

FOR THE PAST three years, wheat growers in key areas of California have been plagued by intense outbreaks of stripe rust. First signs in the current cycle of the disease appeared in the Sacramento Valley in 1960, but it was not until 1961 that widespread and drastic yield losses occurred there. Many fields produced only one half of the yield normally expected.

The disease was present again in the Sacramento Valley and in the Sacramento-San Joaquin Delta area during 1962 but was less severe than in 1961. Great losses occurred again in 1963 and the disease spread over a wider area, into the San Joaquin Valley and along the coastal areas into southern California.

Stripe rust may be recognized by the citron yellow or orange spores, produced in groups, that join to form long stripes between the veins of the leaves. In severe attacks the entire leaf is covered, and the spores are produced on the leaf sheath, on the stem, and in the individual florets of the wheat spike. Wind-borne spores are the cause of infection. Infected volunteer wheat plants or possibly other grass plants in California may serve as inoculum reservoirs. Cool, humid weather favors the development of the disease.

In 1961, as a part of the long-time cereal variety development program conducted by the University of California, Department of Agronomy and the Agricultural Extension Service, a regional yield test was conducted in the Sacramento Valley near Meridian, Sutter County, where a severe outbreak of stripe rust occurred. Five varieties introduced by Dr. C. W. Schaller and C. A. Suneson of the Department of Agronomy were found to possess various levels of resistance to stripe rust. Four of the varieties were developed in Mexico: Yaqui 54, Lerma Rojo, Sinaloa 54, Chapingo 53.

The varieties from Mexico were developed cooperatively by the Instituto Nacional de Investigaciones Agrícolas, and the Rockefeller Foundation Program of Mexico. The fifth, Gaines, was developed in Washington. All of the commonly grown California varieties were infected by stripe rust. The observations in Sutter County were confirmed in trials conducted on the Davis Campus of the University of California. Idaed 59, a variety introduced from Idaho, and Sentry, a durum variety, were found to be moderately resistant.

Although tolerant to stripe rust, Gaines and Sinaloa 54 were eliminated from further testing because they did not appear to possess other important characteristics

New Wheat Variety Introductions Reduce Stripe Rust Losses

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During the past three years, stripe rust has been a serious problem for California wheat growers. Several varieties introduced from Mexico under the continuing University of California cereal variety improvement program have been found to provide some protection from the disease. In California tests these varieties produced excellent yields in the presence of stripe rust and in general have equalled established California varieties in yield and agronomic characteristics when stripe rust was not a problem. Although tests in cooperation with the California milling industry have shown the resistant or tolerant Mexican varieties to be somewhat deficient in quality, they can be used when they meet the standards normally required by the milling industry. These deficiencies apparently are no greater than those existing in currently used California varieties. Until more information on their general acceptability is available, production of these varieties probably should be limited to districts with recurrent heavy losses from stripe rust. Programs to develop varieties which are resistant to stripe rust and more acceptable in other characteristics are underway.

required of varieties adapted to production in the Central Valley of California. The remaining five varieties were planted in the 1962 trials.

Although the infection levels were lower in 1962 than in 1961, they were high enough to demonstrate that Nainari 60 and Pitic 62, two additional introductions from Mexico, were resistant to stripe rust and to confirm the reactions of Yaqui 54 and Lerma Rojo observed in 1961. Idaed 59 and Sentry were found to be more susceptible to stripe rust under field conditions than expected. Although resistant, Chapingo 53, one of the original Mexican introductions, was dropped from further consideration because of excessive plant height.

1963 tests

In 1963, Lerma Rojo, Yaqui 54, Nainari 60, Pitic 62 and Idaed 59 were again tested in field trials. The four Mexican varieties again performed well when grown under stripe rust conditions. Idaed 59, as in 1962, failed to show as much tolerance to stripe rust infection as observed in 1961, although it was more tolerant than the California varieties.

The varieties Lerma Rojo and Pitic 62 have shown complete immunity to stripe rust. Nainari 60 and Yaqui 54 have

Left to right: Ramona 50, Nainari 60, Yaqui are awned, whereas Yaqui 54 is awnleted.



