1998 REGIONAL BARLEY, COMMON AND DURUM WHEAT, TRITICALE, AND OAT PERFORMANCE TESTS IN CALIFORNIA[1]

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University of California Cooperative Extension regional cereal evaluation tests were conducted in the intermountain valleys of northeastern California; the Sacramento, San Joaquin, and Imperial Valleys; and in the south central coastal region in 1998. Entries in the tests included standard cultivars, new and soon-to-be released cultivars, and advanced breeding lines from both public and private cereal breeding programs. Winter barley (12 entries) was evaluated at one location; fall-sown spring barley (37entries), at 8 locations; and spring-sown spring barley (31 entries), at 3 locations. Winter wheat (17 entries) was evaluated at one location; fall-sown hard red and hard white spring wheat (50 entries), at 11 locations; durum wheat (34 entries), at 5 locations; and spring-sown spring wheat (24 entries), at 3 locations. Triticale (14 entries) was evaluated at 4 locations; and oat (16 entries), at one location. A cereal hay/forage test (40 entries) was evaluated at one location.

Tests were conducted at University of California Field Stations or in fields of cooperating growers. Tests were planted at seeding rates of 1.2 million seeds per acre for common and durum wheat tests if irrigation was planned (requiring from 85 to 137 lb/acre for common wheat and from 106 to 174 lb/acre for durum wheat, depending on the entry) and at 1.0 million seeds per acre for rainfed wheat and all barley, triticale and oat tests (requiring from 71 to 114 lb/acre for common wheat, 69 to 131 lb/acre for barley, 85 to 118 lb/acre for triticale, and 57 to 99 lb/acre for oat, depending on the entry). Randomized complete block designs with four replications were used. Each plot was six drill rows wide (6-inch row spacing) and 25 feet long, except at the UC Desert Research and Extension Center (Imperial) where plots were 16 feet long and at the UC Intermountain Research and Extension Center (Tulelake) where plots were nine drill rows (5 feet) wide. Grain was harvested with a Wintersteiger Seedmaster Universal 150 plot combine. Foliar diseases were assessed at the soft-to-medium dough stage of growth by estimating the percentages of areas of penultimate leaves (flag-1 leaf) affected. BYD assessments, however, were based on the percentage of plants showing symptoms. Black point was assessed on grain samples of durum wheat after harvest. Yield, test weight, kernel weight, plant height, days to heading and maturity, lodging, shattering, disease reaction, and grain quality were determined as indicated in the tables. Information regarding each site is given in Table 1.

Small grain sowings in California for the 1998 season were estimated at 490,000 acres of common wheat, 181,000 acres of durum wheat, 220,000 acres of barley, and 300,000 acres of oat (predominantly for hay). Leading cultivars were hard red wheats RSI 5 (114,000 acres), Yecora Rojo (109,000 acres), Express (83,000 acres), and Brooks (68,000 acres). RSI 5 acreage in the San Joaquin Valley (about half of its total) is primarily green-chop for dairies. The expansion of durum into the San Joaquin Valley continued, where 88,000 acres, mostly the variety 'Kronos', were planted. Kronos also was the most widely grown durum in the Imperial Valley, and was sown on 133,000 acres statewide. The 1998 season was very wet and remained very cool through the spring, resulting in high levels of septoria tritici blotch and stripe rust on wheat. Continuous disease pressure from *Septoria tritici* overwhelmed all cultivars and lines with previously effective resistance in some locations in the Sacramento Valley. The disease extended much further south in the Central Valley than normal due to frequent rain showers. Cultivars in

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the San Joaquin Valley, such as Brooks and Yecora Rojo, with no resistance, were severely affected. By early May, wheat stripe rust also became severe in UC Regional test plots from Chico in Butte Co. (northern Sacramento County) south to Corcoran in Kings County (San Joaquin Valley). Some commercial plantings in the same areas had "hot spots" of severe disease, including the main cultivar in the Sacramento Valley, Express. New strains (combinations of virulences) of wheat stripe rust have become established. Barley stripe rust become severe on fall-sown barley in the Central Valley by mid-April and on spring-sown barley in the Tulelake basin by mid-July. Yield losses of commercial fall-sown barley were less than in the previous two seasons, ranging from 10-20%, because disease onset was late and the more susceptible cultivars are no longer grown. Much of the wheat and barley crop was shallow rooted due to heavy early season rainfall and saturated soil conditions; as a result, lodging was widespread. Rainfall continued into June, causing some sprout damage to early fall-sown wheat. The combination of early sowing, shallow rooting, lodging and late season rainfall resulted in higher than normal levels of black point (black-tip) on durum wheat in the San Joaquin Valley.

