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INTERNATIONAL GRAIN SORGHUM PROTEIN YIELD AND QUALITY TRIALS: REPORT NO. 3

Department of Agronomy
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Agricultural Experiment Station
Purdue University
West Lafayette, Indiana

INTERNATIONAL GRAIN SORGHUM

PROTEIN YIELD AND QUALITY TRIALS

REPORT NO. 3

K. S. Porter, A. Spies, G. Srinivasan,
D. L. Oswalt, R. DeLong and J. D. Axtell

Department of Agronomy and
International Programs in Agriculture
Purdue University

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INTERNATIONAL GRAIN SORGHUM PROTEIN YIELD AND QUALITY TRIALS - REPORT NO. 3*

K. S. Porter, A. Spies, G. Srinivasan, D. L. Oswalt
R. DeLong, and J. D. Axtell**

INTRODUCTION

The Third International Grain Sorghum Protein Yield and Quality Trial was conducted by the Purdue University-USAID Sorghum Project in cooperation with 35 research workers at 71 locations in 22 foreign countries, Hawaii and the continental United States. This report summarizes data returned from 15 of the locations.

The trial had 36 entries which consisted of 25 lines selected at Purdue University, nine lines selected from previous International Yield Trials (498001, 498002, 498009, 498021, 498022, 498023, 498029, 498042, 498043), one Ethiopian high lysine line (498044), and one commercial hybrid (498024). Lines were selected on the basis of grain yield and general agronomic performance and the hybrid was included as a check.

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** Purdue Project Assistant Director, Administrative Assistant, Post-doctoral Assistant, Former Purdue Project Assistant Director (now with ICRISAT in Hyderabad, India), Field Technician, and Project Director in the Department of Agronomy, Purdue University, W. Lafayette, Indiana.
Grateful acknowledgement is given to the cooperators who grew the nurseries and supplied the data.

The high lysine line (IS 11758) was included for yield evaluation under various environments.

Entries were arranged into three height groups and were planted in three-row plots with three replications. Suggested row length was five meters with 75 cm between rows. Yield was measured by harvesting three meters from the center row of each plot.

Data on the following characteristics were reported by cooperators where possible:

Days to flower: days from planting until 50% of the plants were in half bloom.

Height: number of cm from ground to top of panicle of average center row plant.

Disease resistance: rating 1 = resistant to 9 = susceptible.

Insect resistance: rating 1 = resistant to 9 = susceptible.

Lodging resistance: rating 1 = 10% lodged to 9 = 90% lodged.

Bird damage: rating 1 = 10% damage to 9 = 90% damage.

Grain yield: wet weight of panicles per plot and dry weight of panicles or weight of dry threshed grain per plot (kg/ha).

It was not possible to obtain data on all characteristics at all locations due to differences in environments and pest infestations. Average values for data collected at each location are presented in the accompanying tables.

Determinations of tannin content (measured as catechin equivalents-CE) and percent protein were made in the Purdue-AID Sorghum Project Chemical Laboratory on samples grown at the Indiana location only. Protein values were determined using the Auto Analyzer and CE values were obtained by the Vanillin-Hydrochloric Acid method.*

RESULTS AND DISCUSSION

Data from the 15 locations returning information are summarized in the accompanying tables. At many locations, data on all entries were not collected due to a variety of circumstances. As a result, averages are based on data from different numbers of locations.

Yields varied greatly among locations and entries, ranging from a low of 245 kg/ha to a high of 11,198 kg/ha. Yields in excess of 7000 kg/ha were reported for four lines and the commercial hybrid at at least one location.

The line 954063 showed the highest average yield (5285 kg/ha) for the locations reporting. The hybrid NK 300 ranked second with an average yield of 4592 kg/ha. Other lines superior in yield were 954066, IS 10648, IS 16468, IS 3441, and IS 12278. Of the nine lines previously included in International Yield Trials, five ranked in the top third of this trial (498001, 498009, 498023, 498002, 498029).

