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2003 REGIONAL BARLEY, COMMON AND DURUM WHEAT, TRITICALE, AND OAT PERFORMANCE TESTS IN CALIFORNIA¹

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University of California Cooperative Extension 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 2003. Entries in the tests included standard cultivars, new and soon-to-be released cultivars, and advanced breeding lines from both public and private breeding programs. Fall-sown winter barley (8 entries) was evaluated at one site; fall-sown spring barley (27 entries), at 7 sites; and spring-sown spring barley (32 entries), at three sites. Fall-sown winter wheat (18 entries) was evaluated at one site; fall-sown spring wheat (38 entries total), at eleven sites (not all entries were evaluated at all sites); and spring-sown spring wheat (21 entries), at three sites. Durum wheat (38 entries) was evaluated at 6 sites. Fall-sown winter triticale (12 entries) was evaluated at one site; fall-sown spring triticale (5 entries), at 3 sites. Fall-sown spring oat (15 entries) was evaluated at one site.

Tests were conducted at University of California Field Stations or in fields of cooperating growers. Tests were sown at seeding rates of 1.2 million seeds per acre for common and durum wheat tests (equivalent to 82 to 126 lbs/acre for common wheat, and from 97 to 156 lbs/acre for durum wheat, depending on the entry) if irrigation was planned and at 1.0 million seeds per acre for rainfed wheat and all barley, oat and triticale tests. Randomized complete block designs with four replications were used. Each plot was nine drill rows wide (5 to 6-inch row spacing) and 20 feet long, except at the UC Desert Research and Extension Center (Imperial) where plots were 16 feet long. 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.

The small grain crop for the 2003 season in California, according to the California Agricultural Statistics Service, included 742,000 acres of wheat (including 132,000 acres of durum wheat), 130,000 acres of barley and 250,000 acres of oat. Triticale acreage wasn't estimated, but over 50,000 acres were grown in the state, primarily in the San Joaquin Valley. Main common wheat cultivars in 2003 were Yecora Rojo (135,000 acres), Express (98,000 acres), Bonus (60,000 acres), Summit (57,200 acres), Stander (37,000 acres), and Dirkwin (37,000 acres). Hard white wheat was sown on about 33,000 acres and included the cultivars Klasic (20,000 acres), Blanca Grande (13,000 acres), and Plata (4,100 acres). Main durum cultivars in 2003 were Kronos (76,000 acres), Mohawk (24,500 acres) and Orita (15,000 acres). About 200,000 acres of wheat and triticale were harvested as green-chop forage for dairies in California's Central Valley. Wheat stripe rust devastated the California wheat crop in 2003. A combination of very mild winter temperatures (particularly December through January) and early planting (particularly of wheat for forage for dairies) resulted in very early infections, about 6 weeks earlier than normal for California's Central Valley. Cool conditions persisted much longer in spring than usual, allowing stripe rust to reach very high levels throughout the Central Valley and surrounding areas.

¹These tests were conducted by the UC Davis Department of Agronomy and Range Science and Cooperative Extension. Land for the tests, the grain produced and other facilities were contributed by cooperating growers identified in Table 1. Quality evaluations were provided by the California Wheat Commission (CWC) quality laboratory. The assistance of growers and the CWC quality laboratory is acknowledged with appreciation. The regional testing program is supported in part by funds provided by the California Crop Improvement Association and the California Wheat Commission.

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Where stripe rust was very severe and fields were not treated with fungicide, highly susceptible cultivars (Dirkwin, Bonus, Brooks, Cavalier) suffered 75% or more yield loss; susceptible cultivars (Yecora Rojo, Anza, Klasic, Eldon, Yolo, Kern, Serra, Dariel, Kama), 50-70% yield loss; moderately susceptible cultivars (Express), 20-40% yield loss; and moderately resistant cultivars (Stander, Beth Hashita), 5-15% yield loss. Very few cultivars (Summit, Blanca Grande, and Plata) maintained resistance through the season. Durum cultivars also were affected by stripe rust. Kofa, Ria, Mohawk, Deluxe, Topper, Orita, and Candura were susceptible; Duraking and Kronos, moderately susceptible; and Bravadur, Crown, Matt, and Platinum, moderately resistant. At the end of the 2002 season 12 races of wheat stripe rust had been identified in California. Additional races were identified in 2003. Statewide, yield losses averaged more than 25%. More fungicide applications were made to wheat in California in 2003 than ever before.

