a concentration of 2.5 ml commercial product per liter of water.

When you spray, make sure that no fungicide is sparyed on the two strips where the natural disease epidemic will be observed.

Data Worksheets

You received two series of forms. Keep one for your files (cooperator copy) and return the other one to E. Duveiller at CIMMYT South Asia. Forms have been prepared with Plot, Replicate and Genotype (=entry) number. Filling this form is self explanatory. Pages are numbered from 1 to 4 and one page is used per strip. Due to limited space for name we could not write the complete pedigree on these forms; hence refer to the attached list if you want to know the details of the cross.

Helminthosporium scores (HLB) should be taken three times during the season since we look at degrees of susceptibility and rate of disease progress. Agronomic and other general data requested will provide background information related to disease effects on yield and how the environment affects spot blotch. Please record other diseases and rust data if they happen to occur.

Management of the Trial

The trial should be conducted under optimal conditions for plant development. Please indicate type of fertilizer and amount, as well as number of irrigations and quantity of water if possible. If the experiment is rainfed the give rainfall data during the wheat season.

Since we are looking for moderate levels of resistance and want to analyze spot blotch data generated under natural conditions, do not inoculate the experiment. We assume it is located in a fairly hot spot location. However, if the disease is not severe your data are still valuable to us because we can possibly relate the information with sub-optimal environmental conditions. It will help us in understanding the epidemiology of spot blotch pathosystem.

General Data Required

The normal information, obtained by standard techniques for your yield trials, will be taken. Data for each plot should be sent so proper statistical analysis can be done. It will include the following:

1. Days to Heading (when 50% of heads are emerged from the boot)
2. Height (cm)
3. Days to Maturity (when 50% of peduncles are physiologically mature, i.e. have turned yellow)
4. Percent Lodging; when plants are physiologically mature (zero % indicates fully upright plants and 100% plants completely fallen)
5. Yield (gram/plot); harvest entire plots for yield determination and indicate plot size
6. Thousand grain weight (gm) (=TKW)
7. Growth stage following Zadoks' scale (0-100) (see GS on data worksheet and scale included)

Disease Data

In several cases, the blight that you will be observing may not be due to *Bipolaris sorokiniana* only, and other diseases will be present. Please indicate which one if you can and score all blights together.

In order to keep the trial simple, we decided to score HLB using the double digit scale proposed by CIMMYT after Saari and Prescoot's work. The scale goes from 00 to

99. The first digit (D1) indicates the disease progress in height and the second digit (D2) refers to severity (diseased leaf area). Do not start to take note before heading. The double digit scale has extensively been used by breeders for evaluating disease severity on whole plants. Please find attached, a page explaining how to use the double digit scale.

Start readings when the first lesions appear on the F-1 of several entries and continue throughout the season [about Growth Stage 60 on Zadoks' scale attached hereafter]. **All genotypes should be scored at the same date**. Some of them may have no disease when other ones present already some symptoms. The period between each reading will depend on how fast the disease is increasing. A few days only may separate the readings if the weather is warm.

Growth stage should be taken with every disease reading. We want to know the relationship between disease and earliness of the genotype. Please use the Zadoks' scale that is enclosed. Dates of every reading must be noted.

Climatic Data

Please provide climatic data (rainfall-mm-and if possible max and min daily temperatures) during the wheat growing season. Start with sowing date. You can send us a photocopy or write the information by hand on a separate sheet of paper, indicating the date.

Please Find Attached

1) List of genotypes (30 entries)
2) 2 x 4 pages to record field data: one set to be returned to CIMMYT; one set is for the cooperator
3) Zadoks' scale for growth stage (0-100)
4) Double digit scale with examples for how to use it
5) The detailed layout of the trial.

Comments

Your comments are welcome. Please tell us if the design is easy to use, if there are specific problems in your location and make suggestions.

