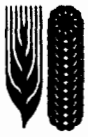
Results of the Third Aluminum Tolerance Screening Nursery (1984-85)



Results of the Third Aluminum Tolerance Screening Nursery (1984-85)

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Abbreviation	Scientific name	Variable name(scale)	Nombre de la variable (escala)	Nom de la variable (échelle)
AL TOL	–	Aluminum tolerance (0-9 scale)	Tolerancia al aluminio (escala 0-9)	Tolérance à l'aluminium (échelle 0-9)
ALT B	*Alternaria triticina*	Alternaria leaf blight (0-9 scale)	Tizón por alternaria (escala 0-9)	Alternaria (échelle 0-9)
ANT DMGE	–	Ant damage (percentage)	Porcentaje de daño por hormigas	Dégat du aux fourmis en pourcentage
APHD DMGE	–	Aphid damage (percentage)	Porcentaje de daño por áfidos	Dégat du aux pucerons en pourcentage
ARMY WORM	–	Army worm damage (percentage)	Porcentaje de daño por gusano cogollero	Dégat du aux noctuelles en pourcentage
BAC S	*Xanthomonas campestris* pv. translucens	Bacterial leaf streak or stripe (0-9 scale)	Rayado bacteriano y pajilla negra (escala 0-9)	Rayure bactérienne (échelle 0-9)
BAC SP		Bacterial species	Especies bacterianas	Espices bactériennes
BAC B	*Psuedomonas syringae* pv. striafaciens	Bacterial blight (0-9 scale)	Tizón bacteriano de la hoja (escala 0-9)	Brulure bactérienne des feuilles (échelle 0-9)
BAR S	*Pyrenophora graminea* (syn. *Drechslera gramineum*, syn. *Helminthosporium gramineum*)	Barley stripe (0-9 scale)	Mancha estriada de la cebada	Taches brunes de l'orge (*Helminthosporium gramineum*) (échelle 0-9)
BIRD DMGE	–	Bird damage (percentage)	Porcentaje de daño por pájaros	Dégat du aux oiseaux en pourcentage
BW	–	Bread wheat	Trigo	Blé
BYDV	–	Barley yellow dwarf virus (0-9 scale)	Virus del enanismo amarillo de la cebada (escala 0-9)	Jaunisse nanisante de l'orge (échelle 0-9)
CHECK MARK	–	Selected for further investigation	Seleccionada para investigación adicional	Selectionnée pour recherche additionnelle
COVD SMUT	*Ustilago hordei (U. kolleri)*	Covered smut (percentage)	Porcentaje de carbón cubierto	Charbon couvert en pourcentage
EARS/M2	–	Ears per square meter	Espigas por metro cuadrado	Epis par mètre carré
FALL NO	–	Falling number (seconds)	Actividad alfa amilasa (segundos)	Activité de l'alpha amylase (en secondes)
FERT %	–	Fertility (percentage)	Porcentaje de fertilidad	Fertilité en pourcentage
FRST DMGE	–	Frost damage (percentage)	Porcentaje de daño por heladas	Dégat du au gel en pourcentage
FUS N	*Fusarium nivale* (syn. *Monographella nivalis*)	Fusarium leaf blotch (0-9 scale)	Mancha de la hoja y moho níveo (moho blanco) (escala 0-9)	Tache de la feuille (*Fusarium nivale*)(échelle 0-9)
GERM %	–	Germination (percentage)	Porcentaje de germinación	Germination en pourcentage
HAIL DMGE	–	Hail damage (percentage)	Porcentaje de daño por granizo	Dégat du à la grêle en pourcentage
HEAD DAYS	–	Number of days to heading	Número de días al espigamiento	Nombre de jours à l'épiaison
HEL SP	*Helminthosporium* spp.	Helminthosporium (0-9 scale)	Helminthosporium (escala 0-9)	Helminthosporium (échelle 0-9)
L FIRE	–	Leaf fire (0-9 scale)	Tizón foliar (escala 0-9)	Sécheresse des feuilles (échelle 0-9)
LEAF RUST	*Puccinia recondita*	Wheat leaf rust (Cobb scale)	Roya de la hoja-trigo (escala de Cobb)	Rouille brune du blé (échelle de Cobb)
LEAF RUST	*Puccinia hordei*	Barley leaf rust (Cobb scale)	Roya de la hoja-cebada (escala de Cobb)	Rouille brune de l'orge (échelle de Cobb)
LODG %	–	Lodging (percentage)	Porcentaje de acame (vuelco)	Verse en pourcentage
LSE SMUT	*Ustilago nuda (U. tritici)*	Loose smut (percentage)	Porcentaje de carbón volador	Charbon nu en pourcentage
MAT DAYS	–	Number of days to maturity	Número de días a la madurez	Nombre de jours à la maturation
MOIST %	–	Moisture (percentage)	Porcentaje de humedad	Humidité en pourcentage
NECK BRK	–	Neck breakage (percentage)	Porcentaje de rotura de cuello	Cassure du pédoncule en pourcentage
NET B	*Pyrenophora teres* (syn. *Drechslera teres*, syn. *Helminthosporium teres*)	Net blotch (0-9 scale)	Mancha reticulada (escala 0-9)	Helminthosporium de l'orge (échelle 0-9)
NOBS	–	Number of observations	Número de observaciones	Nombre d'observations
OFS	–	Free State Streak	Estriado del estado libre	Rayure Free State
PC	–	Percentage	Porcentaje	Pourcentage
PLNT DENS	–	Plant density (stems/m2)	Densidad de plantas (tallos/m2)	Population de plantes (tiges/m2)
PLNT HT	–	Plant height (cm)	Altura de planta (cm)	Hauteur (cm)
POW M	*Erysiphe graminis*	Powdery mildew (0-9 scale)	Oídio o cenicilla polvorienta (escala 0-9)	Oïdium (échelle 0-9)
PROT %	–	Protein (percentage)	Porcentaje de proteína	Protéine en pourcentage
SCAB %	*Fusarium* spp.	Head scab (percentage)	Porcentaje de roña	Fusarium de l'épi en pourcentage
SCLD	*Rhynchosporium secalis*	Scald (0-9 scale)	Escaldadura (escala 0-9)	Rhyncosporium (échelle 0-9)
SDMT INDX	–	Sedimentation index (cc)	Indice de sedimentación (cc)	Indice de sédimentation (cc)
SEP N	*Leptosphaeria nodorum* (syn. *Septoria nodorum*)	Septoria glume blotch (0-9 scale)	Tizón de la gluma (escala 0-9)	Septoria nodorum (échelle 0-9)
SEP P	*Septoria passerinii sacc.*	Septoria leaf blotch (barley)	Mancha foliar (cebada)	Tache septorienne des feuilles de l'orge
SEP S	*Septoria* spp.	Septoria glume/leaf blotch (0-9 scale)	Septoria (escala 0-9)	Septoria (échelle 0-9)
SEP T	*Mycosphaerella graminicola* (syn. *Septoria tritici*)	Septoria leaf blotch (0-9 scale)	Mancha foliar o tizón foliar (escala 0-9)	Septoria tritici (échelle 0-9)
SHTR %	–	Shattering, head (percentage)	Porcentaje de desgrane (espiga)	Egrenage en pourcentage
SL	–	Sea level	Nivel del mar	Niveau de la mer
SPT B	*Cochliobolus sativus* (syn. *Bipolaria sorokiniana*, syn. *Helminthosporium sativum*)	Spot blotch (0-9 scale)	Tizón foliar (escala 0-9)	Tache de la feuille (*Helminthosporium sativum*) (échelle 0-9)
STEM RUST	*Puccinia graminis*	Stem rust (Cobb scale)	Roya del tallo (escala de Cobb)	Rouille noire (échelle de Cobb)
STRP RT.H	*Puccinia striiformis*	Stripe rust, head (percentage)	Porcentaje de roya amarilla (espiga)	Rouille jaune sur épi en pourcentage
STRP RT.L	*Puccinia striiformis*	Stripe rust, leaf (Cobb scale)	Roya amarilla-hoja (escala de Cobb)	Rouille jaune sur feuilles (échelle de Cobb)
STRP V	–	Barley stripe mosaic virus (scale 0-9)	Virus del mosaico lineal de la cebada (escala 0-9)	Mosaïque striée de l'orge (échelle 0-9)
TAN S	*Pyrenophora tritici-repentis* (syn. *Helminthosporium tritici-repentis*)	Tan spot (0-9 scale)	Mancha foliar amarilla (escala 0-9)	Helminthosporium tritici (échelle 0-9)
Tcl	–	Triticale	Triticale	Triticale
TEST WT	–	Test weight (kg/hl)	Peso hectolítrico (kg/hl)	Poids spécifique (kg/hl)
1000 G.W.	–	1000-grain weight (g)	Peso de 1000 granos (g)	Poids de 1000 grains (g)
VAR	–	Variety	Variedad	Variété
VTY	–	Variety	Variedad	Variété
YELL BERR	–	Yellow berry (percentage)	Porcentaje de panza blanca	Mitadinage en pourcentage
YIELD KG/HA	–	Yield (kg/ha)	Rendimiento (kg/ha)	Rendement (kg/ha)

The Third Aluminum Tolerance Screening Nursery

Sanjaya Rajaram, Wolfgang Pfeiffer, and Maximino Alcalá[1]

Introduction

The most important among the world's problem soils are the highly leached acidic Oxisols and Ultisols, which are characterized by toxic levels of soluble aluminum and manganese. These soils cover approximately 1 billion hectares of tropical and subtropical areas of Brazil, Southeast China, Southeast Asia, and Central Africa. Currently, these areas are either undeveloped for agriculture, or, where cultivated, are of very low productivity. To meet the rapid growing demand for food during the next four decades, these problems soils must be developed and improved in productivity. This can be done by a combination of plant improvement, corrective chemical fertilization and improved management practices.