BARLEY

Winter barley. The intermountain winter barley test contained 12 entries, all 6-row feed barleys except for one 6-row malting line (88Ab536) and one spring barley (Steptoe). Yield and agronomic performance data are given in Table 2. Stripe rust was severe on Steptoe, Sunstar Pride, Sunstar Double, Showin and Eight-Twelve. Kold, Westbred Sprinter and Strider were resistant. Average yields ranged from 1000 to 5570 lb/acre. Kold and Strider were the highest yielding entries. Boyer and Strider were the highest yielding from 1997-98 while Boyer and Westbred Sprinter were the highest yielding in the three-year period 1996-98 (Table 3).

Fall-sown spring barley. The fall-sown spring barley test contained 37 entries, including 15 cultivars and 22 advanced lines from seven breeding programs (University of California, Western Plant Breeders, Arizona Plant Breeders, Busch Ag Resources, Inc., CIMMYT, Buttonwillow Research, and World Wide Wheat). Most entries were 6-row spring feed barleys, but there also were three 2-row feed barleys (CMB 89A-915, CMB 89A-952, and CMB 90A-761), one 2-row malting barley (Merit) and one 6-row malting barley (B1614). Yield and agronomic performance data for individual sites are given in Tables 4-12. Barley scald was moderate to severe at eight sites. Cultivars UC 603, Nebula, and advanced lines UCD 92-10588, UCD 92-10585, UCD 92-10615 (UC 937), UCD 95-2407, UCD 95-3167, UCD 95-1540, UCD 95-1398, CMB 89A-915, CMB 89A-952, CMB 90A-362, CMB 90A-761, and APB A-18 were resistant. Stripe rust was severe at six locations. Cultivars UC 603 and advanced lines UCD 92-10588, UCD 92-10585, UCD 92-10615 (UC 937) , UCD 95-1540, UCD 95-1398, IBYT 90-84, CMB 89A-915, CMB 89A-952 and CMB 90A-362 were resistant. Leaf rust was moderate to severe at three locations and was most severe on cultivars Patti, UC 603 and advanced lines BA 2391 and WWW BA 4513. Net blotch occurred at five locations and was most severe on advanced line WWW BA 8063 and the cultivar Max. Bushel weights were very low at locations where scald and/or stripe rust were severe. Lodging was severe at five locations. Cultivars UC 603 and Nebula and advanced line APB A-20 had the best lodging resistance. Entries B1614, IBYT 90-84, CMB 89A-915, CMB 89A-952, CMB 90A-761 shattered severely. Average yields ranged from 1450 lb/acre at the rainfed Yolo site to 4350 lb/acre at the Butte site. Entries APB A-20, APB A-25 and APB A-15 were highest yielding in the Sacramento Valley; entries APB A-20, UCD 92-10585, APB A-15, APB A-25 and UCD 92-10588, in the San Joaquin Valley; and entries UCD 92-10588, CMB 90A-761, and BA 2391, in rainfed areas. In the three-year period 1996-98, entries UCD 92-10585, UCD 92-10588, and UCD 92-10615 (UC 937) were the highest yielding in the Sacramento Valley and the San Joaquin Valley, while UCD 92-10588, BA 2391, Arivat, and UCD 92-10615 (UC 937) were the highest yielding in rainfed areas (Table 13).

Spring-sown spring barley. The intermountain spring barley test contained 31 entries (2-row and 6-row feed and malting barleys), including 18 cultivars and 13 advanced lines from twelve breeding programs (University of California, Oregon State University, USDA/University of Idaho, Busch Ag Resources, Coors, University of Minnesota, Utah State University, Washington State University, University of Saskatchewan, Western Plant Breeders, Arizona Plant Breeders, and World Wide Wheat). Yield and agronomic performance data for individual sites are given in Tables 14-16. Stripe rust was severe at Tulelake and Siskiyou. Entries UCD 92-10591, UC/NK 2867, SR 58-4, BCD 47, Orca and Bancroft were resistant. Lodging was severe at Tulelake; entries UCD 92-10591, UC/NK 2867, NK2897/STP-B32, Orca, UT002120, UT004603, and BCD 22 had the best lodging resistance. Average yields ranged from 3920 lb/acre at the Lassen site to 4950 lb/acre at the Siskiyou site. Entries SR58-4 and NK2897/STP-B32 were the highest yielding at the Lassen site; Baronesse, Merit, and UT004603, at the Siskiyou site; and UT004603, UCD 92-10591, and UC/NK 2867, at the Tulelake site. Over the three locations, UT004603, Statehood, and the stripe rust resistant entry UC/NK 2867 (UC 960) were highest yielding in 1998. In the three-year period 1996-98, UCD 92-10591 and UC/NK 2867 were highest yielding at Tulelake; Baronesse and Rollo, at Siskiyou; and UC/NK 2867 and UCD 92-10591, region wide (Table 17).

