

Wheat, Barley, Durum and Advanced Lines Test, Gila Bend, AZ, 1995 (Final Report)

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Introduction

Field trials of both commercial cultivars and advanced lines were grown under low desert conditions to compare yield and quality on the Paloma Ranch west of Gila Bend, AZ. The long range goal is to identify cultivars with both high yield and superior quality. It is hoped that the cultivars can be identified and brought to commercial release through this type of testing.

Methods and Materials

The field trial was established after seedbed preparation following the previous cotton crop. Cone planters were used to insure uniform seeding rates. Each plot consisted of 6 rows on 11 inch spacing. Seeding rate was 87 lb./ac on 20 ft plots that were trimmed to 16ft. The center four rows were harvested and weighed in the field. The experimental design was a randomized complete block with 6 replicates. Check varieties were included for barley (Gustoe), durum (Aldura), and wheat (Yecora rojo). Plots were planted on 14 December 1994 and watered 19 December.

The plots received 42" of water at regular intervals (2, 15 February; 5, 17 March; and 4, 25 April). Nitrogen fertilizer was applied twice in February (80 lb. each application), on 5 March (60 lb.) and on 25 April (40 lb.).

Data collected includes grain yield, kernel characteristics, milling performance, and pasta or baking quality. The durum quality analysis was performed by the California Wheat Commission Laboratory in Woodland, CA and the wheat quality analysis was performed by the USDA Wheat Quality Lab in Fargo, ND. The durum analysis was not possible for each entry since some samples were lost in shipment.

Results and Discussion

Yield, test weight, and kernel weight for the barley, durum, and wheat entries are presented in Tables 1-3. Quality characteristics of durum (Tables 4-6) and wheat (Tables 7-9) are also presented. The yields in this particular test were low and the variation from plot to plot was high especially for the barley. Initial stands were good and the plots appeared uniform during the growing season, and we have no explanation for the variability in grain yields. We will not draw any definite conclusions from this trial since varietal performance varies annually. The results from this trial will be most useful when combined with data from other years.

Acknowledgments

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Table 1. Yield, test weight, and kernel weight of barley varieties and experimental lines.

Entry	Source ^a	Grain yield ^b	Test weight	1000 Kernel weight
		lbs/acre	lbs/bu	grams
Gustoe	WPB	4618	56.0	39.4
DA587-170	WPB	3579	57.7	40.0
DA587-124	WPB	4039	56.3	39.2
Barcott	WPB	4054	58.7	42.0
DA592-47	WPB	5331	58.5	47.8
Fiesta	WPB	3965	58.4	44.3
7001	APB	5227	56.6	41.0
7002	APB	4841	57.7	37.9
BA8055	FMC	4990	57.0	37.8
Max	FMC	6356	56.6	42.1
BA1129	FMC	4752	56.8	46.1
BA8017	FMC	5005	53.2	37.3
BA7128	FMC	5807	55.0	42.9
BA7139	FMC	4485	56.7	40.3
BA7026	FMC	3594	48.8	41.1
BA8063	FMC	5064	55.1	40.2
UC337	UC	4529	54.3	41.3
UC476	UC	4633	55.2	43.1
CM72	UC	3564	55.1	48.2
AVERAGE		4111	56.0	44.0

^a Source: APB = Arizona Plant Breeders, Cimmyt = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders.

^b Grain yield: LSD (5%) = 1082 lbs/acre and cv = 23.5%.

Table 2. Yield, test weight, and kernel weight of durum varieties and experimental lines.