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* Burns, R. E. 1963. Methods of tannin analysis for forage crop evaluation. Bulletin N.S. 32 - Department of Plant Pathology, Georgia Experiment Station, Experiment, Georgia.

The average number of days to flower among entries ranged from 63 - 93 days with an overall average of 74 days. Plant height ranged from 98 - 316 cm with an average of 171 cm for all entries at all locations. The effect of day length and temperature on height and flowering were reflected in the large variation for these characteristics.

Percent protein for the short and medium height groups ranged from 9.8% to 17.4%. The high lysine line IS 11758 had a protein percentage of 17.2%. Other tall, photoperiod sensitive lines were not characterized for percent protein because they did not set seed at the Indiana location.

Most lines in this trial ranked low in tannin content (C.E. less than 1.0). High tannin lines showed no marked advantage in yield over low tannin lines in this study. High tannin lines as a group did show more bird resistance than low tannin lines. Of the ten high tannin entries rated, eight had average bird damage of less than 20%.

Susceptibility of the entries to lodging, disease, and insect damage varied greatly among locations. In areas of high disease and insect incidence, entries varied from 20% to 90% susceptibility indicating the presence of variability for resistance among the entries. Lodging also varied greatly from location to location with ranges of from 10% to 90% lodged plants at a single location. Lodging, insect and disease susceptibility ratings are summarized in the accompanying tables.

Of the 36 entries distributed with this trial, 13 were selected by one or more cooperators as superior germplasm sources for breeding purposes or for further study. Selected entries were 498001, 498003, 498005, 498008, 498024, 498031, 498041, 498042, 498043, 498044, 498045, 498047, and 498048.

This trial, as well as similar International Yield Trials conducted in the past, has provided the opportunity for sorghum workers at many different locations to evaluate high yielding lines and to select germplasm adapted to local conditions.

Table 1. Summary of results of yield, days to flower and height for the Third International Grain Sorghum Yield Trial.

Entry	Ident.	Yield Ave.	Yield Range (kg/ha)	Yield Rank	Height Ave. (cm)	Height Range (cm)	Days to flower Ave.	Days to flower Range
498001	954063	5285	4547 - 5907	1	121	103 - 142	71	56 - 83
2	IS 2375	3124	970 - 5210	10	100	83 - 125	67	55 - 82
3	IS 12282	2606	560 - 4472	24	120	89 - 152	70	50 - 115
4	IS 6451	2575	610 - 5135	27	126	65 - 172	73	58 - 83
5	IS 2042	2786	374 - 5378	20	113	90 - 137	73	57 - 91
6	IS 12278	3256	683 - 5997	7	118	94 - 145	71	58 - 91
7	IS 0874	3097	1127 - 7347	11	128	97 - 150	64	49 - 80
8	IS 8070	2595	400 - 4151	25	131	91 - 162	76	56 - 119
9	954066	3677	2387 - 4980	3	98	92 - 103	78	76 - 80
10	121166	2978	640 - 7475	17	119	83 - 150	72	60 - 83
11	121123	2070		33	159	150 - 168	93	82 - 103
12	IS 10648	3490	1340 - 4707	4	133	102 - 155	76	71 - 86
21	954206	3069	2867 - 4249	13	166	143 - 189	76	62 - 93
22	954164	2980	1600 - 4515	16	170	143 - 193	79	66 - 93
23	IS 3441	3328	800 - 8823	6	156	110 - 191	76	57 - 118
24	NK 300	4592	1170 - 7897	2	176	127 - 220	70	56 - 106
25	IS 9333	2782	245 - 6684	21	164	108 - 297	72	56 - 105
26	IS 12316	3052	660 - 4247	14	162	105 - 210	63	45 - 105
27	367124	3178	1210 - 6554	8	163	112 - 207	63	45 - 106
28	IS 9288	2889	683 - 6139	18	156	98 - 195	71	52 - 115
29	954100	3088	2353 - 3590	12	166	155 - 175	82	76 - 88
30	IS 8614	2230	1930 - 2530	32	151	125 - 165	82	74 - 106
31	IS 9285	2554	622 - 5429	28	165	105 - 237	74	50 - 114
32	121183	2665	304 - 4741	22	161	107 - 200	78	65 - 103
41	IS 4225	2580	320 - 5920	26	241	143 - 298	70	57 - 92
42	932065	2664	887 - 5636	23	220	123 - 300	70	55 - 89
43	IS 6881	2513	767 - 5223	29	226	118 - 338	69	50 - 94
44	IS 11758	2503	487 - 5830	30	316	213 - 400	84	76 - 94
45	IS 16365	2503	1047 - 6057	31	270	158 - 385	72	60 - 91
46	IS 16468	3341	1220 - 6580	5	183	132 - 232	68	58 - 90
47	IS 16145	2883	1010 - 6580	19	231	128 - 340	70	55 - 91
48	121087	3015	439 - 11198	15	225	140 - 285	75	63 - 91
49	IS 15391	1673		34	253	182 - 350	85	68 - 101
50	IS 15612	1647		35	202	160 - 240	80	69 - 90
51	IS 2692	1374	1140 - 1607	36	165	113 - 207	78	73 - 83
52	121089	3163		9	200	142 - 250	83	72 - 93
Ave.		2883			171		74	