Returning the Data

Data should be returned to the following address:

Dr. Etienne Duveiller
Regional Wheat Pathologist
CIMMYT International, South Asia Regional Office
P.O. Box 5186, Singha Durbar Plaza Marg
Kathmandu, NEPAL

E-mail: E.Duveiller@cgiar.org
Fax : +977-1-229804 Tel.: +977-1-219262

Please do not return the data to CIMMYT Mexico. Thanks for returning them to Nepal.

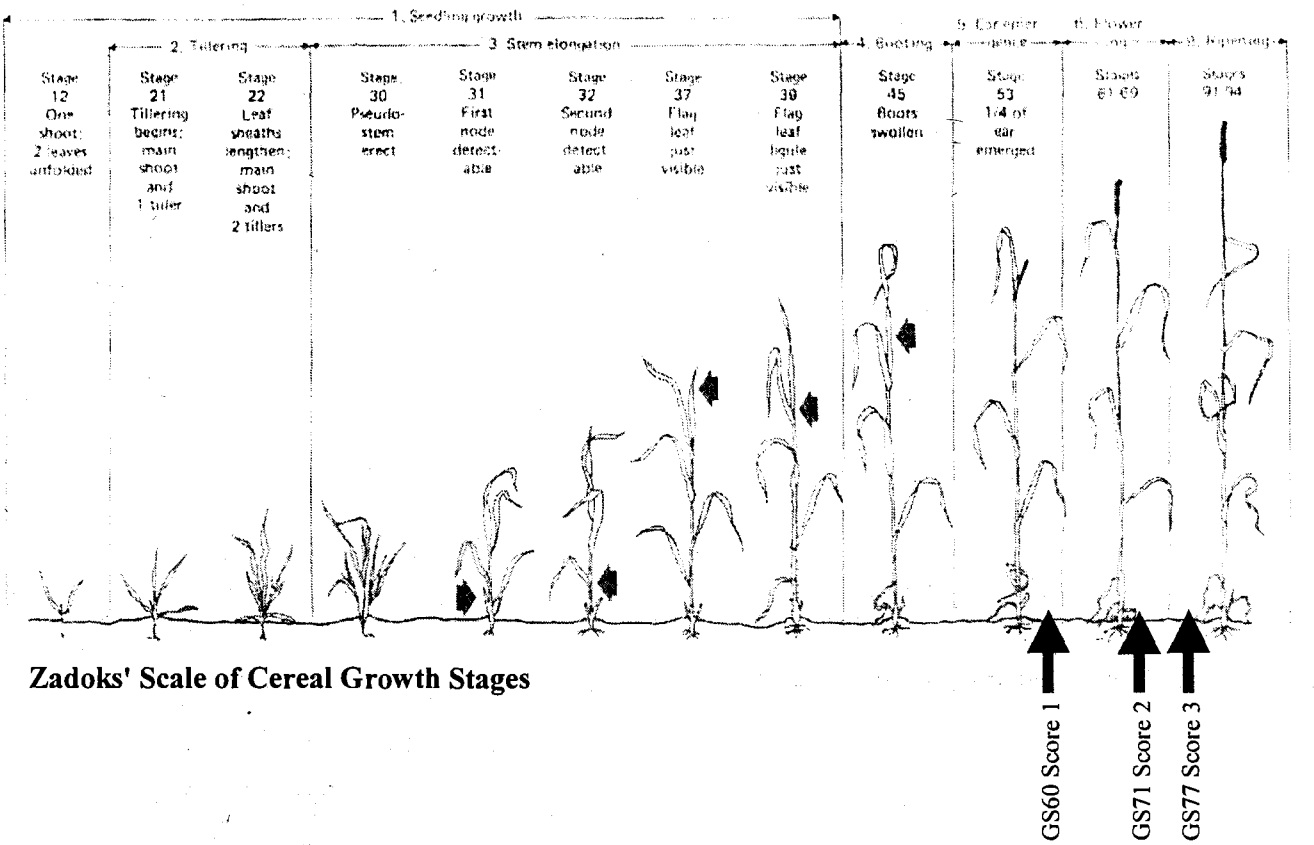
11th HMN Layout 2002-2003

	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
	8	18	16	7	25	10	17	2	26	6	24	19	11	9	27	13	1	14	28	5	23	20	29	15	30	3	12	21	4	22
	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
FUNGICIDE	8	18	16	7	25	10	17	2	26	6	24	19	11	9	27	13	1	14	28	5	23	20	29	15	30	3	12	21	4	22
	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1

Plot number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
GENOTYPE *(Entry)*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Replicate	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1

Descriptions of the principal and secondary growth stages of the Zadoks' scale, as modified by Tottman and Makepeace (1979).