Other diseases occurred, but generally were in much lower severity than wheat stripe rust. Barley stripe rust appeared much later than wheat stripe rust. Low barley stripe rust severity occurred in commercial fields since the predominant cultivars, UC 937 and UC 933, are resistant to current races. However, susceptible cultivars in the statewide tests such as Max and Commander had 100% severity by late May in yield trials in the Central Valley. Wheat leaf rust became severe on susceptible common wheat cultivars in the Central Valley by mid-to-late May. High levels occurred on some of the few cultivars that were not affected by stripe rust. Severe leaf rust also occurred in several commercial durum wheat fields in the Imperial Valley. Fields of Orita, at the soft dough stage, had 70-80% severity in early May. Later (early June), severe leaf rust occurred in that region on California's predominant durum wheat cultivar Kronos.

BARLEY

Fall-sown winter barley. The fall-sown winter barley test contained 8 cultivars. Entries in the test, type of barley, their backgrounds, and seed sources are shown in Table 2. Yield and agronomic performance data are given in Tables 3-4. Frost injury (tips of spikes) was visible on Steptoe (the spring barley check) by the soft dough stage (6/23). Stripe rust was moderately severe on Steptoe and scald was moderately severe on Eight Twelve. Yields ranged from 5170 to 8020 lb/acre. Eight Twelve and Strider were the highest yielding in 2003 and in the two-year period 2002-2003.

Fall-sown spring barley. The fall-sown spring barley test contained 27 entries (twenty-six 6-row spring feed types and one 2-row spring feed type), including 9 cultivars and 18 advanced lines. Entries in the test, type of barley, their backgrounds, and seed sources are shown in Table 5. Yield and agronomic performance data are given in Tables 6-14. Diseases were severe on only a few entries: Stripe rust was severe on Max and Commander at the UC Davis and Madera Co sites; net blotch, on Meltan at the UC Davis and Butte Co sites; scald, on Commander at the Glenn Co site and on Max, Patti, and Commander at the Butte Co site; and BYD, on Meltan at the UC Davis and Madera Co sites and on Commander at the UC Davis site. Lodging was severe to moderately severe for many entries at four sites (Table 13); several entries, including Patti, entries 1113 (UCD C124), 1090 (UCD PYT01 C6), 1092 (UCD PYT01 C39), UC 603 and UC 969, showed excellent lodging resistance. Average yields ranged from 1060 lb/acre at the rainfed San Luis Obispo Co site to 7900 lb/acre at the UC Davis site. Entry 1090 (UCD PYT01 C6) was highest yielding in the Sacramento Valley (eight other entries also averaged over 8000 lb/acre in that region); entries 1090 (UCD PYT01 C6) and 1113 (UCD C124), in the San Joaquin Valley; and entries 1117 (UCD C142) and 1118 (UCD C147), at rainfed sites. In the three-year period 2001-2003, entry 1047 (UCD PYT99 A-13) and UC 933 have been the highest yielding in the Sacramento Valley; entry 1047 (UCD PYT99 A-13) and Patti, in the San Joaquin Valley; and UC 933, Meltan, and entry 1047 (UCD PYT99 A-13) at rainfed sites.

Spring-sown spring barley. The intermountain spring barley test contained 32 entries, including 20 cultivars and 12 advanced lines. Entries in the test, type of barley, their backgrounds, and seed sources are shown in Table 15. Yield and agronomic performance data are given in Tables 16-19. Late season moisture stress reduced yields, bushel weights and kernel weights at the Lassen Co and Siskiyou Co sites, while high yields, bushel weights and kernel weights were attained at the Tulalake site. Stripe rust was severe to moderately severe on several entries, including Steptoe, Legacy, and entries 1083 (6B95-2482), and 1126 (UCD-TL02-79), at the Tulalake site. Average yields ranged from 2950 lb/acre at the Lassen Co site to 6730 lb/acre at the Tulalake site. In the period 2001-2003, entry 1079 (93Ab688), Millenium and Brigham were highest yielding region-wide; Xena was highest yielding in Siskiyou Co; and entries 1079 (93Ab688), 1105 (UCD-TL163), Millenium, Brigham, and 1099 (UCD-TL20), at Tulalake.

WHEAT

Fall-sown winter wheat. The fall-sown winter wheat test contained 18 cultivars. Entries in the test, type of wheat, their backgrounds, and seed sources are shown in Table 20. Yield and agronomic performance data are given in Tables 21-22. Stripe rust was severe on several entries, including Deloris, Boundary, Hubbard, Wincal and Edwin. Several entries lodged severely at harvest. Rohde and Lambert were the highest yielding in 2003 and in the two-year

period 2002-2003 (Table 22).