Table 2. Summary of results of disease, insect, bird and lodging resistance ratings for the Third International Grain Sorghum Yield Trial.

Entry	Identification	Disease	Insect	Bird	Lodging
498001	954063	8	2	0	1
2	IS 2375	4	4	1	1
3	IS 12282	3	3	1	2
4	IS 6451	3	4	2	2
5	IS 2042	3	3	1	0
6	IS 12278	3	3	1	1
7	IS 0874	4	3	1	2
8	IS 8070	4	3	3	2
9	954066	-	4	4	-
10	121166	3	3	1	2
11	121123	-	-	-	-
12	IS 10648	-	3	-	-
21	954206	-	3	0	0
22	954164	-	3	0	0
23	IS 3441	3	3	2	1
24	NK 300	4	3	1	4
25	IS 9333	3	4	1	1
26	IS 12316	4	4	1	4
27	367124	4	4	1	4
28	IS 9288	3	3	2	2
29	954100	-	3	6	-
30	IS 8614	-	4	-	-
31	IS 9285	2	3	3	3
32	121183	3	4	3	2
41	IS 4225	5	3	1	5
42	932065	3	5	2	4
43	IS 6881	4	4	2	2
44	IS 11758	3	4	5	5
45	IS 16365	4	4	2	3
46	IS 16468	3	3	2	2
47	IS 16145	4	3	3	3
48	121087	4	5	3	5
49	IS 15391	-	3	-	-
50	IS 15612	-	4	-	1
51	IS 2692	-	4	-	-
52	121089	-	3	-	2

Location: Argentina (General Villegas)
Cooperator: F. Nider

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375		90	1	1	1	0	4737
3	IS 12282		130	1	1	1	0	3257
4	IS 6451		140	1	1	3	0	3627
5	IS 2042		100	1	1	1	0	4647
6	IS 12278		110	1	1	1	0	3100
7	IS 0874		150	1	1	2	0	4800
8	IS 8070		130	1	1	1	0	3217
10	121166		120	1	1	1	0	4660
23	IS 3441		170	1	1	5	2	3580
24	NK 300		170	3	1	1	9	7063
25	IS 9333		180	1	1	3	1	4413
26	IS 12316		200	3	1	1	9	4247
27	367124		200	1	1	1	9	5113
28	IS 9288		170	2	1	2	6	3123
31	IS 9285		180	2	1	2	8	2403
32	121183		200	1	1	8	0	2710
41	IS 4225		270	1	1	1	6	1040
42	932065		280	1	1	1	8	1290
43	IS 6881		300	1	2	1	4	1290
44	IS 11758		390	1	1	1	1	1350
45	IS 16365		330	1	1	1	1	1217
46	IS 16468		200	1	1	1	8	2440
47	IS 16145		240	1	2	1	9	1020
48	121087		230	1	3	1	9	1330
Mean			195	1	1	2	4	3153
C.V.								23
L.S.D.								1206

