

the light—will succumb to adverse conditions since foliage leaves have little “push-power” themselves. The depth of seeding, therefore, should not exceed the potential coleoptile length or 1½ to 2 inches.

Research is being continued toward correlating coleoptile length with rate of field emergence. How soil temperatures as well as other factors at planting time and during emergence affect stand estab-

lishment in California's wheatlands will be investigated. Laboratory germination techniques will be used for screening various generations of breeding material prior to field plantings and eliminating those selections with inherently poor coleoptile length and/or seedling vigor.

It is hoped that continuous plant breeding efforts combined with laboratory, greenhouse and field evaluations, will result in high yielding, short-statured wheat

varieties for California growers that will have an inherent capacity for strong, rapid, early growth and improved potential for satisfactory stand establishment.

J. T. Feather is Assistant Specialist in Agronomy, C. O. Qualset is Assistant Professor of Agronomy, and H. E. Vogt is Laboratory Technician in Agronomy. J. D. Prato assisted by providing much of the plant height data reported here.

New Sugar Beet Varieties Reduce Losses from Virus Yellows

J. S. MCFARLANE · I. O. SKOYEN

SUGAR BEET PRODUCTION in California is generally hampered by the damaging effect of virus yellows. Earlier research by plant pathologists had shown that there are two separate yellowing diseases involved: beet yellows, and beet western yellows. They are caused by two distinct viruses, both of which are spread by aphids. The green peach aphid, *Myzus persicae* (Sulzer), is the principal vector. The two diseases produce similar symptoms and are difficult to distinguish in the field. First symptoms consist of a slight yellowing of the plant. Vein clearing or etching of young leaves may also be an early symptom of beet yellows, but not of beet western yellows. Older leaves yellow, develop necrotic spots, and die prematurely. Symptoms are usually more severe with beet yellows.

Western yellows

Beet western yellows has a wider distribution than beet yellows and occurs in all beet-growing districts of California. High percentages of infection occur each year in many areas. Beet yellows is widespread in the coastal valleys. Infection often occurs in the Imperial Valley, but frequently takes place after the beets have made much of their growth. In the Central Valley, beet yellows is often a serious problem in districts that grow beets as a continuous crop.

Beet yellows is the more damaging of the two diseases and may cause crop losses of 20 to 40 per cent. Losses from beet western yellows range from about

Two hybrid sugar beet varieties with moderate resistance to virus yellows have been released to California growers. The varieties designated US H9A and US H9B are both monogerm and were developed at the U. S. Agricultural Research Station, Salinas. The new varieties perform best in those areas of the State in which damage from yellows is severe, but they also perform well under yellows-free conditions. In 17 tests under conditions of moderate to severe yellows, US H9A produced 22 per cent more sugar than did the widely grown US H7 variety. In 11 tests, US H9B produced a 27 per cent higher yield of sugar than did US H7. Both varieties averaged about 0.3 of a percentage point higher in sucrose than did US H7. Seed has been produced by the sugar companies and is now available for wide scale planting.

10 to 20 per cent. When both viruses are present, the losses are additive. Losses are greatest when infection occurs to young plants.

Breeding program

A breeding program to develop varieties resistant to yellows has been underway at the U.S. Agricultural Research Station, Salinas, since 1955. A survey of more than 350 different varieties and breeding lines failed to uncover a source

of high resistance. Improvements in resistance have been made by selecting from existing varieties and breeding lines after field inoculation with a combination of beet and western yellows viruses. Greatest progress has been made with selections from US 75, an open-pollinated, multigerm variety that was widely used in California during the 1950s. After five successive generations of selection, the 413 line (which shows about one-half as much damage from yellows as US 75) was developed. The selection is multigerm and does not yield enough to be used as a commercial variety. Extensive testing has shown 413 to perform well when used as the pollen parent in hybrids.

US H9A and US H9B

Two monogerm, hybrid varieties utilizing the 413 selection as the pollen parent have been released for use by sugar beet growers. The varieties, designated US H9A and US H9B, were developed at the U. S. Agricultural Research Station in cooperation with the Beet Sugar Development Foundation, the California Beet Growers Association, and the University of California. They have been tested during the past three years by the U. S. Department of Agriculture and the California sugar companies.

US H9A has the parentage (562HO x 569) x 413. The parentage of US H9B is similar except for the substitution of 546 for the 569 inbred. The seed-bearing parent, 562HO x 569, is an F₁ hybrid

PERFORMANCE OF US H9A AND US H9B EXPRESSED IN PER CENT OF PERFORMANCE OF THE STANDARD US H7 VARIETY IN TESTS EXPOSED TO VARYING AMOUNTS OF VIRUS YELLOWS.