Aluminum and manganese toxicities are among the most important factors limiting the growth of crop plants in many acid soils of the world. Aluminum toxicity is particularly severe below pH 5.0, but has been reported in soils with pH values as high as 5.5. The current approach to soil fertility recommends changing the soil pH by liming, which is not always economically feasible, particularly in strongly acid subsoils.

Aluminum toxicity severely inhibits root growth by preventing cell division in the root apical meristem. The resulting drastically restricted root system makes the plant vulnerable to moisture stress and unable to utilize low levels of available essential plant nutrients.

Besides the direct effect of excess free aluminum on root growth, high acidity also leads to free iron in the soil solution. Subsequently, phosphate will be fixed in aluminum and iron salts, resulting in phosphate deficiencies.

While breeding for tolerance to aluminum was initiated in Brazil in the 1920s and resistant germplasm was obtained, yield levels remained low. In the CIMMYT Program, high-yielding but aluminum-susceptible lines were available. Thus a cooperative breeding program was initiated. There are currently many advanced lines available that combine tolerance to aluminum with high yield potential as a result of this approach.

Similar to other traits, aluminum tolerance is not sought for an isolation; good agronomic performance and resistance to diseases are simultaneously incorporated. Therefore many aluminum-resistant lines also have good levels of resistance to such diseases as stripe rust and the septorias. In certain entries some resistance is available to fusarium and tanspot.

The breeding effort for aluminum tolerance is three-pronged. In the laboratory advanced lines are screened by visual evaluation of root growth after exposure to high concentrations of aluminum. Regrowth in a nutrient solution following staining of the roots is subsequently checked. Promising materials are tested in three locations in Brazil: Passo Fundo (EMBRAPA), Cruz Alta (FECOTRIGO), and Cascavel (OCEPAR) where they are grown in acid soils with high levels of soluble aluminum. In addition selected lines are grown in Patzcuaro, where free aluminum is not in excess, but soils are fairly acidic and phosphate is deficient. The combined results of testing under artificial and natural conditions in this shuttle breeding effort have been very positive. It should be noted that there was an exceptional varietal response under free aluminum conditions. Alondra is susceptible to soluble aluminum, but yields very well under such conditions. This favorable response appears due to the ability of Alondra to efficiently utilize even low amounts of phosphorus. In the recently released variety, Thornbird, increased phosphorus efficiency with true tolerance to aluminum has been combined. It is the first of the new generation, shorter stature, early, aluminum-tolerant, and high-yielding wheats emanating from this cooperative shuttle breeding effort.

Methodology

The Third Aluminum Tolerance Screening Nursery was sent in September 1984 to be grown in the 1984-85 season. Nurseries went to 60 cooperators in 43 countries. The 88 advanced lines and checks in the nursery had been chosen from among CIMMYT's best materials. All had been evaluated in the laboratory, grown and observed by CIMMYT scientists under acid soil and low phosphate conditions in Patzcuaro and under a high-yield environment with pressure from major diseases on the CIANO Experiment Station in the Yaqui Valley in northwest Mexico, and under high free aluminum conditions in Brazil. At CIANO, the seed for this international nursery was multiplied, cleaned, and treated with insecticide and organic fungicide before shipment.

Instructions on nursery management accompanied the mailing of seeds to each cooperator. Enough seed from each line was provided for a double row, unreplicated, of at least 2 m in length. A field book was included with each nursery set, providing a standard format for recording data desired by CIMMYT. In receiving and processing the data returned by cooperators, CIMMYT assumes that the nursery was properly handled and that accurate results were reported. We cannot, however, attest to the rigor with which the trials were grown and results were obtained.

[1]/Head, bread wheat program; bread wheat breeder, and, head, international nurseries.

Thirty-one of the cooperators receiving the nursery returned field books with performance data at their locations (Table 1) in time to be included in this report. The choice of variables measured and the data returned rests with the individual cooperator. We have included in this summary selected variables reported to us. The number of observations differs from variable to variable. The reader is urged to note the number of observations at the head of each variable column in the summary table (Table 2); this may be an important indicator of the level of credibility that should be inferred. The reader should also bear in mind that the yield reported is from a single plot, essentially grown for observation rather than as a rigorous, replicated yield trial.

Presentation of results. So that data in this report will be of optimal use to the reader, we present the results in three forms:

1. One international summary, listing the sites from which data were returned, with notations of all variables recorded and reported.

2. A table reporting the means of all observations from sites with uniform and discrete data for each variable measured for each line in the nursery.

3. Selected tables reporting the best performance by individual lines on major variables, usually the top 5 to 10 percent. The table of contents lists all variables reported in this way.

Cooperators were asked to use agronomic and disease reporting methodology as described in the "Instructions for the Management and Reporting of Results for the CIMMYT Wheat Program International Nurseries." Data reported are simple means computed from those supplied by the cooperators. Data on rusts recorded by the modified Cobb scale were converted to average coefficients of infection (ACI) as explained below.

Cooperator participation. Feedback information of two kinds from cooperators is vital to the quality of this and other CIMMYT international nursery reports: first, the prompt return of carefully recorded data from each and every trial site; second, identification of environmental and management factors (e.g. moisture problem, birds, etc.) that become part of our cooperator's station file. We ask for feedback of both kinds.

Rust scoring—Disease scores for stem, leaf and stripe rust infections recorded in the manner recommended by Dr. W.Q. Loegering (USDA International Spring Wheat Rust Nursery, 1959) are converted to a numeric coefficient of infection (CI) prior to being used in any calculations. Each original reading recorded in this manner consists of severity (percentage of rust infection on the plants) and response (kind of infection) scores. Severity is recorded as percent of infection acording to the modified Cobb scale. If only a trace is visible, T or TR may be reported and is given the value of 1 percent.

Responses may be recorded by using one of the following codes. The numeric values assigned to these codes are shown at the right.

Response	Equivalent numeric value
VR	0.2
R	0.2
MR	0.4
M or X	0.6
MS	0.8
S	1.0
VS	1.0

Severity and response are recorded together, with severity first (for example, 5MR). The equivalent coefficient of infection is calculated by multiplying the numeric equivalents of each part. For example:

Disease score	Coefficient of infection
5MR	5(0.4) = 2.0
TR	1(0.2) = 0.2
TRR	1(0.2) = 0.2
60S	60(1.0) = 60.0
0*	(0)(0) = 0.0

* If there is no visible infection on the plant, only a zero is reported.

Reactions may be more variable than can be represented by a single severity and response reading. This variability may be recorded in two ways: 1) A comma or slash indicates plants have segregated into clear-cut classes. The first rating reported is included in the computations. 2) If a range of reactions is recorded, it is denoted by a dash. In these cases the coefficient of infection is the average of the two scores. Examples of these situations are given below:

Disease score	Coefficient of infection
5R,40S	The first rating 5R = 5(0.2) = 1.0 is used in all computations
40M/60S	The first rating 40M = 40(0.6) = 24.0 is used in all computations
15R 5S	[15(0.2) + 5(1.0)]/2 = 4.0

A range may be reported for severity only or reponse only. In each of these cases the average severity or average response is calculated before multiplying the two together. For example:

Disease score	Coefficient of Infection
10-20MS	[(10 + 20)/2](0.8) = 12.0
40MR MS	40[(0.4 + 0.8)/2] = 24.0
5-10MR R	[(5 + 10)/2][(0.4 + 0.2)/2] = 2.25

In most tables only average coefficients of infection (ACI) are reported. However, in some tables the highest rust reading (HR) may be reported as severity/response scores.

Summary of Results

Of the 60 nurseries distributed, data were received for 31 (Table 1). The means for all yield, agronomic, and disease resistance characteristics for the 88 entries at all locations are listed in Table 2. In addition the top-performing entries for yield, heading, maturity, stem rust, leaf rust, stripe rust, septoria tritici blotch, and tolerance to free aluminum are featured in Tables 3-10.

Yield—Table 3 lists the 20 highest yielding entries, based on 18 locations. Almost one quarter of the entries yielded on average more than 2800 kg/ha. The mean yield for these entries ranged from 2830.5 kg/ha for PF70354-YACO"S" to 3128.9 kg/ha for PF70354-ALD"S". For the whole nursery, yield varied from 1808.8 kg/ha for entry 52, PF70354-YACO"S", a sister of the earlier mentioned entry, to 3128.9 kg/ha for entry 1, PF70354-ALD"S". It should be recognized that yield evaluation based on unreplicated trials can be misleading, but in this case some degree of validity can be claimed because of the high number of locations represented. Based on these data, further investigation of the breadth of adaptability of the entries in Table 3 by distributing them in a replicated trial appears to be warranted.