Location: Argentina (Salto)
Cooperator: F. Nider

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	81	105	0	4	0	0	2810
3	IS 12282	82	112	0	0	0	0	1903
4	IS 6451	83	135	0	9	0	0	1227
5	IS 2042	81	105	0	2	0	0	2893
6	IS 12278	80	113	0	5	0	0	1820
7	IS 0874	80	120	0	7	0	0	2340
8	IS 8070	94	132	0	2	0	0	2853
10	121166	80	122	0	5	0	0	2740
23	IS 3441	94	170	0	1	0	0	3807
24	NK 300	81	180	0	1	0	0	4980
25	IS 9333	93	180	0	8	0	1	1560
26	IS 12316	78	180	0	1	0	2	2497
27	367124	79	180	0	1	0	3	2490
28	IS 9288	83	180	0	2	0	1	1203
31	IS 9285	82	190	0	6	0	1	1667
32	121183	93	170	0	3	0	0	1943
41	IS 4225	92	290	0	4	0	4	1620
42	932065	88	260	0	9	0	9	1443
43	IS 6881	94	200	0	2	0	2	2040
44	IS 11758	94	240	0	9	0	9	1430
45	IS 16365			0	9	0	9	
46	IS 16468			0	0	0	4	
47	IS 16145			0	0	0	3	
48	121087			0	9	0	9	
Mean		86	168	0	4	0	2	2263
C.V.		10	5					22
L.S.D.		2	15					824

Location: Bangladesh (Dacca)
Cooperator: Duane W. Moore

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	73	90	4	4	1	1	970
3	IS 12282	68	89	3	3	1	1	1247
4	IS 6451	80	65	2	3	1	1	807
5	IS 2042	89	90	2	2	1	1	1007
6	IS 12278	79	94	2	1	1	1	683
7	IS 0874	73	97	3	3	1	1	1127
8	IS 8070	71	91	5	1	1	1	603
10	121166	78	105	2	2	1	1	1170
23	IS 3441	69	110	4	2	1	1	1090
24	NK 300	68	127	3	4	1	1	1170
25	IS 9333	84	108	2	1	1	1	1370
26	IS 12316	60	105	4	3	1	1	660
27	367124	60	112	4	3	1	1	1210
28	IS 9288	68	98	3	2	1	1	683
31	IS 9285	65	105	3	2	1	1	806
32	121183	74	110	2	3	1	1	770
41	IS 4225	82	143	2	2	1	1	320
42	932065	69	123	3	3	1	1	887
43	IS 6881	68	118	3	3	1	1	767
44	IS 11758	-	-	-	-	-	-	-
45	IS 16365	70	160	4	1	1	1	1047
46	IS 16468	69	132	3	2	1	1	1370
47	IS 16145	69	128	3	3	1	1	1010
48	121087	82	142	2	1	1	1	1290
Mean		73	110	3	2	1	1	959
C.V.		42.7	7.1	35.8	56.1	20.0	-	40.0
L.S.D.		5.1	12.9	-	-	-	-	627.9

Location: Brazil (Arcoverde)
Cooperator: M. A. Faris

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	65	123					5210
3	IS 12282	59	125					3515
4	IS 6451	75	125					4447
5	IS 2042	73	137					5141
6	IS 12278	70	150					5624
7	IS 0874	65	132					3982
8	IS 8070	60	132					3636
10	121166	65	150					3838
23	IS 3441	63	152					5205
24	NK 300	61	165					4828
25	IS 9333	71	147					4545
26	IS 12316	57	140					3675
27	367124	58	138					3063
28	IS 9288	62	145					5367
31	IS 9285	58	137					4823
32	121183	70	158					4741
41	IS 4225	71	213					2479
42	932065	63	168					3320
43	IS 6881	60	165					3579
44	IS 11758	79	270					5502
45	IS 16365	63	200					3236
46	IS 16468	62	170					4161
47	IS 16145	61	182					3677
48	121087	68	173					4852
Mean		65	158					4269