Zadoks Scale	Description	Zadoks Scale	Description	Zadoks Scale	Description
	Germination		**Stem elongation**		**Milk Development**
00	Dry seed	30	Pseudostem erection	71	Kernel watery ripe
01	Start of imbibition	31	1st node detectable	73	Early milk
03	Imbibition complete	32	2nd node detectable	75	Medium milk
05	Redicle emerged from seed	33	3rd node detectable	77	Late milk
07	Coleoptile emerged from seed	34	4th node detectable		
09	Leaf just at coleoptile tip	35	5th node detectable		**Dough development**
		36	6th node detectable	83	Early dough
	Seedling growth	37	Flag leaf just visible	85	Soft dough
10	First leaf through coleoptile	39	Flag leaf ligule/collar just visible	87	Hard dough
11	First leaf unfolded				
12	2 leaves unfolded		**Booting**		**Ripening**
13	3 leaves unfolded	41	Flag leaf sheath extending	91	Kernel hard (difficult to divide by thumbnail)
14	4 leaves unfolded	45	Boots just swollen	92	Kernel hard (can no longer be dented by thumbnail)
15	5 leaves unfolded	47	Flag leaf sheath opening	93	Kernel loosening in daytime
16	6 leaves unfolded	49	First awns visible	94	Overripe, straw dead and collapsing
17	7 leaves unfolded			95	Seed dormant
18	8 leaves unfolded		**Inflorescence emergence**	96	Viable seed giving 50% germination
19	9 or more leaves unfolded	51	First spikelet of inflorescense visible	97	Seed not dormant
		53	¼ of inflorescence emerged	98	Secondary dormancy induced
	Tillering	55	½ of inflorescence emerged	99	Secondary dormancy lost
20	Main stem only	57	¾ of inflorescence emerged		
21	Main stem and 1 tiller	59	Emergence of inflorescence complete		
22	Main stem and 2 tillers				
23	Main stem and 3 tillers		**Anthesis**		
24	Main stem and 4 tillers	60	Beginning of anthesis		
25	Main stem and 5 tillers	65	Anthesis half complete		
26	Main stem and 6 tillers	69	Anthesis complete		
27	Main stem and 7 tillers				
28	Main stem and 8 tillers				
29	Main stem and 9 or more tillers				