Fall-sown spring wheat. The fall-sown spring wheat test contained 38 entries (not all entries were evaluated at all sites), including 19 cultivars and 19 advanced lines. Entries in the test, type of wheat, their backgrounds, and seed sources are shown in Table 23. Yield, agronomic performance, and quality data are given in Tables 24-38. Freeze damage, expressed as basal stem rot, extensive blotching of leaves, stunting, and irregular heading, occurred on many entries at the Butte Co site. Two large areas at the Glenn Co rainfed site were stunted with “white heads” indicative of dryland root rot; these areas, affecting many plots, were lower yielding than the remainder of the site. Stripe rust occurred very early in the season and reached very high severity throughout the Central Valley and surrounding areas. Many entries were severely affected (Table 35). The disease greatly reduced grain yields, bushel weights and kernel weights of susceptible entries and masked the presence of other diseases such as leaf rust and *Septoria tritici* blotch. Cultivars and lines with low disease reactions (resistant to moderately resistant) to stripe rust included Plata, Blanca Grande, Summit, Beth Hashita, and Stander, and entries 1394 (RSI 99WY51394), 1395 (UCD 010390598), 1396 (UCD 010390601), 1392 (DA 900-229), and 1288 (BZ-256W). Losses due to stripe rust were less at the Kings Co site because the grower applied Quadris fungicide in late March. Although some disease control was obtained, the disease reappeared in late April. The severity of stripe rust obscured leaf rust; only entries that were not severely damaged by stripe rust had tissue available or infection by leaf rust. Plata, Blanca Grande, and Stander and entry 1394 (RSI 99WY51394) had high leaf rust severity at several sites. Lodging was moderately severe to severe at three sites (Butte Co, UC Davis, and Kern Co); entries with good lodging resistance included Stander, Kama, entries 1343 (YU 995-231W), 1391 (DA 998-101), Kern, and 1361 (UCD 990370078). Grain protein content of samples from four sites in the Sacramento Valley, three sites in the San Joaquin Valley and one site in the Imperial Valley was measured (Table 36). Mean grain protein content ranged from 11.6% to 14.0% for samples from the Sacramento Valley, from 11.3% to 15.1% for samples from the San Joaquin Valley, and from 11.2% to 14.2% for samples from the Imperial Valley. Quality evaluations (conducted by the California Wheat Commission laboratory) of samples from the Kings Co site (Table 37) showed that the highest loaf volumes and overall bread scores were produced by entries 1289 (BZ998-247W) and 1400 (WWW BR5874); eleven additional entries were rated fully satisfactory. Average grain yields ranged from 620 lb/acre at the rainfed San Luis Obispo Co site to 6390 lb/acre at the Imperial site. Summit and Plata (stripe rust resistant) were the highest yielding in the Sacramento Valley (averaging 6790 and 6570 lbs/acre, respectively) and in the San Joaquin Valley (averaging 7280 and 7240 lbs/acre, respectively). Bonus and Klasic were the highest yielding in the Imperial Valley where only trace levels of stripe rust occurred. In the three-year period 2001-2003, Summit was the highest yielding in the Sacramento Valley; Plata and Summit, in the San Joaquin Valley; Bonus and Klasic, in the Imperial Valley; and Klasic, Stander, Express, and Summit, at rainfed sites (Table 38).

Spring-sown spring wheat. The intermountain spring wheat test contained 21 entries, including 16 cultivars and 5 advanced lines. Entries in the test, type of wheat, their backgrounds, and seed sources are shown in Table 39. Yield and agronomic performance data are given in Tables 40-43. Both the Lassen Co and Siskiyou Co sites suffered late-season drought stress, resulting in low grain yields, low bushel weights, and low kernel weights. Stripe rust was severe on one cultivar, Twin, at the Tulelake site. Lodging was moderately severe to severe at the Tulelake site. Average yields ranged from 3220 lb/acre at the Lassen Co site to 6520 lb/acre at the Tulelake site where the top-yielding entry (Alturas) yielded 7570 lb/acre. In the three-year period 2001-2003, Alpowa and Alturas were the highest yielding region-wide and at Tulelake (Table 43).

Durum wheat. The durum wheat test contained 38 entries (not all entries were evaluated at all locations), including 18 cultivars and 20 advanced lines. Entries in the test, their backgrounds, and seed sources are shown in Table 44. Yield, agronomic performance, and quality data are given in Tables 45-56. Two tests were conducted at Imperial, one with normal irrigation (at planting (12/16) + 4 irrigations (1/14, 3/10, 4/10, 5/2); total applied water: 24.95") and one with reduced irrigation (at planting (12/16) + 2 irrigations (3/10, 4/24); total applied water: 18.84") (Tables 49-50). Entries in the reduced irrigation test averaged 7 days earlier in heading and 13 days earlier in maturity than in the normal irrigation test, and yielded an average of 1100 lb/acre less (5960 lb/acre vs 7050 lb/acre) than they did in the normal irrigation test. Stripe rust was severe on many entries at the UC Davis, Madera Co, King Co, and Kern Co sites. Cultivars and lines with low disease reactions (resistant to moderately resistant) to stripe rust included Bravadur, entry 1375 (UCD 992050023), Crown, Platinum, Topper, Matt, and entry 1303 (WWW D6523) (Table 51). Losses due to stripe rust were less at the Kings Co site because the grower applied Quadris fungicide in late March. Although some disease control was obtained, stripe rust reappeared in late April. Low to moderate levels of black point occurred on some entries at the UC Davis, Kings Co, Madera Co and Kern Co sites; entries 1315 (RSI 99WV30413) and 1317 (RSI 98WV13832) had relatively high average black point severity, while Platinum, entries 1412 (WWW D4079), 1303 (WWW D6523), Mohawk, 1304 (WWW D5384-2), 1375 (UCD 992050023), and 1376 (APB D990D-213) had low black point severity (Table 51). Lodging was moderately severe to severe at the Imperial, Kings Co and Kern Co sites. Grain protein content of samples from the four sites in the Central Valley and the two sites in the Imperial Valley was measured (Table 52).