Location: Brazil (Cachoeira Dourada - MG)
Cooperator: Paulo M. Ribas

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	60	100	9	1	1	6	2722
3	IS 12282	62	135	5	1	1	1	4472
4	IS 6451	63	172	8	1	1	7	1465
5	IS 2042	62	123	8	1	1	1	3179
6	IS 12278	61	98	8	1	1	3	2172
7	IS 0874	57	138	9	1	1	9	-
8	IS 8070	80	162	8	1	8	1	1543
10	121166	60	98	9	1	1	5	1901
23	IS 3441	78	187	6	3	6	1	1829
24	NK300	69	220	9	1	2	6	3421
25	IS 9333	60	168	8	1	2	1	2951
26	IS 12316	57	195	8	1	1	9	-
27	367124	57	182	9	1	1	9	-
28	IS 9288	63	190	3	1	6	1	2593
31	IS 9285	77	237	2	1	8	1	2229
32	121183	66	177	8	2	4	7	-
41	IS 4225	60	298	9	1	1	9	-
42	932065	80	300	4	1	9	2	-
43	IS 6881	75	338	6	6	7	2	-
44	IS 11758	90	377	4	1	9	5	-
45	IS 16365	88	385	4	2	9	4	-
46	IS 16468	80	232	4	4	8	1	-
47	IS 16145	86	340	6	1	9	2	-
48	121087	83	285	6	4	8	4	-
Mean		70	214	7	2	4	4	2540
C.V.		2	8	12	10	25	30	19
L.S.D.		4	29	-	-	-	-	839

Location: Brazil (Caruaru)
Cooperator: M. A. Faris

Entry	Ident.	Days to Flower	Ht (cm)	Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	70	101					1638
3	IS 12282	63	105					779
4	IS 6451	83	97					1827
5	IS 2042	82	123					374
6	IS 12278	77	123					1835
7	IS 0874	67	104					1328
8	IS 8070	63	106					1541
10	121166	76	131					1812
23	IS 3441	64	135					2119
24	NK 300	63	139					3529
25	IS 9333	71	125					245
26	IS 12316	62	119					1478
27	367124	63	114					1422
28	IS 9288	65	109					994
31	IS 9285	62	106					622
32	121183	79	142					304
41	IS 4225	73	167					1361
42	932065	63	143					2694
43	IS 6881	64	130					1962
44	IS 11758	83	213					1156
45	IS 16365	64	158					2517
46	IS 16468	63	140					3020
47	IS 16145	63	137					2744
48	121087	74	140					897
Mean		69	129					1592

Location: Brazil (Sao Bento do Una)
Cooperator: M. A. Faris

Entry	Ident.	Day Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	62	108					6636
3	IS 12282	57	125					3828
4	IS 6451	62	127					5135
5	IS 2042	59	127					5378
6	IS 12278	59	138					5997
7	IS 0874	60	130					7347
8	IS 8070	56	146					3787
10	121166	64	142					7475
23	IS 3441	57	140					8823
24	NK 300	56	165					7897
25	IS 9333	63	148					6684
26	IS 12316	51	148					6170
27	367124	52	152					6554
28	IS 9288	57	140					6139
31	IS 9285	52	150					5429
32	121183	65	146					4464
41	IS 4225	66	235					5920
42	932065	57	177					5636
43	IS 6881	62	172					5223
44	IS 11758	76	303					3707
45	IS 16365	60	223					6057
46	IS 16468	60	197					6580
47	IS 16145	60	196					6580
48	121087	67	200					11198
Mean		60	164					6194