Heading date—The 14 entries that headed within 84 days, averaged over 10 locations, are presented in Table 4. Of these IAS58(KAL-BB x CJ"S"/ALD"S") headed the earliest, after 80 days, while (MRNG(NAD-TOR x PCH(BLT"S"-MES"S"))PAT72195(2)-ZP"S" x ALD"S"-EMU"S" headed after 84 days, as did ALDAN"S"-IAS58. The heading date in the entire nursery ranged from 97.6 days after planting for entry 47, PF70354-BOW"S", to 80 days for entry 2, IAS58(KAL-BB x CJ"S"/ALD"S").

Maturity—The 14 entries maturing, on average over 11 locations, in less than 133 days are listed in Table 5. The mean heading date for these ranged from 128.2 days for PF70354-ALD"S" x MES"S" to 132.8 days for (MRNG(NAD-TOR x PCH(BLT"S"-MES"S"))PAT72195(2)-ZP"S" x ALD"S"-EMU"S". The latest entry in the entire nursery, PF70354-YACO"S", matured after 146.6 days.

Rusts—The mean average coefficients of infection (ACI) for stem rust, leaf rust, and stripe rust for all reporting locations are given in Table 2. Tables 6, 7, and 8 include the entries most resistant to stem rust, leaf rust, and stripe rust, respectively.

With respect to stem rust, the ACIs ranged from 0.0 for several entries to 39.8 for entry 81, Maringa. The 37 entries that were found to be highly resistant, with ACIs equal or lower than 2.0, are given in Table 6. The most resistant entries were four SIS"S"-CAN"S" x ALD"S" sisters, two MON"S"-ALD"S" sisters, DOVE"S"-BUC"S", PF70354-BOW"S" and PF7339-DOVE"S", which had ACIs of 0.1 or less. Close to half of all the entries in the nursery showed high levels of resistance.

For leaf rust, the ACIs ranged from 0.0 for several entries to 50.0 for the susceptible check, Jupateco 73 (Table 2). The 26 entries that had the highest degree of leaf rust resistance are listed in Table 7. Their ACI values are equal or lower than 2.0. The five most resistant entries are two ALDAN"S"-IAS58 sisters, IAS58 (KAL-BB x CJ"S"/ALD"S"), PF7339-DOVE"S" and PF74354LD x ALD"S", which scored 0.1 or less. Almost one third of the entire nursery was highly resistant.

ACIs for stripe rust ranged from 0.6 for entry 19, (MRNG(NAD-TOR x PCH/BLT"S"-MES"S"))PAT72195(2)-ZP"S" x ALD"S"-EMU"S", to 55.4 for entry 20, the susceptible check, Jupateco 73 (Table 2). Four entries had ACIs of less than 1.5 (Table 8): three sisters of the above mentioned cross and SPT"S".

Although the number of locations represented for the rusts is not very high, it appears that, especially for stem and leaf rust, high levels of resistance are available. Since stripe rust may well occur in the higher rainfall and cooler areas where aluminum toxicity can be a problem, the availability of resistance to this pathogen in the ALTSN needs to be enhanced.

Septoria tritici—Almost one third of the entries had adequate levels of resistance to *S. tritici*. Table 9 presents the 25 most resistant entries to *S. tritici*, averaged over five locations. Relative disease height according to the Saari-Prescott 0-9 scale for these entries was less than 6.0. The disease levels ranged from 4.8 for PF70354-YACO"S" and ((KVZ/TOB-CTFN x BB)BLO"S")SNB"S" to 5.8 for several entries. In the entire nursery the most susceptible entry, the susceptible check Jupateco, scored 7.4.

Aluminum—The 44 entries most tolerant to free aluminum, averaged over five locations, are presented in Table 10. These entries scored 5.4 or less on a 0.9 scale: their mean reaction scores ranged from 5.4 for several entries to 2.4 for Maringa. The most susceptible entry in the entire nursery, the susceptible check Jupateco 73, scored 7.8. Thus 50% of the entries showed adequate levels of tolerance to free aluminum across a number of locations.

Table 1. Locations from which data were reported, with variables reported

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
1	AFRICA	KENYA	RIFT VALLEY-ELDORET	5 50 75
2	AFRICA	KENYA	RIFT VALLEY-NJORO	5 8
3	AFRICA	MALAWI	NTCHEU DISTRICT (CENTRAL REG.)	1 4 9
4	AFRICA	TANZANIA	E. AFRICA	70
5	AFRICA	TANZANIA	IRINGA	1 9 50
6	AFRICA	TANZANIA	MBEYA-U. A. C.	1 4 5 9 50 62 75
7	AFRICA	ZAMBIA	NORTHERN-KATITO	50
8	ASIA	BANGLADESH	JESSORE	1 3 4 9 50 68
9	ASIA	THAILAND	CHIANGRAI	1 3 9 50
10	ASIA	THAILAND	NAKHON RATCHSIMA	1 4 9 50
11	EUROPE	NORWAY		1 3 4 10 61
12	EUROPE	POLAND	WARSAW	1 9 50 62
13	EUROPE	PORTUGAL	ELVAS	62
14	EUROPE	PORTUGAL	TRAS-OS-MONTES	1 3 4 9 50
15	EUROPE	SPAIN	MADRID	50
16	MIDDLE EAST	SYRIA	ALEPPO-TEL HADYA	1 4 9 50
17	MIDDLE EAST	TURKEY	SAKARYA	3 9 61
18	NORTH AMERICA	MEXICO	SONORA-CIANO	1 3 4 7 8 9
19	NORTH AMERICA	MEXICO	TOLUCA	3 9 62
20	NORTH AMERICA	U. S. A.	CALIFORNIA-DAVIS	77
21	NORTH AMERICA	U. S. A.	OREGON-CORVALLIS	75
22	OCEANIA	NEW ZEALAND	MANAWATU	50 77
23	SOUTH AMERICA	BOLIVIA	COCHABAMBA	1 9
24	SOUTH AMERICA	BRAZIL	PARANA	1 50
25	SOUTH AMERICA	BRAZIL	PARANA-CASCAVEL	1 50
26	SOUTH AMERICA	BRAZIL	PARANA-PONTA GROSSA	7 8 9 50 61
27	SOUTH AMERICA	BRAZIL	PONTA GROSSA	1 4 9 61 62
28	SOUTH AMERICA	BRAZIL	RIO GRANDE DO SUL-CRUZ ALTA	1 50 75
29	SOUTH AMERICA	BRAZIL	SAO PAULO-CAMPINAS	1 3 4 7 9 50 61 68 75
30	SOUTH AMERICA	ECUADOR	QUITO, PICHINCHA	3 5 50 77
31	SOUTH AMERICA	PERU	CUSCO-TARAY	1 3 4 5 8 9

*VARIABLE IDENTIFICATIONS

1	YIELD	KG/HA	3	HEAD	DAYS	4	MAT	DAYS	5	STRP	RT. L	7	LEAF	RUST
8	STEM	RUST	9	PLNT	HT	10	LODG	%	50	CHECK	MARK	61	POW M	0-9
62	SEP T	0-9	68	SPT B	0-9	70	HEL SP	0-9	75	AL TOL	0-9	77	BYDV	0-9

Table 2. Summary of the means of all variables: yield, agronomic, and disease data

VTY NO.	VARIETY OR CROSS AND PEDIGREE	GRAIN	ORIGIN	YIELD KG/HA	HEAD DAYS	MAT DAYS	STRP RT. L	LEAF RUST	STEM RUST	PLNT HT
		NUMBER OF OBSERVATIONS:		(18)	(10)	(11)	(5)	(3)	(4)	(17)
1	PF70354-ALD"S" CM47090-14M-1Y-1F-703Y-10F-705Y-2F-0Y			3128.9	88.8	137.2	45.0	5.0	5.8	89.5
2	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-2F-2Y-1Y-3M-1Y-0M			2845.6	80.0	131.1	41.2	2.7	0.5	81.2
3	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-4F-1Y-4Y-1M-1Y-0M			2843.3	88.8	143.2	25.6	0.0	0.5	82.3
4	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-1M-1Y-0M			2759.1	85.3	135.7	22.0	0.3	2.0	82.0
5	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-7M-3Y-0M			2843.4	85.4	142.4	26.0	0.3	1.5	85.6
6	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-8M-5Y-0M			2620.8	88.4	142.8	29.6	0.7	3.0	83.7
7	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-2Y-6M-2Y-0M			2689.7	86.6	136.3	30.8	0.7	3.0	89.1
8	MDN"S"-ALD"S" CM53460-4M-1Y-1Y-3M-1Y-1M-0Y			2839.1	85.5	136.6	4.8	5.0	0.0	86.8
9	MDN"S"-ALD"S" CM53460-4M-1Y-2Y-3M-2Y-7M-0Y			3111.2	89.2	143.3	10.4	8.0	0.0	87.8
10	ALDAN"S"-IA858 CM53481-6Y-1Y-1M-3Y-0M			2484.5	84.0	134.2	27.0	0.0	1.0	82.3
11	ALDAN"S"-IA858 CM53481-6Y-1Y-1M-3Y-1M-0Y			2579.9	83.8	134.4	11.2	0.0	0.8	78.7
12	ALDAN"S"-IA858 CM53481-6Y-1Y-4M-1Y-1M-1Y-0M			2367.7	83.9	141.0	16.8	0.7	2.3	78.1
13	ALDAN"S"-PF70354 CM53524-10M-1Y-1Y-1Y-103F-0Y			2684.4	87.9	134.9	28.0	0.7	0.8	78.4
14	KAL-BB X ALD"S"-B7408 CM53596-1M-3Y-2Y-4M-1Y-0M			2644.6	84.5	130.9	20.4	1.7	1.3	82.5
15	IA854-ALD"S" CM56805-3Y-1Y-4M-1Y-1M-1Y-0M			2944.5	82.8	133.2	32.0	3.0	1.5	83.2
16	PF70354-ALD"S" X MES"S" CM57597-Z-1Y-1Y-3M-2Y-1M-0Y			2634.6	81.3	128.2	9.6	3.7	2.0	81.9
17	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-1M-2Y-2M-4Y-0M			2474.6	84.9	132.8	1.2	7.0	3.0	87.3
18	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-4M-2Y-1M-0Y			2612.3	84.0	132.5	1.2	7.3	2.0	83.9
19	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-7M-1Y-1M-2Y-0M			2621.6	84.1	132.7	0.6	7.3	0.3	85.0
20	JUPATECO73			2192.4	83.1	136.9	55.4	41.7	0.0	76.0
21	MARINGA			2636.5	86.1	134.0	40.4	30.7	30.0	103.3
22	SPT"S" CM58478-B-2Y-1Y-2M-1Y-0M			2780.1	88.4	143.8	1.4	7.0	1.0	84.9
23	SPT"S" CM58478-B-2Y-1Y-2M-2Y-0M			3015.8	87.3	142.3	17.4	2.3	0.5	81.6
24	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-1M-0Y			2342.9	81.6	129.8	8.4	4.7	2.0	71.7
25	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-2M-0Y			2301.9	81.2	129.5	8.8	8.7	0.0	69.2
26	DOVE"S"-BUC"S" CM58808-27Y-2M-10Y-1M-0Y			1819.0	81.9	129.9	10.6	3.7	0.5	69.7