Entry	Source	Grain yield	Test weight ^c	1000 kernel weight ^d
		lbs/acre	lbs/bu	grams
Minos	APB	5512	—	—
Aldura	NK	5625	64.0	43.2
Aruba	WPB	5691	—	—
Kofa	WPB	4955	—	—
WB881	WPB	5227	62.5	49.9
Turbo	WPB	5061	59.9	44.2
Cortez	WPB	5548	60.7	41.8
8009	WPB	5524	62.7	39.4
8010	WPB	5952	61.7	47.8
8011	WPB	5394	61.5	42.9
8012	WPB	5097	61.4	42.9
8013	WPB	6035	63.2	50.3
Aconchi	Cimmyt	6772	—	—
8001	APB	6320	63.0	44.1
6004	APB	5703	—	—
Reva	FMC	4954	63.0	45.9
DuraKing	FMC	5702	—	—
D8869	FMC	5881	62.4	41.9
D1856	FMC	5726	62.5	47.1
D1636	FMC	5572	61.7	48.8
D1405	FMC	4467	—	—
D1268	FMC	6023	—	—
D5317B	FMC	5215	62.9	44.0
D1128	FMC	5773	—	—
D2505	FMC	5762	—	—
D5318B1	FMC	4752	61.4	39.0
Bravadur	FMC	4372	—	—
D8940A	FMC	5453	62.4	39.2
Durex	FMC	5049	—	—
AVERAGE		5487	62.3	44.2

^a Source: APB = Arizona Plant Breeders, Cimmyt = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders.

^b Grain yield: LSD (5%) = 927 lbs/acre and cv = 16.0%.

^c Test weight: A rough index of flour yield.

^d Kernel weight: Index of potential milling yield.

Table 3. Yield, test weight, and kernel weight of durum varieties and experimental lines.

Entry	Source ^a	Grain yield ^b lbs/acre	Test weight ^c lbs/bu	1000 kernel weight ^d grams
Yecora rojo	UC	5508	61.8	41.8
DA990-15	WPB	5633	59.9	35.6
PH991-87	WPB	5029	60.1	39.5
DA989-20	WPB	5584	60.9	38.6
PH989-80W	WPB	5910	60.8	35.0
DA992-130	WPB	5495	60.6	44.2
906WR	APB	5435	61.3	35.6
9003WR	APB	5227	60.9	41.2
Cavalier	FMC	5475	61.8	44.4
Poco red	FMC	5485	61.3	38.6
BR8631	FMC	5485	60.6	39.5
BR7073	FMC	4128	59.4	45.5
BR7073B	FMC	5762	61.6	46.5
BR9118	FMC	5188	60.9	36.2
BR8631-1	FMC	5287	60.7	39.2
BR1277	FMC	4841	61.2	42.7
BR1231	FMC	5633	61.2	36.9
BR1283	FMC	5049	59.0	41.7
BR1153	FMC	5415	60.2	36.8
BR1434	FMC	4336	60.2	37.5
BR9216	FMC	5079	61.7	41.8
BR1235	FMC	4970	59.4	36.8
Brooks	WPB	6395	63.0	41.8
AVERAGE		5320	61.0	40.3

^a Source: APB = Arizona Plant Breeders, Cimmyt = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders.

^b Grain yield: LSD (5%) = 437 lbs/acre and cv = 11.5%.

^c Test weight: A rough index of flour yield.

^d Kernel weight: Index of potential milling yield.

Table 4a. Durum kernel characteristics.