Mean grain protein content ranged from 12.6% to 14.7% for samples from the Central Valley, and from 12.1% to 15.0% for samples from the Imperial Valley. Orita, Crown, and entries 1407 (UCD 022040012) and 1369 (WWW D1138) had grain protein content of 14% or higher averaged over all sites. Quality evaluations (conducted by the California Wheat Commission laboratory) of samples from the Kings Co (Table 53) and Imperial (Table 54) sites showed that samples of four entries from the Kings Co site: Mohawk, entries 1250 (YU 895-130), 1376 (APB D99OD-213), and 1407 (UCD 022040012); and eight entries from the Imperial site: Orita, Candura, and entries 1250 (YU 895-130), 1303 (WWW D6523), 1304 (WWW 5384-2), 1371 (YU 897-44), 1372 (YU 897-60), and 1376 (APB D99OD-213), had the highest possible pasta color scores. Average grain yields ranged from 3020 lb/acre at the Madera Co site to 7050 lb/acre at the Imperial (normal irrigation) site. Platinum and entry 1375 (UCD 992050023) were the highest yielding in the San Joaquin Valley; and entry 1375 (UCD 992050023), Topper and Platinum, in the Imperial Valley. In the three-year period 2001-2003, Platinum was the highest yielding in the San Joaquin Valley; and Topper, Duraking, Deluxe, Orita, and Crown, in the Imperial Valley (normal irrigation) (Table 55). In the three-year period 2001-2003, Duraking, was the highest yielding in the Imperial Valley under reduced irrigation (Table 56).

TRITICALE

Fall-sown winter triticale. The fall-sown winter triticale test contained 12 entries, including 5 cultivars and 6 advanced lines, and the soft white wheat check cultivar Stephens. Entries in the test, seed sources, and yield and agronomic performance data for the Siskiyou Co site are given in Table 57. Grain yield ranged from 5730 to 7780 lb/acre. Entries Elan and MAH 3800 were the highest yielding. The wheat cultivar Stephens yielded about 79% of the top-yielding triticale. In the two-year period 2002-2003, Decor was the highest yielding.

Fall-sown spring triticale. The triticale test contained 5 entries, including 4 cultivars, and a wheat check (Yolo). Entries in the test, their backgrounds, and seed sources are shown in Table 58. Yield and agronomic performance data are given in Tables 59-62. Stripe rust was severe on the wheat check cultivar Yolo and on the triticale cultivars Juan and Trical 96 at the UC Davis and Kings Co sites. Losses due to stripe rust were less at the Kings site because the grower applied Quadris fungicide in late March. Average grain yields ranged from 3900 lb/acre at the UC Davis site to 7100 lb/acre at the Imperial site. Trical 111 was highest yielding at the UC Davis site; Trical 105, at the Kings Co site; and Trical 105, at the Imperial site. In the three-year period 2001-2003, Trical 111 was highest yielding in the Sacramento Valley; Trical 105, in the San Joaquin Valley; and Juan, in the Imperial Valley (Table 62). In the same period the wheat cultivar Yolo yielded about 49% of the top-yielding triticale in the Sacramento Valley; about 88%, in the San Joaquin Valley; and about 98%, in the Imperial Valley.

OAT

Fall-sown spring oat. The oat test contained 15 entries, including 9 cultivars and 16 advanced lines. Entries in the test, their backgrounds, and seed sources are shown in Table 63. Yield and agronomic performance data are given in Tables 64-65. BYD was very severe on Cal Red and Curt and moderately severe on many other entries; Pert and entries 129 (UCD 94-409), and 148 (UCD 96-412) showed the best resistance. Crown rust was very severe on Montezuma, Kanota, and Curt. Lodging was very severe for Curt, Montezuma, Cal Red, Kanota, Bates 89, Swan, and Sierra; entry 148 (UCD 96-412) and Pert had the best lodging resistance. Average grain yields ranged from 860 to 4940 lb/acre at the UC Davis site. Pert was the highest yielding in 2003. In the three-year period 2001-2002, entry 128 (UCD 94-408) was the highest yielding.