LODG %	CHECK MARK	POW M 0-9	SEP T 0-9	SPT B 0-9	HEL SP 0-9	AL TOL 0-9	BYDV 0-9
(1)	(18)	(5)	(5)	(2)	(1)	(5)	(3)
8.0	44.4	5.2	6.4	4.5	7.0	4.4	4.3
1.0	27.8	5.8	6.0	6.0	5.0	5.0	4.0
1.0	5.6	5.2	6.2	4.5	5.0	5.4	3.7
1.0	33.3	5.6	6.2	4.5	7.0	5.8	4.7
1.0	33.3	5.4	5.8	3.5	7.0	6.0	4.7
0.0	38.9	5.8	5.6	3.5	7.0	5.2	3.7
0.0	38.9	6.2	5.8	3.5	7.0	5.0	4.0
1.0	38.9	5.2	6.0	4.5	5.0	5.2	4.7
0.0	33.3	5.8	5.8	3.5	5.0	5.0	5.0
3.0	16.7	5.8	6.2	4.5	8.0	5.4	6.0
1.0	11.1	5.6	7.0	3.5	8.0	5.4	6.3
0.0	16.7	5.8	6.4	3.5	8.0	5.2	6.0
0.0	22.2	6.2	6.3	4.5	8.0	5.2	5.3
1.0	5.6	5.6	5.8	5.5	7.0	5.8	5.3
0.0	27.8	5.6	6.4	3.5	7.0	4.4	5.7
7.0	27.8	5.2	6.6	3.5	6.0	5.6	5.7
0.0	11.1	4.4	6.8	4.5	8.0	6.2	5.0
0.0	16.7	3.4	6.4	3.5	7.0	6.0	4.7
0.0	22.2	3.8	6.4	4.5	7.0	6.6	5.3
7.0	16.7	6.4	7.4	4.5	8.0	7.8	5.0
5.0	11.1	3.6	6.6	5.5	8.0	3.4	4.5
1.0	22.2	5.6	7.2	3.5	7.0	5.2	5.3
0.0	33.3	5.8	7.0	6.0	8.0	5.4	5.3
1.0	22.2	6.8	7.0	5.5	8.0	7.0	5.0
0.0	33.3	7.0	6.4	4.5	8.0	6.6	4.5
0.0	5.6	6.8	6.6	6.0	8.0	6.0	4.5

Table 2. Continued

VTY NO.	VARIETY OR CROSS AND PEDIGREE	GRAIN	ORIGIN	YIELD KG/HA	HEAD DAYS	MAT DAYS	STRP RT. L	LEAF RUST	STEM RUST	PLNT HT
		NUMBER OF OBSERVATIONS:		(18)	(10)	(11)	(5)	(3)	(4)	(17)
27	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-1M-0Y			2307.8	88.1	135.9	28.0	1.0	0.0	85.6
28	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-3M-0Y			2217.7	88.6	138.8	30.0	3.7	0.0	86.8
29	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-4M-0Y			2221.5	88.7	136.2	30.0	1.7	0.5	86.9
30	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-5M-0Y			2329.5	88.4	137.5	24.0	0.7	0.0	89.0
31	SIS"S"-CAN"S" X ALD"S" CM62319-46LB-2B-2Y-0M			2238.5	83.5	134.5	21.4	7.0	0.0	81.8
32	MOR"S"-MON"S" CM64736-9Y-2M-2Y-4M-0Y			2558.8	84.2	135.5	20.8	3.7	1.3	80.5
33	MOR"S"-MON"S" CM64736-11Y-1M-4Y-0M			2260.4	84.4	132.3	23.2	5.7	1.0	79.7
34	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-0Y			2694.4	87.3	138.1	19.2	13.7	0.8	92.8
35	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-1Y-0M			2400.1	87.5	138.0	15.2	1.3	1.0	92.2
36	PF70354-BOW"S" CM67910-17Y-1M-4Y-2M-1Y-0M			2618.3	88.3	136.6	25.2	1.7	0.0	87.5
37	PF70354-BOW"S" CM67910-7Y-1M-3Y-0Z-5Y-0M			2494.8	92.5	144.2	24.8	5.0	3.0	85.9
38	PF70354-BOW"S" CM67910-7Y-1M-3Y-0Z-6Y-0M			2505.6	92.5	145.0	24.8	5.0	1.5	88.6
39	PF70354-BOW"S" CM67910-7Y-1M-4Y-0Z-1Y-0M			2351.9	92.3	143.3	17.2	3.7	5.0	82.6
40	JUPATECO73			2677.6	83.3	134.6	49.0	50.0	6.3	76.0
41	MARINGA			2969.5	86.1	137.5	30.0	22.0	23.0	108.7
42	PF70354-BOW"S" CM67910-7Y-1M-4Y-0Z-2Y-0M			2526.9	86.2	136.8	23.6	7.3	6.8	80.8
43	PF70354-BOW"S" CM67910-7Y-1M-8Y-0Z-5Y-0M			2745.1	88.0	136.7	17.6	6.0	4.0	86.1
44	PF70354-BOW"S" CM67910-7Y-1M-8Y-0Z-6Y-0M			2630.5	88.5	136.8	16.6	3.3	3.5	86.1
45	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-1Y-0M			2712.8	94.5	145.2	37.2	3.0	5.3	87.8
46	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-5Y-0M			2435.9	94.6	144.4	33.6	3.3	3.0	87.8
47	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-6Y-0M			2691.2	97.6	143.8	32.4	4.7	4.8	88.5
48	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-1Y-0M			2562.0	93.6	140.0	23.2	4.7	19.5	76.1
49	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-2Y-0M			2733.0	94.3	146.6	20.8	5.0	12.5	75.0
50	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-3Y-0M			2830.5	93.1	143.8	19.2	10.7	17.0	73.8
51	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-6Y-0M			3025.2	93.4	146.4	23.2	3.3	14.0	73.3
52	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-7Y-0M			1808.8	93.5	142.6	27.4	3.0	14.5	71.4
53	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-8Y-0M			2849.6	94.2	144.8	23.2	4.0	15.0	73.8
54	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-10Y-0M			2877.5	90.7	138.3	27.2	7.7	21.0	73.6
55	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-11Y-0M			2766.7	90.3	137.5	27.2	5.7	28.0	75.9