Entry	Source ^a	Kernel Protein ^b %	Kernel Moisture %	Kernel Ash ^c %	NIR		Black Tip ^f %	Kernel Size Distribution (200g)			
					Hardness ^d %	HVAC ^e %		7W 2.8mm g	10W 2.0mm g	12W 1.7mm g	Pan <1.7 g
Minos	APB	—	—	—	—	—	—	—	—	—	—
Aldura	NK	14.14	7.24	1.72	109.2	99	—	153.0	45.7	1.1	0.1
Aruba	WPB	—	—	—	—	—	—	—	—	—	—
Kofa	WPB	—	—	—	—	—	—	—	—	—	—
WPB881	WPB	14.73	7.67	1.75	106.9	100	—	187.0	12.4	0.5	0.2
Turbo	WPB	14.47	8.32	1.65	107.7	100	—	162.7	36.0	1.0	0.2
Cortez	WPB	14.30	7.28	1.87	104.9	100	—	155.0	43.5	1.0	0.3
8009	WPB	13.68	7.85	1.56	104.9	100	—	134.8	63.5	1.4	0.3
8010	WPB	13.57	7.53	1.58	102.9	100	—	174.6	24.0	0.8	0.2
8011	WPB	14.35	7.49	1.77	104.8	98	—	167.3	31.8	1.0	0.1
8012	WPB	15.06	7.09	1.93	110.2	100	—	169.5	30.0	0.6	0.1
8013	WPB	14.92	7.74	1.70	106.6	100	—	185.8	14.0	0.5	0.1
Aconchi	Cimmyt	—	—	—	—	—	—	—	—	—	—
8001	APB	13.81	6.98	1.72	97.6	98	—	150.5	47.8	1.5	0.3
6004	APB	—	—	—	—	—	—	—	—	—	—
Reva	FMC	14.32	8.02	1.86	103.7	99	—	170.5	28.9	0.5	0.2
Duraking	FMC	—	—	—	—	—	—	—	—	—	—
D8869	FMC	14.03	7.46	1.58	106.6	98	—	150.1	48.6	1.2	0.5
D1856	FMC	14.70	7.59	1.78	111	100	—	170.3	29.1	0.5	0.2
D1636	FMC	14.44	7.81	1.73	102.6	99	—	180.5	19.0	0.6	0.2
D1405	FMC	—	—	—	—	—	—	—	—	—	—
D1268	FMC	—	—	—	—	—	—	—	—	—	—
D5317B	FMC	14.06	8.04	1.63	107.9	98	—	161.1	37.8	1.2	0.3
D1128	FMC	—	—	—	—	—	—	—	—	—	—
D2505	FMC	—	—	—	—	—	—	—	—	—	—
D5318B1	FMC	14.35	7.82	1.86	102.4	99	—	138.5	60.4	1.3	0.2
Bravadur	FMC	—	—	—	—	—	—	—	—	—	—
D8940A	FMC	14.22	7.56	1.78	100.3	99	0.1	140.3	57.9	2.0	0.1
Durex	FMC	—	—	—	—	—	—	—	—	—	—
AVE.		14.28	7.61	1.72	105.4	99	0.1	161.7	37.3	1.0	0.2

^a Source: APB = Arizona Plant Breeders, Cimmyt = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders

^b Kernel protein: based on 12% moisture content, index of overall quality.

^c Ash: mineral content, gives flour a dull appearance, bran has higher ash content than flour.

^d NIR hardness: the higher the value, the harder the kernel, and the greater water absorption in flour.

^e HVAC: hard vitreous amber count, related to protein content and quality.

^f Black tip: a fungal disease that lowers quality by adding specks to the pasta.

Table 4b. Durum milling and semolina characteristics.