Location: Brazil (Serra Talhada)
Cooperator: M. A. Faris

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	54	125					3632
3	IS 12282	54	142					4389
4	IS 6451	77	170					-
5	IS 2042	61	125					1801
6	IS 12278	60	135					4598
7	IS 0874	53	145					3486
8	IS 8070	63	140					3952
10	121166	60	138					3245
23	IS 3441	61	153					5165
24	NK 300	51	172					7105
25	IS 9333	64	173					2406
26	IS 12316	49	160					3978
27	367124	50	162					4765
28	IS 9288	55	195					4125
31	IS 9285	50	118					4695
32	121183	76	188					-
41	IS 4225	60	267					1745
42	932065	55	230					2791
43	IS 6881	51	225					3289
44	IS 11758	79	293					-
45	IS 16365	62	320					1397
46	IS 16468	58	207					5074
47	IS 16145	57	287					3691
48	121087	68	265					0439
Mean		60	189					3608

Location: Indiana (Purdue Agronomy Farm)
Cooperator: K. Porter

Entry	Ident.	Days to Flower	Ht (cm)	Catechin Equivalent	Percent Protein	Grain Yield (kg/ha)
498001	954063	83	126	0.23	12.6	5907
2	IS 2375	77	103	0.28	12.8	4073
3	IS 12282	77	130	0.46	12.0	1557
4	IS 6451	78	137	0.18	12.6	3413
5	IS 2042	76	119	0.39	13.8	3453
6	IS 12278	75	124	0.53	10.8	2780
7	IS 0874	74	144	0.54	-	2573
8	IS 8070	84	148	3.54	12.1	-
9	954066	77	103	0.38	17.4	4980
10	121166	79	130	0.48	11.6	2687
11	121123	82	150	0.61	-	2070
12	IS 10648	72	155	0.3	11.7	4423
21	954206	85	189	0.21	12.0	2867
22	954164	86	193	0.29	9.8	2843
23	IS 3441	90	185	0.74	12.3	800
24	NK 300	82	202	4.01	10.8	1593
25	IS 9333	76	168	0.64	14.1	1980
26	IS 12316	69	189	2.08	12.1	3790
27	367124	70	185	2.48	10.8	4553
28	IS 9288	78	168	0.38	11.4	1480
29	954100	76	175	0.48	12.4	2353
30	IS 8614	74	164	4.31	13.4	2530
31	IS 9285	82	192	0.29	12.7	1970
32	121183	76	165	0.70	12.7	-

(continued next page)

Location: Indiana (Purdue Agronomy Farm)
Cooperator: K. Porter

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Entry	Ident.	Days to Flower	Ht (cm)	Catechin Equivalent	Percent Protein	Grain Yield (kg/ha)
41	IS 4225	80	291	2.46	-	5603
42	932065	85	245	2.40	-	-
43	IS 6881	84	297	4.92	-	-
44	IS 11758	-	-	0.38	-	-
45	IS 16365	88	350	3.19	-	-
46	IS 16468	85	211	3.38	-	-
47	IS 16145	88	277	3.32	-	-
49	IS 15391	101	350	0.05	-	--
50	IS 15612	90	240	1.56	-	-
51	IS 2692	83	207	0.82	-	1140
52	121089	93	250	0.04	-	-
Mean		81	192	1.31	12.6	2976

Location: Indonesia (N. Sumatra - Uniroyal Plantations)
Cooperator: I. Tataming

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	68	83	3	4	-	-	1733
3	IS 12282	65	100	4	4	5	1	1300
4	IS 6451	78	102	-	4	-	-	2677
6	IS 12278	74	110	-	6	4	-	3660
8	IS 8070	70	110	-	4	4	-	1700
9	954066	76	98	-	4	4	-	2387
10	121166	80	83	-	4	3	-	2233
12	IS 10648	71	102	-	3	-	-	1340
23	IS 3441	67	112	-	7	4	-	1943
25	IS 9333	70	118	-	4	-	1	2343
26	IS 12316	61	123	-	8	-	1	1677
27	367124	60	117	-	7	-	2	1397
28	IS 9288	66	122	-	5	5	-	1943
29	954100	81	167	-	3	6	-	3320
30	IS 8614	67	125	-	4	-	-	1930
32	121183	79	107	-	8	-	-	2563
41	IS 4225	69	202	-	4	-	4	3163
43	IS 6281	63	175	-	3	-	-	2177
44	IS 11758	90	318	-	-	-	-	5830
46	IS 16468	66	145	-	5	-	-	1220
49	IS 15391	68	182	-	3	-	-	1673
50	IS 15612	69	160	-	4	-	1	1647
51	IS 2692	73	113	-	4	-	-	1607
52	121089	72	142	-	3	-	2	3163
Mean		71	134	4	5	4	2	2276