LODG %	CHECK MARK	POW M 0-9	SEP T 0-9	SPT B 0-9	HEL SP 0-9	AL TOL 0-9	BYDV 0-9
(1)	(18)	(5)	(5)	(2)	(1)	(5)	(3)
0.0	22.2	3.8	6.6	6.0	8.0	6.0	4.3
0.0	22.2	3.6	7.0	5.5	6.0	6.4	4.3
0.0	11.1	3.4	7.0	5.5	5.0	6.6	4.7
0.0	16.7	3.6	6.8	5.5	4.0	6.2	4.7
0.0	0.0	3.8	6.6	4.5	4.0	5.8	5.3
0.0	16.7	5.6	6.8	6.0	5.0	5.0	4.5
0.0	5.6	5.6	7.0	4.5	4.0	5.4	4.5
0.0	33.3	4.2	6.4	4.5	5.0	3.6	6.0
0.0	38.9	4.0	6.0	4.5	5.0	3.8	6.0
1.0	33.3	3.8	6.0	4.5	4.0	4.6	6.3
0.0	38.9	5.0	6.0	4.0	4.0	6.2	4.3
0.0	33.3	5.4	5.6	3.0	4.0	5.8	4.7
0.0	16.7	4.6	5.4	4.0	4.0	6.6	4.3
0.0	5.6	5.8	6.6	4.5	6.0	7.0	4.0
8.0	16.7	4.0	6.0	4.5	5.0	3.2	4.5
0.0	16.7	5.8	6.4	3.5	4.0	6.0	4.3
0.0	27.8	5.8	6.0	3.5	4.0	5.4	4.7
0.0	16.7	4.8	6.2	3.5	6.0	5.2	4.7
0.0	16.7	4.6	5.2	3.5	6.0	6.0	5.0
0.0	16.7	4.6	5.2	3.5	5.0	5.4	5.3
0.0	27.8	5.0	5.6	3.0	5.0	5.0	5.0
0.0	11.1	6.0	4.8	3.5	5.0	6.2	5.0
0.0	33.3	6.4	5.6	3.0	6.0	4.4	4.5
0.0	27.8	6.8	5.0	4.0	6.0	6.6	4.5
0.0	33.3	6.4	5.6	5.5	4.0	5.8	5.5
0.0	0.0	5.8	5.8	4.0	7.0	6.0	6.5
0.0	22.2	6.8	6.4	4.0	3.0	5.8	6.0
0.0	22.2	6.6	6.0	6.0	3.0	6.0	5.5
0.0	27.8	6.6	6.6	6.0	4.0	6.0	5.5

Table 2. Continued

VTY NO.	VARIETY OR CROSS AND PEDIGREE	GRAIN	ORIGIN	YIELD KG/HA	HEAD DAYS	MAT DAYS	STRP RT. L	LEAF RUST	STEM RUST	PLNT HT
	NUMBER OF OBSERVATIONS:			(18)	(10)	(11)	(5)	(3)	(4)	(17)
56	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-12Y-0M			2564.1	94.2	144.5	27.2	2.3	25.0	73.9
57	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-13Y-0M			2842.3	91.4	142.9	16.8	2.0	30.5	72.9
58	PF70354-YACO"S" CM67911-4Y-1M-3Y-0Z-1Y-0M			2513.8	94.0	140.5	20.6	1.0	23.0	82.1
59	PF70354-YACO"S" CM67911-4Y-1M-3Y-0Z-2Y-0M			2504.3	92.4	138.7	24.4	0.7	32.0	83.1
60	JUPATECO73			2573.4	84.1	130.9	39.0	32.0	7.5	81.3
61	MARINGA			2798.0	87.4	133.7	30.8	8.0	30.5	102.5
62	PF7339-DOVE"S" CM67915-1M-1Y-2M-2Y-0M			2529.1	89.2	135.3	20.8	0.0	0.0	98.9
63	AU-UP301 X ALD"S" CM67965-1M-1Y-3M-1Y-0M			2176.5	91.8	139.8	19.6	13.3	11.3	78.4
64	(SPRW"S"[(BB X SN64-KLRE/CHA)GB(K)])VEE"S" CM67976-2M-2Y-3M-3Y-0M			3001.8	89.2	136.3	10.0	0.7	7.3	77.4
65	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-2Y-4M-1Y-0M			2414.4	86.1	135.3	26.0	14.0	9.5	80.7
66	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-1M-1Y-0M			2933.9	86.8	130.8	22.5	15.3	3.8	74.1
67	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-1Y-0M			3089.0	88.8	136.0	34.0	26.0	8.8	79.8
68	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-2Y-0M			2950.8	88.7	131.5	20.0	16.3	6.3	80.6
69	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-3M-1Y-0M			2899.5	89.8	136.7	21.6	6.7	5.0	80.5
70	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-1Y-0M			2417.4	91.7	141.2	16.8	2.0	3.5	72.0
71	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-2Y-0M			2354.5	91.9	142.2	12.8	1.3	5.3	72.6
72	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-4Y-0M			2666.5	92.9	141.9	14.4	1.3	3.8	75.1
73	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-2M-3Y-0M			2259.1	95.2	143.6	15.0	2.0	2.8	77.9
74	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-2M-4Y-0M			1951.3	95.7	144.0	15.2	3.7	1.0	80.4
75	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-4M-5Y-1M-1Y-0M			2792.8	89.6	136.9	24.0	20.0	1.5	83.4
76	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-2Y-2M-1Y-0M			2280.1	87.2	130.1	28.0	28.7	0.5	77.5
77	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-3Y-1M-1Y-0M			2406.3	88.2	134.9	18.8	29.0	0.8	83.6
78	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-3Y-1M-2Y-0M			2587.9	87.7	133.5	22.0	32.3	0.5	83.2
79	CNT8 X PF70354-ALD"S" CM70371-1M-4Y-0Z-1Y-0M			2772.6	84.8	134.7	21.0	7.3	12.0	89.3
80	JUPATECO73			2346.5	86.8	135.7	50.0	46.7	3.8	78.7
81	MARINGA			2578.5	86.8	133.4	28.4	28.7	39.8	105.7
82	THB"S" F11915-A-502M-1Y-3F-702Y-4F-0Y			2925.8	90.1	136.9	19.6	2.7	14.0	87.8
83	E7408-PAM"S" X HORK"S"-PF73226 F13906-F-2Y-3M-2Y-0M			2224.5	88.6	140.8	26.0	3.0	8.0	83.4
84	PAT7392(KAL-BB X CJ"S"/ALD"S") B27108-2M-1Y-3M-4Y-0M			2471.7	90.7	138.9	9.8	3.0	13.3	86.6
85	BUT"S"-CEP75195 OC3229-1M-1Y-4M-1Y-0M			2466.6	83.2	134.6	4.0	3.0	7.3	82.8

LODG %	CHECK MARK	POW M 0-9	SEP T 0-9	SPT B 0-9	HEL SP 0-9	AL TOL 0-9	BYDV 0-9
(1)	(18)	(5)	(5)	(2)	(1)	(5)	(3)
0.0	22.2	7.0	5.4	4.0	4.0	6.0	5.0
0.0	33.3	6.8	5.4	5.0	8.0	5.2	5.5
0.0	27.8	6.0	5.2	4.0	8.0	5.8	4.0
1.0	22.2	5.8	6.0	4.0	5.0	6.4	4.0
1.0	0.0	5.8	7.0	6.5	6.0	7.3	4.0
8.0	16.7	3.8	5.8	6.0	3.0	3.4	4.0
0.0	27.8	4.2	6.4	6.0	3.0	5.4	5.0
0.0	16.7	6.6	5.6	4.0	7.0	6.4	5.3
1.0	16.7	6.2	6.6	6.0	7.0	5.2	5.0
0.0	16.7	5.4	6.2	6.5	8.0	5.4	4.3
0.0	5.6	6.2	6.8	5.5	8.0	5.8	5.0
0.0	16.7	5.4	6.4	5.0	6.0	4.6	5.0
1.0	11.1	5.8	6.4	6.0	7.0	4.8	5.0
0.0	11.1	5.6	6.0	6.0	7.0	6.2	4.7
0.0	11.1	6.2	5.2	4.0	8.0	4.2	4.0
0.0	16.7	5.6	5.6	5.0	6.0	5.4	5.0
0.0	11.1	5.8	5.4	4.0	6.0	5.6	5.0
0.0	22.2	6.0	5.8	4.0	8.0	5.6	5.0
0.0	33.3	5.8	4.8	4.5	8.0	5.8	5.0
0.0	27.8	5.6	6.8	5.5	6.0	5.8	5.3
0.0	11.1	5.8	6.4	5.0	5.0	5.8	5.7
0.0	5.6	6.0	6.4	5.5	5.0	5.8	5.3
0.0	11.1	5.6	6.4	5.5	6.0	5.8	5.7
0.0	50.0	4.4	6.6	4.0	7.0	5.0	6.3
0.0	0.0	6.2	7.2	4.5	5.0	6.8	4.5
8.0	5.6	3.0	6.2	5.5	8.0	2.4	4.0
1.0	16.7	4.4	6.6	4.5	4.0	5.2	5.3
1.0	22.2	5.6	6.6	5.5	8.0	5.0	6.3
0.0	16.7	5.4	6.4	4.5	8.0	5.2	5.7
3.0	16.7	3.8	6.6	5.5	8.0	5.2	5.7

Table 2. Continued

VTY NO.	VARIETY OR CROSS AND PEDIGREE	GRAIN	ORIGIN	YIELD KG/HA	HEAD DAYS	MAT DAYS	STRP RT. L	LEAF RUST	STEM RUST	PLNT HT	LODG %	CHECK MARK	POW M 0-9	SEP T 0-9	SPT B 0-9	HEL SP 0-9	AL TOL 0-9	BYDV 0-9
	NUMBER OF OBSERVATIONS:			(18)	(10)	(11)	(5)	(3)	(4)	(17)	(1)	(18)	(5)	(5)	(2)	(1)	(5)	(3)
86	PF74354 X LD-ALD"S" OC3551-1M-1Y-0Z-2Y-0M			2302.0	90.6	137.3	13.6	0.0	6.5	87.5	0.0	5.6	4.6	6.2	5.0	8.0	5.4	5.7
87	PF74354 X LD-ALD"S" OC3551-4M-1Y-0Z-8Y-0M			2527.1	89.7	136.3	20.8	0.7	2.5	91.8	0.0	11.1	5.8	7.2	6.0	8.0	4.2	6.3
88	VEE"S"-CEP7713 OC3597-4M-2Y-0Z-1Y-0M			2603.7	85.1	134.3	36.2	16.7	11.0	76.6	1.0	22.2	4.6	7.0	5.5	7.0	3.8	6.0