Entry	Source ^a	Total	Semo-	Semo-	Semo-	Semo-	Speck ^e	Alveo-	Alveo-	Wet	Dry	Fall	Color
		Extrac-	lina	lina	lina	lina		graph ^f	graph ^f				
		tion ^b	Extrac-	Pro-	Moist-	Ash ^d	10in ⁻²	W	P/L	%	%	‡	Value ^h
		%	%	%	%	%							
Minos	APB	—	—	—	—	—	—	—	—	—	—	—	—
Aldura	NK	73.0	63.5	12.80	14.31	0.74	26	—	—	34.6	12.2	975	27.0
Aruba	WPB	—	—	—	—	—	—	—	—	—	—	—	—
Kofa	WPB	—	—	—	—	—	—	—	—	—	—	—	—
WPB881	WPB	74.5	63.5	13.20	14.43	0.76	26	285	2.07	37.8	15.3	1305	26.4
Turbo	WPB	71.8	62.7	13.21	13.34	0.73	24	138	1.42	37.5	14.7	848	24.9
Cortez	WPB	69.3	60.8	12.81	15.65	0.78	24	213	2.14	36.6	13.2	723	25.5
8009	WPB	73.6	63.2	12.30	14.58	0.71	18	194	1.54	37.8	15.0	890	28.2
8010	WPB	70.9	61.4	12.20	14.68	0.76	26	243	1.79	36.8	14.7	706	30.7
8011	WPB	71.4	62.4	13.10	14.48	0.84	19	277	1.54	37.9	14.8	1049	28.2
8012	WPB	73.8	63.9	13.75	14.27	0.79	22	256	1.67	39.6	15.4	1174	27.9
8013	WPB	70.0	61.9	13.30	14.36	0.80	20	341	1.87	38.4	14.8	1244	26.8
Aconchi	Cimmyt	—	—	—	—	—	—	—	—	—	—	—	—
8001	APB	73.5	63.2	12.55	14.15	0.77	14	—	—	—	—	648	28.0
6004	APB	—	—	—	—	—	—	—	—	—	—	—	—
Reva	FMC	70.1	61.4	13.30	14.47	0.83	24	278	1.95	37.0	14.3	1456	25.7
Duraking	FMC	—	—	—	—	—	—	—	—	—	—	—	—
D8869	FMC	73.0	63.3	12.90	14.34	0.78	19	171	1.00	39.2	16.0	1432	24.2
D1856	FMC	72.8	63.1	13.39	14.23	0.82	17	173	2.30	35.5	13.1	666	21.9
D1636	FMC	73.6	64.2	13.05	14.14	0.81	20	297	1.93	37.3	13.9	1204	27.5
D1405	FMC	—	—	—	—	—	—	—	—	—	—	—	—
D1268	FMC	—	—	—	—	—	—	—	—	—	—	—	—
D5317B	FMC	71.3	63.1	12.75	14.36	0.87	26	239	2.69	38.3	15.8	728	25.1
D1128	FMC	—	—	—	—	—	—	—	—	—	—	—	—
D2505	FMC	—	—	—	—	—	—	—	—	—	—	—	—
D5318B1	FMC	70.3	61.8	13.09	14.10	0.95	15	307	2.22	35.5	13.7	743	28.8
Bravadur	FMC	—	—	—	—	—	—	—	—	—	—	—	—
D8940A	FMC	70.7	62.3	12.89	14.10	0.92	18	230	1.19	37.0	14.6	697	28.7
Durex	FMC	—	—	—	—	—	—	—	—	—	—	—	—
AVE.		72.1	62.7	12.96	14.32	0.80	21	243	1.82	37.3	14.4	958	26.8

^a Source: APB = Arizona Plant Breeders, Cimmyt = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, and WPB = Western Plant Breeders

^b Total extraction: flour yield plus semolina.

^c Semolina protein: based on 12% moisture content.

^d Specks: number of bran specks, test efficiency of milling.

^e Alveograph: device for measuring elasticity of dough.

‡ Falling no.: related to starch viscosity, larger numbers are desirable.

^h Color "b" value: a measure of the yellowness of the semolina, larger numbers desired.

Table 4c. Durum pasta analysis.

Entry	Source ^a	Color	Color "b"	Color	Cooked	Cooking	Firmnesse
		"L" Value	Value	Score ^b	Weight ^c	Loss ^d	
					g	g	g/cm ²
Minos	APB	—	—	—	—	—	—
Aldura	NK	57.1	43.8	10.0	33.8	7.3	4.8
Aruba	WPB	—	—	—	—	—	—
Kofa	WPB	—	—	—	—	—	—
WPB881	WPB	57.0	43.8	9.5	30.4	6.3	6.9
Turbo	WPB	55.7	40.3	8.0	30.8	6.8	6.6
Cortez	WPB	55.5	42.8	9.0	31.3	6.2	6.8
8009	WPB	56.1	43.6	9.5	30.6	7.0	6.6
8010	WPB	56.8	49.2	10.0	30.0	6.7	6.9
8011	WPB	55.9	46.0	10.0	29.9	5.4	7.8
8012	WPB	56.5	45.8	10.0	29.2	6.4	7.7
8013	WPB	56.9	44.2	10.0	29.7	6.6	7.3
Aconchi	Cimmyt	—	—	—	—	—	—
8001	APB	58.5	45.5	10.0	31.9	7.2	4.4
6004	APB	—	—	—	—	—	—
Reva	FMC	57.1	42.3	9.5	29.9	6.8	7.2
Duraking	FMC	—	—	—	—	—	—
D8869	FMC	56.3	41.4	9.0	30.3	6.4	7.0
D1856	FMC	57.4	39.0	8.5	30.3	6.9	6.9
D1636	FMC	57.4	45.3	10.0	30.0	6.4	7.2
D1405	FMC	—	—	—	—	—	—
D1268	FMC	—	—	—	—	—	—
D5317B	FMC	55.5	41.2	9.0	30.3	6.7	6.6
D1128	FMC	—	—	—	—	—	—
D2505	FMC	—	—	—	—	—	—
D5318B1	FMC	55.6	43.7	9.5	30.0	7.0	6.5
Bravadur	FMC	—	—	—	—	—	—
D8940A	FMC	54.9	44.9	9.5	29.7	7.2	6.5
Durex	FMC	—	—	—	—	—	—
AVE.		56.5	43.6	9.5	30.5	6.7	6.6