Zadoks' Scale of Cereal Growth Stages

Entry Number	Genotype/Cross	11th HMN
1	SW 89-5422	
2	Chirya 7	CS/Th.Curv.//GLEN/3/PVN/4/NINGMAI-4/OLN//ALD/YANGMAI-4
3	Kanchan	
4	BL 2179 = NL588/HD2307//NL623 (Bhirikuti)	
5	Pfau/Vee#5	CM85795-26Y-0M-0Y
6	BL2029	G162/BL1316//NL297
7	Yangmai #6	
8	Chirya 1	CIGM87.110
9	Ciano 79	CM31678-R-4Y-2M-21Y-0M
10	PBW373	
11	K 7	
12	CMH81.38/2*KAUZ//ATTILA	CMSS94Y00283S-0300M-0100Y-0100M-19Y-1M-0Y
13	Ning 8201	
14	Raj 3765	
15	RR21 (=Sonalika)	II18427-4R-1M
16	Milan/Sha-7	CM97550-0M-2Y-030H-3Y-3Y-0Y-1M-010Y-0FUS-015PR-0B
17	Maya/mon//Kauz/Trm/3/Pvn/Buc//Har-424	BD(ISD)387-22ISD-0ISD-0ISD-0ISD-07ISD-0DI
18	K 8027	
19	Achyut	
20	CROC 1/AE.SQ(224)//YACO/3/MUNIA	CMSS93Y01054S-9Y-1KBY-010M-010Y-3M-0KBY-0M-15KBY-0Y
21	COQ/F61.70/CNDR/3/OLN/4/PHO	CM 60907-B-1Y-6M-6Y-1M-3Y-2M-OY
22	PRL/TONI	CM 67360-2Y-3M-4Y-1M-1Y-2M-0Y
23	ALTAR-84/AE. SQUARROSA(224)//*YACO	CIGM 90.455-2Y-1M-OPR-1B-OPR
24	BARKAT/KVZ	BD(ISD)162-421ISD-0ISD-0ISD-0ISD-5ISD-01ISD
25	KAN/6/COQ/F61.701//CNDR/OLN/4/PHOS/MRNG/ALAN/CNO	JESS 349-X-OJE-1DI-ODI-ODI-ODI-OIODI-ODI
26	GOURAB (=TURACO/CHIL)	CM 92354-33M-OY-OM-6Y-OB
27	IAS 58/3/KAL/BB//ALD/4/OLN/TRM//7C/ALD/5/ PEACOCK	BD(JAM)208-1JE-0JE-0JE-0JE-RJE
28	BL1473	
29	BL 2537=CROC 1/AE.SQ(210)//4*YACO/3/GUAM 92/4/SHA 7//PRL/3/FASAN	CMSS96M058121-040Y-5M-020B-6B-0B
30	BAW 898	CM 92354-33M-0Y-0M-6Y-0B-0BGD

1. relative disease height – 5
2. 10% of infected leaves is diseased – 1 (Example 1)

1. relative disease height – 5
2. 90% of infected leaves is diseased – 9

3. relative disease height – 8
4. 10% of infected leaves is diseased – 1

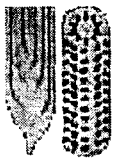
1. relative disease height – 8
2. 90% of infected leaves is diseased – 9

Double-digit (00-99) scale representing the vertical disease progress (first digit) and severity estimate (second digit)

Using CIMMYT's Double Digit Scale

For example, a certain line of wheat is infected by foliar blight. If the height of the disease is at about the mid-point of the plant, the score on the 0-9 Saari-Prescott scale for relative height is 5. In Example 1, the average coverage with foliar blight on only those leaves that are infected (that is those at and below the midpoint) is 10%. Then the numerical disease description is 51.

Evaluation time: For an optimal evaluation each line needs to be assessed three times (three scores). The first score should be recorded at GS60 (Zadoks Scale), the second one at GS71 and the third one at GS77. The two last scores are the most important.



CIMMYT®

International Maize and Wheat Improvement Center

Sustainable Maize and Wheat Systems for the Poor

Research Material Transfer Agreement (MTA)

CIMMYT Research Products

(FOR USE BY NON-COMMERCIAL RECIPIENTS OF MATERIALS NOT DESIGNATED FAO "IN-TRUST")

The International Maize and Wheat Improvement Center (CIMMYT) has adopted this Research Material Transfer Agreement (MTA) to ensure that CIMMYT's efforts and assets continue to be used for the benefit of the resource poor in the developing world. Be receiving and retaining Research Material (defined below) accompanied by this MTA, the Recipient thereof (Recipient) signifies its agreement to be bound by the following terms and conditions:

1 The Research Material covered by this MTA includes (a) the materials described in the attached list (Listed Material); (b) any germplasm, cell, organelle, gene, molecular construct, or any other biological material derived from the Listed Material; and (c) any software, processes and other information associated with the Listed Material (collectively "Research Material")

2 Recipient shall use the Research Material solely for research and testing purposes at the facilities within the country to where the Research Material is shipped from CIMMYT. Recipient may publicly disclose data resulting from its use of the Research Material. Recipient shall ensure that neither Recipient nor anyone else distributes, transfers or releases the Research Material to third parties for any purpose, without CIMMYT's prior written consent. Recipient shall notify CIMMYT of any third-party request for Research Material, and shall direct such third party requests to CIMMYT.