Table 3. Top performing entries: yield

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
3	AFRICA	MALAWI	NTCHEU DISTRICT (CENTRAL REG.)	1
5	AFRICA	TANZANIA	IRINGA	1
6	AFRICA	TANZANIA	MBEYA-U. A. C.	1
8	ASIA	BANGLADESH	JESSORE (1ST. DATE)	1
9	ASIA	THAILAND	CHIANGRAI	1
10	ASIA	THAILAND	NAKHON RATCHSIMA	1
11	EUROPE	NORWAY		1
12	EUROPE	POLAND	WARSAW	1
14	EUROPE	PORTUGAL	TRAS-OS-MONTES	1
16	MIDDLE EAST	SYRIA	ALEPPO-TEL HADYA	1
18	NORTH AMERICA	MEXICO	SONORA-CIANO (1ST DATE)	1
23	SOUTH AMERICA	BOLIVIA	COCHABAMBA	1
24	SOUTH AMERICA	BRAZIL	PARANA	1
25	SOUTH AMERICA	BRAZIL	PARANA-CASCAVEL	1
27	SOUTH AMERICA	BRAZIL	PONTA GROSSA	1
28	SOUTH AMERICA	BRAZIL	RIO GRANDE DO SUL-CRUZ ALTA	1
29	SOUTH AMERICA	BRAZIL	SAO PAULO-CAMPINAS	1
31	SOUTH AMERICA	PERU	CUSCO-TARAY	1

*VARIABLE IDENTIFICATIONS
1 YIELD KG/HA

Table 3. Continued

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 3	5	6	8	9	10	11	12	14	16	18	23	24	25	27	28	29	31	MEAN
1	PF70354-ALD"S" CM47090-14M-1Y-1F-703Y-10F-705Y-2F-0Y	2700	3258	3104	3673	160	2093	2839	2150	2458	2266	4610	5866	---	---	1417	---	6625	3714	3128.9
9	MON"S"-ALD"S" CM53460-4M-1Y-2Y-3M-2Y-7M-0Y	3033	2528	5076	2933	80	1666	3346	1720	2341	---	6554	4250	---	---	1917	---	3875	4238	3111.2
67	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-1Y-0M	2733	3780	2847	2906	40	906	3559	2290	2346	---	6610	5166	---	---	2750	---	2313	5000	3089.0
51	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-6Y-0M	3533	3519	3590	2719	---	1733	3053	1400	2277	3666	5721	1950	2190	---	1500	---	2813	5714	3025.2
23	SPT"S" CM58478-B-2Y-1Y-2M-2Y-0M	3066	3223	3558	2946	---	2479	3439	2500	2138	---	3055	4516	---	---	2167	---	3500	2619	3015.8
64	(SPRW"S"[(BB X SN64-KLRE/CHA)QB(K)]}VEE"S" CM67976-2M-2Y-3M-3Y-0M	4000	3823	2390	3133	---	1693	2239	1780	2224	---	5999	3850	---	---	2333	---	1750	3809	3001.8
41	MARINGA	2766	3649	3014	3126	1400	2373	4493	2750	2442	---	3999	5066	---	1852	1167	---	2875	3571	2969.5
68	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-2Y-0M	3440	3328	2471	2846	120	1986	3079	1800	2112	---	6721	4416	---	---	1917	---	2313	4762	2950.8
15	IAS54-ALD"S" CM56805-3Y-1Y-4M-1Y-1M-1Y-0M	3400	3580	4627	2853	226	1706	3813	1250	2336	---	4249	3850	---	---	2333	593	4875	4476	2944.5
66	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-1M-1Y-0M	3000	2928	4318	2926	293	1226	2586	1800	1834	---	4943	3833	---	---	2500	---	2125	6762	2933.9
82	THB"S" F11915-A-502M-1Y-3F-702Y-4F-0Y	2333	3667	2653	3213	---	1799	3399	2010	1866	---	3944	4733	---	---	2833	---	2063	3523	2925.8
69	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-3M-1Y-0M	2333	2954	4014	2593	26	1266	2919	1000	2074	---	6332	3400	---	---	3167	---	2563	5952	2899.5
54	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-10Y-0M	3200	3519	4205	2039	---	2119	2119	2280	2042	---	6110	1783	2000	---	1667	---	2250	4952	2877.5
53	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-8Y-0M	3066	3302	3510	2386	---	1573	2959	2630	1645	1866	6110	2550	---	---	2667	---	2250	3381	2849.6
2	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-2F-2Y-1Y-3M-1Y-0M	1633	2589	3563	2926	---	1533	2706	1530	1786	---	6554	3683	---	2074	2250	---	3250	3761	2845.6
5	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-7M-3Y-0M	1866	2711	3387	3133	---	1626	3746	1310	1888	---	5221	4233	2440	2519	1333	---	4000	3238	2843.4
3	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-4F-1Y-4Y-1M-1Y-0M	1866	2693	3132	2906	---	1359	2786	1630	2144	---	4888	3000	---	---	2167	---	3250	5142	2843.3
57	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-13Y-0M	3266	2954	4247	2646	---	1506	3066	830	1760	2000	5055	2283	---	---	2667	---	2750	4762	2842.3
8	MON"S"-ALD"S" CM53460-4M-1Y-1Y-3M-1Y-1M-0Y	3166	2607	4146	3146	80	1973	2879	900	2117	1933	5527	4983	1310	---	1917	---	5000	4142	2839.1
50	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-3Y-0M	3466	3084	3878	2539	---	1879	2359	2580	1632	---	6221	2216	2500	---	2500	---	2250	2523	2830.5

Table 4. Top performing entries: days to heading

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
8	ASIA	BANGLADESH	JESSORE (1ST. DATE)	3
9	ASIA	THAILAND	CHIANGRAI	3
11	EUROPE	NORWAY		3
14	EUROPE	PORTUGAL	TRAS-OS-MONTES	3
17	MIDDLE EAST	TURKEY	SAKARYA	3
18	NORTH AMERICA	MEXICO	SONORA-CIANO (1ST DATE)	3
19	NORTH AMERICA	MEXICO	TOLUCA	3
29	SOUTH AMERICA	BRAZIL	SAO PAULO-CAMPINAS	3
30	SOUTH AMERICA	ECUADOR	QUITO, PICHINCHA	3
31	SOUTH AMERICA	PERU	CUSCO-TARAY	3

*VARIABLE IDENTIFICATIONS
3 HEAD DAYS

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 8	9	11	14	17	18	19	29	30	31	MEAN
2	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-2F-2Y-1Y-3M-1Y-0M	59	48	57	144	128	83	72	67	79	63	80.0
25	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-2M-0Y	62	48	54	152	130	83	73	67	80	63	81.2
16	PF70354-ALD"S" X MES"S" CM57597-Z-1Y-1Y-3M-2Y-1M-0Y	59	48	58	150	129	83	79	67	77	63	81.3
24	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-1M-0Y	62	48	55	152	130	83	73	67	83	63	81.6
26	DOVE"S"-BUC"S" CM58808-27Y-2M-10Y-1M-0Y	63	48	59	152	131	83	73	67	80	63	81.9
15	IAS54-ALD"S" CM56805-3Y-1Y-4M-1Y-1M-1Y-0M	65	52	58	152	131	83	77	67	80	63	82.8
20	JUPATECO73	68	52	60	144	129	85	78	67	77	71	83.1
85	BUT"S"-CEP75195 OC3229-1M-1Y-4M-1Y-0M	60	55	60	143	129	82	86	67	82	68	83.2
40	JUPATECO73	70	54	58	144	129	85	78	67	80	68	83.3
31	SIS"S"-CAN"S" X ALD"S" CM62319-46LB-2B-2Y-0M	62	58	57	150	128	86	79	67	85	63	83.5
11	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-1M-0Y	65	52	60	150	129	83	78	67	86	68	83.8
12	ALDAN"S"-IAS58 CM53481-6Y-1Y-4M-1Y-1M-1Y-0M	64	52	59	150	129	83	77	67	88	70	83.9
10	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-0M	64	53	62	150	129	83	78	67	86	68	84.0
18	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-2P"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-4M-2Y-1M-0Y	63	52	60	152	133	85	80	67	80	68	84.0

Table 5. Top performing entries: days to maturity

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
3	AFRICA	MALAWI	NTCHEU DISTRICT (CENTRAL REG.)	4
6	AFRICA	TANZANIA	MBEYA-U. A. C.	4
8	ASIA	BANGLADESH	JESSORE (1ST. DATE)	4
10	ASIA	THAILAND	NAKHON RATCHSIMA	4
11	EUROPE	NORWAY		4
14	EUROPE	PORTUGAL	TRAS-OS-MONTES	4
16	MIDDLE EAST	SYRIA	ALEPPO-TEL HADYA	4
18	NORTH AMERICA	MEXICO	SONORA-CIANO (1ST DATE)	4
27	SOUTH AMERICA	BRAZIL	PONTA GROSSA	4
29	SOUTH AMERICA	BRAZIL	SAO PAULO-CAMPINAS	4
31	SOUTH AMERICA	PERU	CUSCO-TARAY	4