WHEAT

Winter wheat. The intermountain winter wheat test contained 17 entries (soft white, club, and hard red wheat) including 14 cultivars and 3 advanced lines from five breeding programs (Oregon State University, University of Idaho, Utah State University, Washington State University and Sunderman Breeding Co.). Yield and agronomic performance data are given in Table 18. Average yields ranged from 4330 to 6380 lb/acre. Lambert (soft white) and Rohde (club) were the highest yielding. In the three-year period 1996-98, Lambert and SDM 00217 have been the highest yielding (Table 19).

Fall-sown spring wheat. The fall-sown spring wheat test contained 50 entries (41 hard red spring, 2 hard red winter, 7 hard white spring), including 13 cultivars and 37 advanced lines from five breeding programs (University of California, Western Plant Breeders, Resource Seeds, Inc., Arizona Plant Breeders, and World Wide Wheat). Yield and agronomic performance data for individual sites are given in Tables 20-31. Septoria tritici blotch was severe to moderately severe at 8 locations. Twenty-three entries were highly susceptible. Least affected entries (most resistant) included UCD 95-111R, DA 993-191, RSI 95W10716, RSI 96WV51505, RSI 96WV54013, RSI 5, and UC 1037. Stripe rust was moderately severe to severe at three locations. Thirteen entries (BR 1283, APB W94B-192, YU 993-68, DA 992-120, UC 96-142R, UC 96-129W, UC 1160, BR 9154, Express, Cuyama, RSI 95W10510, Brooks, and RSI 96WV54013) were highly susceptible at one or more locations. Lodging was moderately severe to severe at seven locations. Entries Stander and RSI 95W10716 had the best lodging resistance. Bushel weights were low at locations where septoria tritici blotch, stripe rust and/or lodging were severe. Moderate to severe shatter occurred at three locations and was most serious at Imperial. Entries YU 993-68, RSI 96WV51505, UC 1161, UC 1162, and Express were most affected. Grain protein content of samples from six of the sites was measured by the California Wheat Commission laboratory (Table 32). Average grain protein content (12% moisture basis) ranged from 11.1% to 14.3%. Seventeen entries had grain protein contents of 13% or greater averaged over the six sites. Entries UC 1163 and APB W95-261 had grain protein contents of 14% or greater averaged over the six sites. Quality evaluations conducted by the California Wheat Commission laboratory on samples from the 1998 Kings site (Table 33) showed the highest loaf volumes and overall bread scores were produced by APB W95-261, BR 9154, Klasic, DA 993-191, and YU 994-183. Average grain yields ranged from 1840 lb/acre at the rainfed Yolo site to 7010 lb/acre at the Imperial site. Entries RSI 96WV51505, DA 993-191, RSI 95W10716, RSI 96WV52305, and UC 1037 were the highest yielding in the Sacramento Valley; entries RSI 96WV54013, RSI 5, and UC 96-129W, in the San Joaquin Valley; entries Klasic, Cuyama, Bonus, APB 89-1-15B, and Brooks, in the Imperial Valley; and entries RSI 96WV54013, UCD 95-111R, and RSI 5, in rainfed areas. In the three-year period 1996-98, UC 1037, UCD 95-111R, RSI 5, UC 1036, and Stander were the highest yielding in the Sacramento Valley; RSI 5 and UC 96-129W, in the San Joaquin Valley; Klasic, Yolo, and Brooks, in the Imperial Valley; and Serra, UCD 95-111W, UCD95-111R and RSI 5, in rainfed areas (Table34).