TABLE 1: WHEAT VARIETY CHARACTERISTICS

Variety	Glume color	Awn type	Plant height	Stripe rust reaction	Maturity	Grain description*
Ramona 50	Bronze	Awnless	Moderately short	Susceptible	Very early	Large kernels, generally hard, white
Wh. Fed. 54	White	Awnless	Intermediate	Susceptible	Moderately early	Medium sized kernels, generally hard, white
Onas 53	White	Awned	Intermediate	Susceptible	Medium	Medium sized kernels, soft, white
Yaqui 54	White	Awnletted	Intermediate	Moderately resistant	Moderately early	Medium sized kernels, medium to hard, red
Nainari 60	White	Awned	Moderately short	Moderately resistant	Moderately early	Medium sized kernels, medium hard, light red
Lerma Rojo	Bronze	Awned	Moderately tall	Immune	Moderately early	Large kernels, medium hard, light red
Pitic 62	White	Awned	Short	Immune	Moderately early	Medium sized kernels, medium hard, light red
Idaed 59	White	Awnless	Moderately tall	Moderately susceptible	Medium	Small to med. sized kernels, generally hard, white
Gaines	White	Awned	Very short	Resistant	Very late	Medium sized kernels, generally soft, white

* Kernel description, not official grades.

shown some leaf damage from stripe rust but are considerably more resistant than California varieties in this respect. The 1963 trials also showed that Nainari 60 and Yaqui 54 are susceptible to floral infection by the stripe rust organism. The importance of the effects of floral infection on these two varieties is still undetermined, but it may have caused some losses in yield and quality.

The characteristics of the resistant varieties are given in table 1, with the Cali-

fornia varieties—White Federation 54, Onas 53, and Ramona 50—listed for comparison. The severity of the damage from stripe rust is illustrated by results given in table 2. Yields of grain are shown for eight varieties tested in areas infected by stripe rust. The relative yields of the varieties both in the presence of stripe rust and in all trials are shown in table 3. These results demonstrate the relative productive capacity of the varieties when grown under a wide range of conditions.

The severity of damage from stripe rust was greater for Onas 53, the later maturing variety, than for the early maturing variety, Ramona 50, which tended to escape serious damage in tests where stripe rust became established late in the growing season. Results presented in table 3 have been duplicated and confirmed in large field scale farm-type strip tests conducted by farm advisors in 11 counties with the cooperation of local growers and the California Crop Improvement Association.

The quality of grain produced was also influenced by stripe rust. The bushel weight of susceptible varieties was reduced significantly in trials where the disease was serious. A susceptible variety that would normally produce high yields of high quality wheat under stripe rust-free conditions might produce, not only low yields, but wheat unfit for milling, under stripe-rust conditions. Thus, the

growers' financial loss would be caused both by a smaller amount of wheat to sell and by a lower price per unit of wheat sold.

In introducing new wheat varieties, many factors other than resistance to stripe rust alone must be considered. The varieties should be generally well-adapted and suitable to the needs of the wheat milling industry. Sample lots of grain from trials conducted in 1961, 1962 and 1963 were submitted to millers in California for milling and baking tests to determine if the stripe rust-resistant varieties have acceptable quality characteristics. California millers continue to show a preference for Ramona 50 and favor its continued production in areas where stripe rust has not caused serious damage. The variety Onas 53 is also favored in some producing areas because it has acceptable pastry flour characteristics. Yaqui 54, in areas where it can be produced at protein levels 12% or higher (14% moisture basis), and Nainari 60 are felt to be the best replacements in areas where stripe rust has been serious on established varieties. Lerma Rojo is not considered to be as useful to the California millers as the other varieties. This variety may become more important if the floral infection of Nainari 60 and Yaqui 54 continues to be serious in the years ahead. Future milling studies will help to determine the effect of floral infec-

and Pitic 62. Note that Nainari 60 and Pitic 62 ed of each variety is immediately below spikes.



TABLE 2: WHEAT YIELDS IN STRIPE RUST-INFECTED AREAS (POUNDS PER ACRE)

Location	Year	Ramona 50	Wh. Fed. 54	Onas 53	Idaed 59	Yaqui 54	Nainari 60	Lerma Rojo	Pitic 62
Sutter Co.	1961	2720	2200	2110	—	4140	—	4380	—
U. C. Davis	1961	4420	2880	2210	—	4060	—	4750	—
Sutter Co.	1962	4610	4150	3350	4190	4160	4850	4450	—
U. C. Davis	1962	3350	3170	—	3430	4050	4660	4300	—
San Joaquin Co.	1962	2410	2210	—	2830	3010	—	3310	—
Sutter Co.	1963	2330	1800	1570	2230	3200	3100	3770	3350
U. C. Davis	1963	2000	—	1040	1600	3150	3140	3700	3080
Fresno Co.	1963	3050	1940	1510	1640	3480	3550	3880	3700



Characteristics of Nainari 60, one of the varieties showing resistance to stripe rust, at a field strip trial conducted by University of California Agricultural Extension Service and the California Crop Improvement Association.

tion by stripe rust on the baking performance of these two varieties. At this time, insufficient testing has been conducted on the flour quality of Pitic 62 to determine its potential as a milling wheat under California conditions.

The performance of the Mexican varieties in tests where stripe rust has not been present or present only at very low levels indicates that these varieties will produce yields equal to established California varieties. This is important since the possibility of a severe outbreak of stripe rust cannot be predicted at planting time.