Location	No. tests	Year	Sugar Yield		Sucrose	
			US H9A	US H9B	US H9A	US H9B
SEVERE YELLOWS						
			Gross tons/A		%	
Salinas Valley	1	1965	116	115	97	103
Salinas Valley	2	1966	126	136	102	103
Sacramento Valley	1	1966	134	136	102	104
Salinas Valley	1	1967	120	122	102	105
Average			124	129	101	104
MODERATE YELLOWS						
Salinas Valley	2	1966	122	118	104	104
Imperial Valley	2	1966	129	141	102	103
Salinas Valley	1	1967	107	....	95	....
Salinas Valley	1	1967	111	110	102	99
Imperial Valley	1	1967	123	124	101	99
Imperial Valley	5	1967	123	....	104	....
Average			121	125	102	102
LIGHT YELLOWS						
Salinas Valley	2	1965	120	....	103	....
Imperial Valley	1	1965	117	....	101	....
Sacramento Valley	1	1966	111	107	101	98
Salinas Valley	3	1967	112	....	100	....
Imperial Valley	2	1967	118	....	102	....
San Joaquin Valley	1	1967	112	....	105	....
Average			115	107	102	98

between the male sterile equivalent of the 562 inbred and the 569 inbred. The 562 inbred is an increase of an S₂ monogerm line selected for bolting and curly top resistance. The male-sterile equivalent of 562 has been produced by crossing 562 to a cytoplasmic male-sterile line and then backcrossing to 562. The 569 inbred is the increase of an S₃ monogerm line and possesses moderate resistance to bolting and curly top. The 546 inbred is an increase of an S₂ monogerm line and possesses good resistance to bolting and curly top. Both F₁ seed-bearing parents have good vigor, bolting resistance, and curly top resistance. They have been used extensively in commercial hybrid varieties and have performed well.

In the testing program, the new hy-

brids were compared with US H7, a monogerm hybrid variety used extensively in California. Yield losses from yellows averaged 27 per cent for US H9A, 28 per cent for US H9B, and 40 per cent for US H7. The bolting resistance of the new hybrids is similar to that of US H7 and is adequate to meet the requirements for early planting in most sugar beet growing districts of the State. The curly top resistance of the new hybrids is also good and is a little superior to that of US H7. Damage from curly top can take place when the plants are infected in the seedling stage, but the varieties will withstand the attacks that occur in most areas without serious injury. Downy-mildew resistance has not been determined, but is expected to be equal to that

of US H7. Sugar factory tests have shown that the juice purity of either US H9A or US H9B is equal to other varieties now being grown.

In 17 tests grown under conditions of moderate-to-severe yellows US H9A produced an average of 22 per cent more sugar per acre than did US H7 (see table). In 11 tests, US H9B produced a sugar yield 27 per cent higher than that of US H7. Sucrose averaged about 0.3 of a percentage point higher for the new hybrids than for US H7. Tests under conditions of light yellows infection showed an average of 15 per cent higher sugar yield and 0.2 per cent higher sucrose content for US H9A than for US H7.

Comparisons between US H9B and US 75 are even more striking. In five tests, under conditions of moderate to severe yellows, US H9B produced 68 per cent more sugar per acre and averaged a 0.9 per cent higher sucrose content than US 75. These results show the improvement that has been made in sugar beet varieties during the past 15 years. US 75 was the first variety developed at the U. S. Agricultural Research Station and brought together curly top, bolting, and downy-mildew resistance. In addition to producing higher sugar yields, the new hybrids are monogerm, whereas US 75 is multi-germ.

All areas

The new varieties may be used in all sugar beet production areas of the State where virus yellows cause damage. Greatest improvements in yield occur when yellows infection is severe, but the varieties will also perform well under yellows-free conditions. Neither variety has *Cercospora* leaf-spot resistance, and could be damaged if grown in areas subject to this disease. The two varieties can be used interchangeably. US H9A has been tested more thoroughly than US H9B, but tests show that both varieties are adapted to a wide range of growing conditions.

Seed of the parent lines has been made available to the sugar companies and a limited amount of commercial seed was produced in 1967. Adequate seed should be available for wide scale planting in the 1968-69 season.

J. S. McFarlane is Research Geneticist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Salinas, and Associate in Agronomy, University of California, Davis. I. O. Skoyen is Research Agronomist, Crops Research Division, Agricultural Research Service, U.S.D.A., Salinas.

COMPARATIVE PERFORMANCE OF FOUR SUGAR BEET VARIETIES GROWN UNDER CONDITIONS OF MODERATE-TO-SEVERE YELLOWS INFECTION.