Durum wheat. The durum wheat test contained 34 entries including 15 cultivars and 19 advanced lines from four breeding programs (University of California, Western Plant Breeders, Arizona Plant Breeders, and World Wide Wheat). Yield and agronomic performance data for individual sites are given in Tables 35-40. Severe lodging occurred at two locations (UC Davis and Kern). Entry UC D93-202 had the best lodging resistance. Physiological leaf spot and stripe rust each were severe to moderately severe on susceptible entries at two locations. Duraking, YU 895-13, Westbred 881, Ocotillo, Kofa, Concord, and WPB 8015 were most susceptible to physiological leafspot. APB 94B-125, WPB 8015, Ocotillo, Kofa, YU 895-13, and Westbred 881 were most susceptible to stripe rust. Septoria tritici blotch was severe at UC Davis. Tackna, Westbred 881, Kofa, Eddie, YU 895-13 and WPB 8015 were most susceptible. Black point incidence was high at all locations except for Imperial. Entry UC D95-211 had the lowest black point score overall. Grain protein content of samples from the five sites was measured by the California Wheat Commission laboratory (Table 41). Average grain protein content (12% moisture basis) ranged from 11.0% to 14.0%. Twelve entries had grain protein contents of 13% or greater averaged over the five sites. UC 896 and Tacna had the highest average grain protein contents. Quality evaluations conducted by the California Wheat Commission laboratory on samples from the 1998 Kings site (Table 42) showed that APB D95-434, Mohawk, and UC D95-202 had the best pasta color scores. Average grain yields ranged from 3510 lb/acre at the Kern site to 8340 lb/acre at the Imperial site. Westbred Turbo, UC D95-213, UC 1171 and UC D95-211 were the highest yielding in the San Joaquin Valley; and UC 1171, UC 1172, and UC D95-213, in the Imperial Valley. In the three-year period 1996-98, UC D95-211, UC D95-213 and Westbred Turbo were the highest yielding in the San Joaquin Valley; and UC D95-213, UC D95-211 and Mohawk, in the Imperial Valley (Table 43).

Spring-sown spring wheat. The intermountain spring wheat test contained 24 entries (17 soft white, four hard red, and three hard white) including 14 cultivars and ten advanced lines from seven breeding programs (USDA/University of Idaho, Oregon State University, Colorado State University, Sunderman Breeding Co., Merrill Lewis, USDA/Washington State University, and Western Plant Breeders). Yield and agronomic performance data for individual sites are given in Tables 44-46. Leaf rust and stripe rust were moderate to severe at Tulelake. Fieldwin, Blanca, and ML042409 were most susceptible to stripe rust while Twin, Westbred 936, and ML042409 were most susceptible to leaf

rust. Average yields ranged from 4460 lb/acre at the Siskiyou site to 7280 lb/acre at the Tulelake site. IDO488 was the highest yielding overall. ID0488 and SDM50030 were the highest yielding at the Lassen and Siskiyou sites; and ID0488, BZ 692-108, and ID 0505, at the Tulelake site. In the three-year period 1996-98, ID0488 was the highest yielding region-wide, while Twin, IDO488, and Vanna were the highest yielding at Siskiyou and IDO488, Pomerelle and Whitebird were the highest yielding at Tulelake (Table 47).

TRITICALE

The triticale test contained 14 entries, including two cultivars, 11 advanced lines, and one wheat cultivar (Yolo) from three breeding programs (University of California, Resource Seeds, Inc., and CIMMYT). Yield and agronomic performance data for individual sites are given in Tables 48-51. There were no disease problems and only moderate lodging for most entries. Average grain yields ranged from 3690 lb/acre at the Sutter site to 8000 lb/acre at the Imperial site. Trical 105, RSI 97TY37812, and RSI 96TY10612 were the highest yielding in the Sacramento Valley; RSI 94TV20635 and RSI 96TV11211, in the San Joaquin Valley; and RSI 97TY37812, RSI 96TY10612 and RSI 96TY10001, in the Imperial Valley. In the three year period 1996-98, Trical 105 was the highest yielding in the Sacramento Valley (yielding 167% of the wheat cultivar Yolo); UC 103, in the San Joaquin Valley (yielding 135% of the wheat cultivar Yolo); and UC 103 and Trical 105, in the Imperial Valley (yielding 103% of the wheat cultivar Yolo) (Table 52).

OAT GRAIN AND CEREAL HAY

The oat grain test contained 16 entries including seven cultivars and nine advanced lines. Yield and agronomic performance data are given in Table 53. Crown rust was very severe on Sierra, Montezuma, Kanota, and Swan. By harvest time lodging was severe on all entries; at the soft dough stage, however, lodging was severe only on Montezuma, Kanota, and Bates 89. Average grain yields ranged from 1160 to 4100 lb/acre. UC 113, UC 125 and Pert were the highest yielding. In the three-year period 1996-98, entries UC 113, UC 125 and Pert were the highest yielding (Table 54). Yield and agronomic performance data for the cereal forage test at the Stanislaus site are given in Table 55. The test was growing well until February, when the area received record rainfall during the entire month. Entries responded differently to the standing water, and several drowned-out. Only entries with the best visual appearance were harvested. Forage yields (at 70% moisture) ranged from 3.7 to 12.4 tons/acre. Entries Westerwald (tetraploid rye) and Trical T2700 (triticale), harvested at growth stages ranging from heading to boot, were the highest yielding.