*VARIABLE IDENTIFICATIONS
4 MAT DAYS

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 3	6	8	10	11	14	16	18	27	29	31	MEAN
16	PF70354-ALD"S" X MES"S" CM57597-Z-1Y-1Y-3M-2Y-1M-0Y	110	137	99	82	116	213	168	126	115	110	134	128.2
25	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-2M-0Y	110	137	99	82	118	213	168	135	124	110	128	129.5
24	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-1M-0Y	110	137	99	82	118	213	168	132	124	110	135	129.8
26	DOVE"S"-BUC"S" CM58808-27Y-2M-10Y-1M-0Y	110	137	99	82	120	213	167	139	124	110	128	129.9
76	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-2Y-2M-1Y-0M	140	137	103	87	118	213	---	132	115	122	134	130.1
66	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-1M-1Y-0M	135	137	108	87	122	213	---	135	115	122	134	130.8
14	KAL-BB X ALD"S"-B7408 CM53596-1M-3Y-2Y-4M-1Y-0M	140	146	106	82	121	213	---	129	115	122	135	130.9
60	JUPATECO73	145	137	105	90	111	213	---	135	115	122	136	130.9
2	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-2F-2Y-1Y-3M-1Y-0M	140	137	99	79	124	213	167	126	115	110	132	131.1
68	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-2Y-0M	135	143	106	88	123	213	---	135	115	122	135	131.5
33	MOR"S"-MON"S" CM64736-11Y-1M-4Y-0M	145	143	106	91	107	213	---	132	115	135	136	132.3
18	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-4M-2Y-1M-0Y	140	149	101	82	132	213	---	135	115	122	136	132.5
19	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-7M-1Y-1M-2Y-0M	140	149	101	82	---	213	---	137	115	122	135	132.7
17	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-1M-2Y-2M-4Y-0M	140	149	102	83	131	213	---	137	115	122	136	132.8

Table 6. Top performing entries: stem rust

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
2	AFRICA	KENYA	RIFT VALLEY-NJORO	8
18	NORTH AMERICA	MEXICO	SONORA-CIANO (1ST DATE)	8
26	SOUTH AMERICA	BRAZIL	PARANA-PONTA GROSSA	8
31	SOUTH AMERICA	PERU	CUSCO-TARAY	8

*VARIABLE IDENTIFICATIONS
8 STEM RUST

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 2	18	26	31	MEAN
30	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-5M-0Y	0	0	0	-----	0.0
8	MON"S"-ALD"S" CM53460-4M-1Y-1Y-3M-1Y-1M-0Y	TR	0	0	TR	0.1
9	MON"S"-ALD"S" CM53460-4M-1Y-2Y-3M-2Y-7M-0Y	0	0	0	TR	0.1
20	JUPATECO73	0	TR	0	-----	0.1
25	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-2M-0Y	0	0	0	TR	0.1
27	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-1M-0Y	0	0	0	TR	0.1
28	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-3M-0Y	0	0	0	TR	0.1
31	SIS"S"-CAN"S" X ALD"S" CM62319-46LB-2B-2Y-0M	0	TR	0	-----	0.1
36	PF70354-BOW"S" CM67910-17Y-1M-4Y-2M-1Y-0M	0	0	0	TR	0.1
62	PF7339-DOVE"S" CM67915-1M-1Y-2M-2Y-0M	0	0	0	TR	0.1
19	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-7M-1Y-1M-2Y-0M	0	5R	0	-----	0.3
2	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-2F-2Y-1Y-3M-1Y-0M	0	0	0	5MR	0.5
3	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-4F-1Y-4Y-1M-1Y-0M	0	0	0	5MR	0.5
23	SPT"S" CM58478-8-2Y-1Y-2M-2Y-0M	0	0	0	5MR	0.5
26	DOVE"S"-BUC"S" CM58808-27Y-2M-10Y-1M-0Y	0	0	0	5MR	0.5
29	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-4M-0Y	0	0	0	5MR	0.5
76	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-2Y-2M-1Y-0M	0	TR	0	5MR	0.6
78	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-3Y-1M-2Y-0M	0	TR	0	5MR	0.6

Table 6. Continued

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 2	18	26	31	MEAN
34	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-0Y	TMS	0	0	5MR	0.7
11	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-1M-0Y	0	5R	0	5MR	0.8
13	ALDAN"S"-PF70354 CM53524-10M-1Y-1Y-1Y-103F-0Y	0	5R	0	5MR	0.8
77	[(KVZ/TOB-CTFN X BB)BLO"S"]VEE"S" CM67983-2M-3Y-1M-1Y-0M	0	5R	0	5MR	0.8
10	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-0M	0	10R	0	5MR	1.0
22	SPT"S" CM58478-B-2Y-1Y-2M-1Y-0M	10MR	0	0	TR	1.0
74	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-2M-4Y-0M	0	5MR	0	5MR	1.0
33	MOR"S"-MON"S" CM64736-11Y-1M-4Y-0M	TR	TR	0	10MR	1.1
35	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-1Y-0M	5MR	TR	0	5MR	1.1
14	KAL-BB X ALD"S"-87408 CM53596-1M-3Y-2Y-4M-1Y-0M	0	10MR	0	-----	1.3
32	MOR"S"-MON"S" CM64736-9Y-2M-2Y-4M-0Y	TR	5R	0	10MR	1.3
5	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-7M-3Y-0M	0	10MR	0	5MR	1.5
15	IAS54-ALD"S" CM56805-3Y-1Y-4M-1Y-1M-1Y-0M	0	10R	0	10MR	1.5
38	PF70354-BOW"S" CM67910-7Y-1M-3Y-0Z-6Y-0M	TR	10MR	0	5MR	1.5
75	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-4M-5Y-1M-1Y-0M	0	10MR	0	5MR	1.5
4	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-1M-1Y-0M	TR	0	0	10MS	2.0
16	PF70354-ALD"S" X MES"S" CM57597-Z-1Y-1Y-3M-2Y-1M-0Y	10MR	10R	0	5MR	2.0
18	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-4M-2Y-1M-0Y	10MR	10R	0	5MR	2.0
24	DOVE"S"-BUC"S" CM58808-27Y-2M-6Y-1M-0Y	0	TR	0	10MS	2.0

Table 7. Top performing entries: leaf rust

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
18	NORTH AMERICA	MEXICO	SONORA-CIANO (1ST DATE)	7
26	SOUTH AMERICA	BRAZIL	PARANA-PONTA GROSSA	7
29	SOUTH AMERICA	BRAZIL	SAO PAULO-CAMPINAS	7

*VARIABLE IDENTIFICATIONS
7 LEAF RUST

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 18	26	29	MEAN
3	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-4F-1Y-4Y-1M-1Y-0M	0	0	0	0.0
10	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-0M	TR	0	0	0.1
11	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-1M-0Y	TR	0	0	0.1
62	PF7339-DOVE"S" CM67915-1M-1Y-2M-2Y-0M	TR	0	0	0.1
86	PF74354 X LD-ALD"S" DC3551-1M-1Y-0Z-2Y-0M	TR	0	0	0.1
4	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-1M-1Y-0M	5R	0	0	0.3
5	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-7M-3Y-0M	5R	0	0	0.3
6	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-8M-5Y-0M	5MR	0	0	0.7
7	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-2Y-6M-2Y-0M	5MR	0	0	0.7
12	ALDAN"S"-IAS58 CM53481-6Y-1Y-4M-1Y-1M-1Y-0M	5MR	0	0	0.7
13	ALDAN"S"-PF70354 CM53524-10M-1Y-1Y-1Y-10JF-0Y	5MR	0	0	0.7
30	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-5M-0Y	5MR	0	0	0.7
59	PF70354-YACO"S" CM67911-4Y-1M-3Y-0Z-2Y-0M	5MR	0	0	0.7
64	(SPRW"S"[(BB X SN64-KLRE/CHA)GB(K)])VEE"S" CM67976-2M-2Y-3M-3Y-0M	5MR	0	0	0.7
87	PF74354 X LD-ALD"S" DC3551-4M-1Y-0Z-8Y-0M	5MR	0	0	0.7
27	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-1M-0Y	5M	0	0	1.0
58	PF70354-YACO"S" CM67911-4Y-1M-3Y-0Z-1Y-0M	5M	0	0	1.0
71	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-2Y-0M	10MR	0	0	1.3
72	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-4Y-0M	10MR	0	0	1.3
35	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-1Y-0M	TMR	10MR	0	1.5
36	PF70354-BOW"S" CM67910-17Y-1M-4Y-2M-1Y-0M	5MS-S	0	0	1.5
14	KAL-BB X ALD"S"-B7408 CM53596-1M-3Y-2Y-4M-1Y-0M	10MR	0	TS	1.7
29	SIS"S"-CAN"S" X ALD"S" CM62319-32LB-1B-2Y-1M-1Y-4M-0Y	5M	5MR	0	1.7
57	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-13Y-0M	10M	0	0	2.0
70	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-1Y-0M	10M	0	0	2.0
73	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-2M-3Y-0M	10M	0	0	2.0

Table 8. Top performing entries: stripe rust

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
1	AFRICA	KENYA	RIFT VALLEY-ELDORET	5
2	AFRICA	KENYA	RIFT VALLEY-NJORO	5
6	AFRICA	TANZANIA	MBEYA-U. A. C.	5
30	SOUTH AMERICA	ECUADOR	QUITO, PICHINCHA	5
31	SOUTH AMERICA	PERU	CUSCO-TARAY	5