^a Source: APB = Arizona Plant Breeders, Cimmyt = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders.

^b Color score: >9 = good, 8.0 - 8.9 = fair, <8.0 = poor.

^c Cooked weight: high cooked weight (>30) combined with high firmness value (>6.0) desired.

^d Cooking loss: <6.0 = good, 6.0 - 6.9 = fair, >7.0 = poor.

^e Firmness: >6.0 = good, 5.0 - 5.9 = fair, <5.0 = poor.

Table 5a. Wheat kernel characteristics.

Entry	Source ^a	Single Kernel Wheat Characterization							NIR Hard- ness ^b	Kernel	
		Large Kernels %	Small Kernels %	Soft %	Semi- Soft %	Semi- Hard %	Hard %	Index		Pro- tein ^c %	Kernel Ash ^d %
Yecora rojo	UC	28	1	0	5	22	73	66.2	66	14.3	1.40
DA990-15	WPB	24	1	1	1	14	84	70.9	77	13.5	1.46
PH991-87	WPB	25	1	0	1	7	92	73.8	75	13.0	1.50
DA989-20	WPB	26	2	1	3	15	81	70.8	82	14.0	1.53
PH989-80W	WPB	22	2	1	1	7	91	74.8	70	13.6	1.49
DA992-130	WPB	31	1	1	4	23	72	67.1	74	13.8	1.49
906WR	APB	23	1	0	4	15	81	69.4	73	13.2	1.45
9003 WR	APB	28	1	1	3	22	74	66.9	67	13.6	1.49
Cavalier	FMC	30	1	1	7	28	64	63.4	70	14.3	1.39
Poco Red	FMC	18	2	1	1	14	84	72.8	81	14.3	1.43
BR8631	FMC	33	1	0	1	15	84	70.7	66	13.9	1.43
BR7073	FMC	33	1	3	12	30	55	60.4	65	12.7	1.46
BR7073B	FMC	34	1	7	30	39	24	50.3	52	13.9	1.45
BR9118	FMC	22	2	1	2	11	86	75.1	84	13.9	1.49
BR8631-1	FMC	23	1	1	2	19	78	68.7	66	13.9	1.46
BR1277	FMC	31	1	1	6	28	65	63.9	71	13.3	1.41
BR1231	FMC	19	2	1	4	22	73	67.5	71	12.9	1.41
BR1283	FMC	22	2	2	5	26	67	64.8	58	12.9	1.40
BR1153	FMC	21	2	1	3	15	81	70.8	86	13.5	1.43
BR1434	FMC	29	2	2	5	25	68	64.9	69	13.8	1.47
BR9216	FMC	30	1	2	5	28	65	65.1	70	13.0	1.44
BR1235	FMC	19	3	4	5	25	66	64.1	55	13.4	1.51
Brooks	WPB	29	1	1	6	29	64	64.6	67	14.0	1.42
AVERAGE		27	1	2	5	22	72	66.8	70	13.6	1.45

^a Source: APB = Arizona Plant Breeders, CIMMYT = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders.

^b NIR Hardness: hard red spring wheats have NIR scores between 60 and 85.