The varieties all show adequate resistance to shattering under most growing conditions. Awne varieties such as Nainari 60, Lerma Rojo and Pitic 62 may shatter more than non-awne varieties, if left standing too long after maturity in windy districts.

Lodging resistance

Lodging resistance in Nainari 60 and Yaqui 54 appears to be equal to that of Ramona 50. Lerma Rojo and Pitic 62 have shown a tendency to lodge in some trials, but they are not considered to be so weak-stawed that they will cause serious management difficulties. Results from combine-harvested strip trials conducted

TABLE 3: WHEAT YIELDS COMPARED TO YAQUI 54

	Trials in stripe rust-infected areas		All trials conducted	
	No. of Comparisons	% of Yaqui 54	No. of Comparisons	% of Yaqui 54
Romana 50	8	85.8	19	92.7
Wh. Fed. 54	7	70.3	16	79.2
Onas 53	6	53.1	13	70.0
Idaed 59	6	75.6	14	83.8
Nainari 60	5	107.0	11	106.4
Lerma Rojo	8	111.2	19	106.9
Pitic 62	3	103.1	6	102.6

by farm advisors indicate that there are no harvest problems with these varieties. Lerma Rojo may require minor combine adjustments because of its large seed and because of the fact that the seed is held tightly in the wheat spike.

Observations show the varieties to be equal to or better than California varieties in resistance to Septoria leaf blotch. Nainari 60 and Pitic 62 have shown a high level of tolerance to the disease. Pitic 62 appears to be more susceptible to root rot than California varieties.

All of the Mexican varieties are susceptible to races of bunt or stinking smut to which California varieties are resistant. Seed treatment with mercury compounds prior to planting prevents this disease. None of the Mexican varieties should be planted without this protection.

Introduction of wheat varieties developed in other areas will continue as a part of the search for high-yielding, well-adapted, stripe rust-resistant varieties which have those quality characteristics desired by the milling industry. Several experimental lines obtained through the Mexican program have shown promise in limited California testing. A breeding program is also underway at Davis to transfer resistance to stripe rust into California varieties acceptable to both growers and the milling industry. In the meantime, growers in areas which have experienced serious stripe rust losses in recent years may wish to consider the use of Nainari 60, Yaqui 54 or Lerma Rojo.

Certified seed of these varieties is not currently available in California. However, a number of California farmers have non-certified seed available for commercial use.

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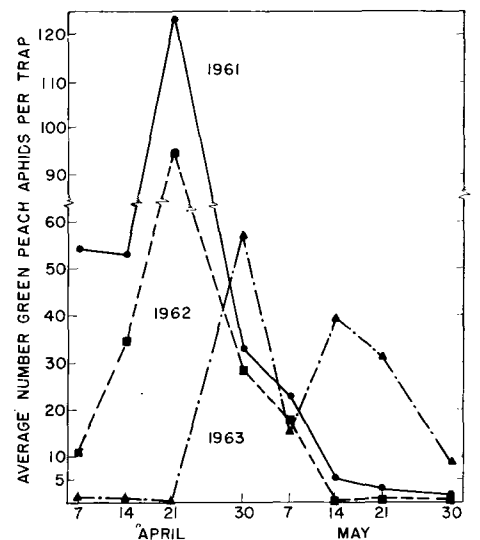
Much of the yield information was obtained from trials conducted in cooperation with farm advisors P. C. Berryman, San Luis Obispo; R. S. Baskett, San Joaquin; L. L. Buschman, C. L. Elmore and J. H. Lindt, Jr., Sutter; B. B. Fischer, Fresno; T. E. Kearney, Yolo; K. H. Ingebretsen, Colusa; T. Lyons, Sacramento; M. D. Morse, Butte; W. E. Pendery, Tulare; and with local growers in each of these counties.

Cooperators in the milling and baking tests were General Mills, The Pillsbury Company, The California Milling Company, Quaker Oat Company, and USDA Western Wheat Quality Laboratory.

Late-Planted Production

THE BEET YELLOWS VIRUS, the beet western yellows virus and the sugar beet mosaic virus are all aphid-borne, and when transmitted to sugar beets at an early stage of growth result in additive damages which can cause production losses of 50% and more. Overwintered sugar beets, harboring all three viruses, are an important source of infection for the spring-planted crop. The green peach aphid, the principal insect transmitting these viruses, reproduces rapidly as tem-

WEEKLY AVERAGES OF GREEN APHIDS TRAPPED DURING APRIL AND MAY, DAVIS, 1963. (AVERAGES BASED ON CATCHES IN EIGHT YELLOW PAN WATER TRAPS)



EFFECT OF PLANTING DATE ON GROSS SUGAR YIELD AT DIFFERENT PLANTING DATES OF HARVEST, DAVIS, 1963