Location: Liberia (Uniroyal Plantations)
Cooperator: Otto Wenger

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498001	954063	56	142		2	0	2	5298
2	IS 2375	55	114		5	0	0	2753
3	IS 12282	50	115		2	0	0	3532
4	IS 6451	58	145		4	4	0	2391
5	IS 2042	57	124		5	0	0	2412
6	IS 12278	58	123		2	0	0	4219
7	IS 0874	49	142		3	0	0	2590
8	IS 8070	58	125		2	4	0	4151
21	954206	62	180		3	0	0	4249
22	954164	66	180		3	0	0	4515
23	IS 3441	58	158		2	0	0	4954
24	NK 300	48	188		5	0	7	5467
25	IS 9333	56	175		3	0	0	1658
26	IS 12316	45	160		7	0	8	2432
27	367124	45	158		7	0	5	3245
28	IS 9288	52	168		2	0	1	4356
41	IS 4225	59	237		5	0	5	1689
42	932065	56	210		4	0	1	3037
43	IS 6281	50	220		6	0	3	2145
44	IS 11758	76	400		3	7	7	563
45	IS 16365	60	292		5	0	3	2225
46	IS 16468	59	197		3	0	1	3547
47	IS 16145	55	218		6	4	4	1896
48	121087	63	235		4	7	2	1278
Mean		56	184		4	1	2	3108
C.V.		1.1	7.1					29
L.S.D		1.0	21.9					1520

Location: Nebraska
Cooperator: W. M. Ross

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498001	954063	82	103					5387
2	IS 2375	82	92					3030
3	IS 12282	115	133					-
4	IS 6451	81	85					2513
5	IS 2042	91	97					1333
6	IS 12278	86	102					3157
7	IS 0874	80	113					3340
8	IS 8070	119	138					-
9	954066	80	92					3663
10	121166	83	98					2537
11	121123	103	168					-
12	IS 10648	86	142					4707
21	954206	93	143					1540
22	954164	93	143					1600
23	IS 3441	118	158					-
24	NK 300	106	177					-
25	IS 9333	105	172					-
26	IS 12316	105	210					-
27	367124	106	207					-
28	IS 9288	115	158					-
29	954100	88	155					3590
30	IS 8614	106	165					-
31	IS 9285	114	172					-
32	121183	103	157					-
41	IS 4225	83	223					3437
42	932065	-	207					-
43	IS 6881	-	250					-
45	IS 16365	-	273					-
46	IS 16468	-	157					-
47	IS 16145	-	230					-

Location: Nebraska (continued)

Entry	Ident.	Days to Flower	Ht (cm)	Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498048	121087	-	233					-
49	IS 15391	-	227					-
50	IS 15612	-	207					-
51	IS 2692	-	175					-
52	121089	-	207					-
Mean			165					

Location: Nigeria (Zaria)
Cooperator: M. M. El-Rouby

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498001	954063	62	113	8		0	0	4547
2	IS 2375	56	78	5		0	0	2250
3	IS 12282	57	92	5		0	0	3033
4	IS 6451	61	125	4		0	0	2533
5	IS 2042	60	95	5		0	0	2617
6	IS 12278	61	100	4		0	0	4070
7	IS 0874	54	100	5		0	0	2000
8	IS 8070	69	125	-		0	0	3383
21	954206	64	153	-		0	0	3620
22	954164	69	162	-		0	0	2963
23	IS 3441	69	142	-		0	0	3010
24	NK 300	61	175	-		0	0	5580
25	IS 9333	58	122	-		0	0	3120
26	IS 12316	54	143	-		0	0	3657
27	367124	54	148	-		0	0	2800
28	IS 9288	57	142	-		0	0	3630
41	IS 4225	57	238	9		0	9	2050
42	932065	65	257	5		0	3	3787
43	IS 6881	62	273	7		0	1	3283
44	IS 11758	80	370	7		9	1	487
45	IS 16365	70	340	6		0	2	3477
46	IS 16468	65	178	6		0	0	4380
47	IS 16145	67	270	6		0	2	3437
48	121087	68	263	5		3	5	3010
Mean		62	175	-		1	1	3197
C.V.		1.5	3.3	-		40.8	-	17.7
L.S.D.		1.6	9.4	-		0.3	-	931.6