*VARIABLE IDENTIFICATIONS
5 STRP RT. L

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 1	2	6	30	31	MEAN
19	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-7M-1Y-1M-2Y-0M	TMS	5MR	0	0	0	0.6
17	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-1M-2Y-2M-4Y-0M	5MS	5MR	0	0	0	1.2
18	[MRNG(NAD-TOR X PCH/BLT"S"-MES"S")] PAT72195(2)-ZP"S" X ALD"S"-EMU"S" CM57616-A-3Y-1Y-4M-2Y-1M-0Y	5MS	5MR	0	0	0	1.2
22	SPT"S" CM5847B-8-2Y-1Y-2M-1Y-0M	5MS-MR	5MS	0	0	0	1.4

Table 9. Top performing entries: *Septoria tritici*

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
6	AFRICA	TANZANIA	MBEYA-U. A. C.	62
12	EUROPE	POLAND	WARSAW	62
13	EUROPE	PORTUGAL	ELVAS	62
19	NORTH AMERICA	MEXICO	TOLUCA	62
27	SOUTH AMERICA	BRAZIL	PONTA GROSSA	62

*VARIABLE IDENTIFICATIONS
62 SEP T 0-9

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 6	12	13	19	27	MEAN
48	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-1Y-0M	5	5	4	6	4	4.8
74	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-2M-4Y-0M	4	3	8	---	4	4.8
50	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-3Y-0M	5	4	7	5	4	5.0
45	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-1Y-0M	4	5	8	5	4	5.2
46	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-5Y-0M	4	5	8	5	4	5.2
58	PF70354-YACO"S" CM67911-4Y-1M-3Y-0Z-1Y-0M	4	3	8	7	4	5.2
70	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-1Y-0M	3	3	8	8	4	5.2
39	PF70354-BOW"S" CM67910-7Y-1M-4Y-0Z-1Y-0M	5	4	8	6	4	5.4
56	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-12Y-0M	6	4	6	7	4	5.4
57	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-13Y-0M	5	4	6	8	4	5.4
72	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-4Y-0M	4	3	8	8	4	5.4
6	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-8M-5Y-0M	4	5	8	7	4	5.6
38	PF70354-BOW"S" CM67910-7Y-1M-3Y-0Z-6Y-0M	6	4	8	6	4	5.6
47	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-6Y-0M	4	5	8	7	4	5.6
49	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-2Y-0M	6	4	6	8	4	5.6
51	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-6Y-0M	5	5	7	7	4	5.6
63	AU-UP301 X ALD"S" CM67965-1M-1Y-3M-1Y-0M	5	4	8	7	4	5.6
71	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-2Y-0M	4	4	8	8	4	5.6
5	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-7M-3Y-0M	6	5	8	6	4	5.8
7	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-2Y-6M-2Y-0M	6	5	8	6	4	5.8
9	MON"S"-ALD"S" CM53460-4M-1Y-2Y-3M-2Y-7M-0Y	5	4	8	8	4	5.8
14	KAL-BB X ALD"S"-B7408 CM53596-1M-3Y-2Y-4M-1Y-0M	7	4	7	7	4	5.8
52	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-7Y-0M	4	6	8	7	4	5.8
61	MARINGA	6	3	8	8	4	5.8
73	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-2M-3Y-0M	5	4	8	8	4	5.8

Table 10. Top performing entries: aluminum tolerance

LOCATIONS	CONTINENT	COUNTRY	AREA	VARIABLES INCLUDED
1	AFRICA	KENYA	RIFT VALLEY-ELDORET	75
6	AFRICA	TANZANIA	MBEYA-U. A. C.	75
21	NORTH AMERICA	U. S. A.	OREGON-CORVALLIS	75
28	SOUTH AMERICA	BRAZIL	RIO GRANDE DO SUL-CRUZ ALTA	75
29	SOUTH AMERICA	BRAZIL	SAO PAULO-CAMPINAS	75

#VARIABLE IDENTIFICATIONS
75 AL TOL 0-9

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 1	6	21	28	29	MEAN
81	MARINGA	0	3	2	2	5	2.4
41	MARINGA	0	3	2	2	9	3.2
21	MARINGA	2	3	1	2	9	3.4
61	MARINGA	2	3	1	2	9	3.4
34	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-0Y	0	5	2	2	9	3.6
35	PF70354-BOW"S" CM67910-17Y-1M-4Y-1M-1Y-0M	0	5	3	2	9	3.8
88	VEE"S"-CEP7713 OC3597-4M-2Y-0Z-1Y-0M	0	4	6	4	5	3.8
70	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-1Y-0M	6	3	1	2	9	4.2
87	PF74354 X LD-ALD"S" OC3551-4M-1Y-0Z-8Y-0M	2	3	9	2	5	4.2
1	PF70354-ALD"S" CM47090-14M-1Y-1F-703Y-10F-705Y-2F-0Y	4	4	3	2	9	4.4
15	IAS54-ALD"S" CM56805-3Y-1Y-4M-1Y-1M-1Y-0M	0	4	7	2	9	4.4
49	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-2Y-0M	2	4	5	2	9	4.4
36	PF70354-BOW"S" CM67910-17Y-1M-4Y-2M-1Y-0M	0	6	8	2	7	4.6
67	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-1Y-0M	2	5	7	4	5	4.6
68	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-4Y-2M-2Y-0M	2	5	8	4	5	4.8
2	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-2F-2Y-1Y-3M-1Y-0M	0	5	7	4	9	5.0
7	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-2Y-6M-2Y-0M	2	4	8	2	9	5.0
9	MON"S"-ALD"S" CM53460-4M-1Y-2Y-3M-2Y-7M-0Y	2	5	7	2	9	5.0
32	MOR"S"-MON"S" CM64736-9Y-2M-2Y-4M-0Y	0	6	8	4	7	5.0
47	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-6Y-0M	4	4	6	2	9	5.0
79	CNT8 X PF70354-ALD"S" CM70371-1M-4Y-0Z-1Y-0M	2	3	9	2	9	5.0
83	E7408-PAM"S" X HORK"S"-PF73226 F13906-F-2Y-3M-2Y-0M	4	5	5	2	9	5.0
6	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-6F-1Y-1Y-8M-5Y-0M	4	4	7	2	9	5.2
8	MON"S"-ALD"S" CM53460-4M-1Y-1Y-3M-1Y-1M-0Y	2	5	8	2	9	5.2
12	ALDAN"S"-IAS58 CM53481-6Y-1Y-4M-1Y-1M-1Y-0M	2	4	7	4	9	5.2
13	ALDAN"S"-PF70354 CM53524-10M-1Y-1Y-1Y-103F-0Y	4	5	6	2	9	5.2
22	SPT"S" CM5847B-8-2Y-1Y-2M-1Y-0M	2	5	8	2	9	5.2
44	PF70354-BOW"S" CM67910-7Y-1M-8Y-0Z-6Y-0M	2	4	7	4	9	5.2

Table 10. Continued

VTY NO.	VARIETY OR CROSS AND PEDIGREE	LOCATIONS 1	6	21	28	29	MEAN
57	PF70354-YACO"S" CM67911-4Y-1M-1Y-0Z-13Y-0M	2	3	4	8	9	5.2
64	(SPRW"S"[(BB X SN64-KLRE/CHA)OB(K)])VEE"S" CM67976-2M-2Y-3M-3Y-0M	2	6	7	6	5	5.2
82	THB"S" F11915-A-502M-1Y-3F-702Y-4F-0Y	4	3	8	2	9	5.2
84	PAT7392(KAL-BB X CJ"S"/ALD"S") B27108-2M-1Y-3M-4Y-0M	6	3	6	2	9	5.2
85	BUT"S"-CEP75195 OC3229-1M-1Y-4M-1Y-0M	0	5	8	4	9	5.2
3	IAS58(KAL-BB X CJ"S"/ALD"S") CM50464-12Y-4F-1Y-4Y-1M-1Y-0M	4	6	6	2	9	5.4
10	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-0M	2	5	9	2	9	5.4
11	ALDAN"S"-IAS58 CM53481-6Y-1Y-1M-3Y-1M-0Y	4	4	8	2	9	5.4
23	SPT"S" CM58478-B-2Y-1Y-2M-2Y-0M	2	6	8	2	9	5.4
33	MOR"S"-MON"S" CM64736-11Y-1M-4Y-0M	4	5	9	4	5	5.4
43	PF70354-BOW"S" CM67910-7Y-1M-8Y-0Z-5Y-0M	2	5	7	4	9	5.4
46	PF70354-BOW"S" CM67910-7Y-2M-2Y-0Z-5Y-0M	4	4	8	2	9	5.4
62	PF7339-DOVE"S" CM67915-1M-1Y-2M-2Y-0M	2	5	9	2	9	5.4
65	[(KVZ/TOB-CTFN X BB)BLO"S"]ALD"S" CM67980-2M-2Y-4M-1Y-0M	4	6	6	6	5	5.4
71	[(KVZ/TOB-CTFN X BB)BLO"S"]SNB"S" CM67982-2M-1Y-1M-2Y-0M	6	3	7	2	9	5.4
86	PF74354 X LD-ALD"S" OC3551-1M-1Y-0Z-2Y-0M	2	5	9	2	9	5.4

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