^c Kernel protein: based on 14% moisture.

^d Kernel ash: low ash content produces bright flour.

Table 5b. Wheat milling performance and baking results.

Entry	Source ^a	Flour Extraction %	Flour Protein ^b %	Flour Ash %	Mixograph Absorption %	Mixograph Pattern ^c	Bake Absorption ^d %	Dough Mixing Time min	Dough Character ^e	Crumb Color ^f	Crumb Grain ^g	Crumb Texture ^h	Loaf Volume cm ³
Yecora rojo	UC	69.2	12.3	0.43	59.0	3	57.0	5.50	2	6	4	4	175
DA990-15	WPB	60.1	11.8	0.43	58.2	3	61.0	5.50	3	0	3	6	185
PH991-87	WPB	60.5	11.4	0.49	58.2	3	58.2	5.00	2	4	4	6	167
DA989-20	WPB	59.4	12.3	0.51	58.6	3	58.6	4.50	2	5	3	5	174
PH989-80W	WPB	56.8	12.4	0.51	58.2	3	58.2	5.00	3	3	3	6	180
DA992-130	WPB	58.7	12.1	0.48	59.3	4.5	03.0	5.00	3	5	5	6	178
906WR	APB	60.0	11.1	0.41	55.8	3	57.1	5.00	2	3	3	5	170
9003 WR	APB	57.3	11.6	0.45	56.9	3	58.1	5.00	2	3	4	5	163
Cavalier	FMC	61.1	12.2	0.43	58.2	3	61.0	5.50	3	5	5	6	183
Poco Red	FMC	58.1	12.2	0.41	55.5	3	59.1	5.00	2	3	3	5	162
BR8631	FMC	55.9	11.7	0.48	56.5	2	60.0	6.00	3	3	4	5	182
BR7073	FMC	60.5	11.2	0.46	58.6	4	61.1	4.50	2	3	5	5	160
BR7073B	FMC	59.2	12.3	0.42	58.6	4	61.1	5.25	3	3	5	5	182
BR9118	FMC	64.1	12.0	0.39	59.0	3	62.0	4.50	3	3	3	6	173
BR8631-1	FMC	58.0	10.4	0.38	57.3	3	61.0	5.50	3	5	4	6	178
BR1277	FMC	63.6	12.0	0.43	59.6	3	55.0	4.50	3	3	3	5	184
BR1231	FMC	62.6	11.2	0.44	55.8	3	58.1	5.50	2	3	5	5	161
BR1283	FMC	53.0	11.2	0.43	54.3	2	56.0	4.50	2	3	4	5	175
BR1153	FMC	59.5	11.8	0.40	57.9	3	55.1	5.50	3	5	4	5	178
BR1434	FMC	56.3	12.1	0.42	57.3	3	53.0	5.50	3	3	3	5	186
BR9216	FMC	62.1	11.5	0.45	55.8	3	57.1	5.50	2	3	5	5	164
BR1235	FMC	51.9	11.8	0.43	55.8	3	55.1	5.00	3	3	4	5	173
Brooks	WPB	62.8	12.1	0.40	57.6	3	57.0	5.50	3	3	3	5	170
AVERAGE		59.1	11.8	0.43	57.4	3	55.6	5.15	3	4	4	5	174

^a Source: APB = Arizona Plant Breeders, CIMMYT = International Maize and Wheat Improvement Center, FMC = Farmers Marketing Corporation, NK = Northrup King, UC = University of California, and WPB = Western Plant Breeders.

^b Flour protein: based on 14% moisture.

^c Mixograph pattern: larger numbers for mixograph pattern indicate stronger mixing characteristics.

^d Bake absorption: amount of water required for optimum dough consistency.

^e Dough character: 0 = sticky-weak, 3=elastic, 6 = buchy.

^f Crumb color: 0 = yellow, 3=dull, 6 = bright white.

^g Crumb grain: 0 = irregular-thick, 3=open-thick, 6 = fine.

^h Crumb texture: 0 = harsh, 3=coarse, 6 = silky.