3 Recipient shall not seek to obtain intellectual property rights in the Research Material without CIMMYT's prior written consent.

4 Recipient may sell, license, assign or otherwise commercially exploit any part of the Research Material only upon receipt of the further, prior written consent of CIMMYT. If such consent is requested, CIMMYT will negotiate in good faith with Recipient in an effort to agree upon mutually beneficial terms for such commercial exploitation.

5 The Research Material is provided with no warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose. CIMMYT makes no representation regarding (a) the accuracy of information supplied to Recipient; (b) whether third parties have rights in or to the Research Material; or (c) the phytosanitary condition of the Research Material, except as stated in the accompanying phytosanitary certificate.

6 Recipient shall, upon request by CIMMYT and at Recipient's cost, provide CIMMYT all information necessary for CIMMYT to ascertain and verify the following: (a) the use(s) made of the Research Material; (b) the results of such use(s); and (c) compliance with the terms and conditions of this MTA.

7 At CIMMYT's request, Recipient shall return on destroy unused Research Material.

8 Recipient may not assign this MTA without CIMMYT's prior written consent.

9 The interpretation and application of this MTA shall be governed by the laws of Mexico.

CIMMYT®

Helminthosporium Monitoring Nursery (HMN)

Code of Ethics

The Helminthosporium Monitoring Nursery (HMN) is jointly organized and distributed by the Nepal Agricultural Research Council (NARC), Institute of Agriculture and Animal Sciences (IAAS) and the CIMMYT-South Asia Regional Program located in Kathmandu, Nepal.

The 11th HMN contains a collection of advanced lines and released cultivars from CIMMYT-Mexico, the Nepal Wheat Research Program (NWRP), the Indian Directorate of Wheat Research Program (DWR), and the Wheat Research Program of the Bangladesh Agricultural Research Council (BARI). The origin of the entries is specified in the nursery list. Different policies apply to the germplasm originated from CIMMYT-Mexico and the germplasm from the other national breeding programs.

The germplasm from CIMMYT-Mexico identified as CIMMYT in the origin is distributed under the following policy:

Recipients are free to release CIMMYT advanced lines where this is possible without obtaining plant variety protection, in which case CIMMYT expects notification and acknowledgement. CIMMYT advanced lines, with or without further selection, are not to be released under plant variety protection without the written permission of CIMMYT. Moreover, whereas in principle CIMMYT recognizes the validity of plant variety protection, it will reserve the right to distribute its germplasm to all clients.

The germplasm from all other national breeding programs must be handled according to the following Code of Ethics, which is modeled after that developed by the U.S. National Wheat Improvement Committee:

1. The originating breeder, station or company has certain rights to the germplasm that is included into the HMN. These rights are not waived with distribution of seeds in the HMN but remain with the originator.

2. The recipient of this germplasm through the HMN shall make no secondary distribution of the germplasm without the permission of the owner/breeder.

3. The breeder, in providing the germplasm for evaluation in the HMN, grants permission for its use in experimental tests under the recipient's control and/or as parent for making crosses from which selections will be made. Uses for which written approval of the owner/breeder is required include:

   a) Increase and release as cultivar;
   b) Reselection from within the stock;
   c) Use as a parent of a commercial F1 hybrid, synthetic, or multiline cultivar;
   d) Use as a recurrent parent in backcrossing;
   e) Mutation breeding;
   f) Selection of somaclonal variants;
   g) Use as a recipient parent for asexual gene transfer, including molecular genetic techniques; or
   h) Testing in regional or international nurseries.

The material is supplied expressly conditional on acceptance of the terms of this agreement. The recipient's retention of the material constitutes such acceptance.