Location: Pakistan (Sahiwal)
Cooperator: R. M. Refigs

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	57	98	5			-	3377
3	IS 12282	71	152	4			9	3107
4	IS 6451	66	155	4			9	3377
5	IS 2042	70	123	4			-	4323
6	IS 12278	68	145	5			-	4187
7	IS 0874	56	138	5			-	4053
8	IS 8070	83	155	6			9	2970
10	121166	67	130	4			-	3780
23	IS 3441	83	178	5			-	2973
24	NK 300	78	197	5			-	4863
25	IS 9333	68	172	4			-	4727
26	IS 12316	63	203	6			-	3783
27	367124	63	200	6			-	3380
28	IS 9288	73	182	5			-	3243
31	IS 9285	82	185	5			-	2296
32	121183	78	183	5			-	4457
41	IS 4225	63	287	7			2	3107
42	932065	89	243	6			2	1757
43	IS 6881	90	283	5			2	1893
44	IS 11758	95	363	5			4	-
45	IS 16365	91	343	6			4	1353
46	IS 16468	90	218	5			1	1620
47	IS 16145	91	297	6			1	1893
48	121087	90	267	7			3	2840
Mean		75	197	5				3190
C.V.		2.7	8.2	13.7				20.3
L.S.D.		3.3	26.6	1.2				1068.1

Location: Pakistan (Tando Jam)
Cooperator: A. H. Natali

Entry	Ident.	Days to Flower	Ht (cm)	Resistance Ratings Disease	Insect	Bird	Lodging	Grain Yield (kg/ha)
498002	IS 2375	73	83	[illegible]	6	2	[illegible]	1290
3	IS 12282	96	110	[illegible]	9	-	[illegible]	560
4	IS 6451	73	112	[illegible]	6	2	[illegible]	610
5	IS 2042	91	95	[illegible]	8	2	[illegible]	440
6	IS 12278	91	112	[illegible]	8	2	[illegible]	940
7	IS 0874	60	132	[illegible]	2	2	[illegible]	1300
8	IS 8070	100	132	[illegible]	9	2	[illegible]	400
10	121166	73	98	[illegible]	7	2	[illegible]	640
23	IS 3441	95	191	[illegible]	7	-	[illegible]	1300
24	NK 300	85	191	[illegible]	4	-	[illegible]	2220
25	IS 9333	70	297	[illegible]	7	-	[illegible]	940
26	IS 12316	65	168	[illegible]	5	2	[illegible]	1630
27	367124	70	196	[illegible]	7	2	[illegible]	1320
28	IS 9288	93	170	[illegible]	7	-	[illegible]	1570
31	IS 9285	95	208	[illegible]	7	-	[illegible]	1160
32	121183	73	188	[illegible]	7	-	[illegible]	2030
41	IS 4225	-	260	[illegible]	4	-	[illegible]	-
42	932065	-	235	[illegible]	9	-	[illegible]	-
43	IS 6881	-	240	[illegible]	9	-	[illegible]	-
44	IS 11758	-	250	[illegible]	8	-	[illegible]	-
45	IS 16365	-	263	[illegible]	7	-	[illegible]	-
46	IS 16468	-	135	[illegible]	6	-	[illegible]	-
47	IS 16145	-	200	[illegible]	8	-	[illegible]	-
48	121087	-	213	[illegible]	9	-	[illegible]	-
Mean		81	178	[illegible]	7	2	[illegible]	1147