Genotype Number	Genotype/Cross in the 11 th HMN		Origin
1	SW 89-5422		China
2	Chirya 7	CS/Th.Curv.//GLEN/3/PVN/4/NINGMAI-4/OLN//ALD/YANGMAI-4	CIMMYT
3	Kanchan		Bangladesh
4	BL 2179 = NL588/HD2307//NL623 (Bhirikuti)		Nepal
5	Pfau/Vee#5	CM85795-26Y-0M-0Y	CIMMYT
6	BL2029	G162/BL1316//NL297	Nepal
7	Yangmai #6		China
8	Chirya 1	CIGM87.110	CIMMYT
9	Ciano 79	CM31678-R-4Y-2M-21Y-0M	CIMMYT
10	PBW373		India
11	K 7		Zambia
12	CMH81 38/2*KAUZ//ATTILA	CMSS94Y00283S-0300M-0100Y-0100M-19Y-1M-0Y	CIMMYT
13	Ning 8201		China
14	Raj 3765		India
15	RR21 (=Sonalika)	II18427-4R-1M	Nepal
16	Milan/Sha-7	CM97550-0M-2Y-030H-3Y-3Y-0Y-1M-010Y-0FUS-015PR-0B	CIMMYT
17	Maya/mon//Kauz/Trm/3/Pvn/Buc//Har-424	BD(ISD)387-22ISD-0ISD-0ISD-0ISD-07ISD-0DI	Bangladesh
18	K 8027		India
19	Achyut		Nepal
20	CROC 1/AE.SQ(224)//YACO/3/MUNIA	CMSS93Y01054S-9Y-1KBY-010M-010Y-3M-0KBY-0M-15KBY-0Y	Nepal/CIMMYT
21	COQ/F61.70/CNDR/3/OLN/4/PHO	CM 60907-B-1Y-6M-6Y-1M-3Y-2M-OY	CIMMYT
22	PRL/TONI	CM 67360-2Y-3M-4Y-1M-1Y-2M-0Y	CIMMYT
23	ALTAR-84/AE. SQUARROSA(224)//*YACO	CIGM 90.455-2Y-1M-OPR-1B-OPR	CIMMYT
24	BARKAT/KVZ	BD(ISD)162-421ISD-OISD-OISD-OISD-5ISD-O1ISD	Bangladesh
25	KAN/6/COQ/F61.701//CNDR/OLN/4/PHOS/MRNG/ALAN/CNO	JESS 349-X-OJE-IDI-ODI-ODI-ODI-OIODI-ODI	Bangladesh
26	GOURAB (=TURACO/CHIL)	CM 92354-33M-OY-OM-6Y-OB	Bangladesh
27	IAS 58/3/KAL/BB//ALD/4/OLN/TRM//7C/ALD/5/PEACOCK	BD(JAM)208-1JE-0JE-0JE-0JE-RJE	Bangladesh
28	BL1473		Nepal
29	BL 2537=CROC 1/AE.SQ(210)//4*YACO/3/GUAM 92/4/SHA 7//PRL/3/FASAN	CMSS96M058121-040Y-5M-020B-6B-0B	Nepal/CIMMYT
30	BAW 898	CM 92354-33M-0Y-0M-6Y-0B-0BGD	Bangladesh/CIMMYT

11th HMN Layout 2002-2003

91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
8	*18*	*16*	*7*	*25*	*10*	*17*	*2*	*26*	*6*	*24*	*19*	*11*	*9*	*27*	*13*	*1*	*14*	*28*	*5*	*23*	*20*	*29*	*15*	*30*	*3*	*12*	*21*	*4*	*22*
R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2

61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
8	*18*	*16*	*7*	*25*	*10*	*17*	*2*	*26*	*6*	*24*	*19*	*11*	*9*	*27*	*13*	*1*	*14*	*28*	*5*	*23*	*20*	*29*	*15*	*30*	*3*	*12*	*21*	*4*	*22*
R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2	R2

FUNGICIDE

31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*
R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1

Plot number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
GENOTYPE *(Entry)*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*
Replicate	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1