C773 yielded significantly more gross sugar under both yellow and white root conditions than its unselected parents. C773 is moderately resistant to virus yellows and has fair to moderate resistance to curly top and bolting. It has root and sugar yield similar to vigorous open-pollinated, self-sterile breeding lines and high sucrose concentration. As a consequence of experimental hybridizations, it was given yield performance equal to currently recommended hybrid cultivars. To maintain maximum heterozygosity and recombination, C773 should be increased by harvesting seed from the self-sterile plants only. C773 should also be useful as a source of yellows resistance within a self-fertile background. It also can be used as a source population for continued mass, recurrent, or reciprocal-recurrent selection in which a combination of self-fertility and genetic male-stereility is required.

C789 (Reg. No. GP 18) is a self-fertile, monogerm, random-mating population that segregates at about 50% for genetic male sterility (a.a). It has mixed red and green hypocotyls. A high frequency of the plants in C789 are a-a. In 1969, 10 monogerm, self-fertile inbred lines were crossed to the male-sterile segregates of a multigerm line similar to NB1. Six multigerm, self-fertile inbred lines were crossed to male-sterile segregates of a monogerm line similar to C563. After one cycle of selfing, the a-alal plants, and randomly outcrossed, were selected to 29 monogerm, self-fertile inbred lines planted at the perimeter of the isolation plot. Eight of these pollinators were common to the monogerm lines first used. Except for NB1 and C04, all types of the lines listed in these composite pollinators were developed in the yellows resistance breeding program at Salinas. Their reactions to virus yellows ranged from susceptible to moderately susceptible. Plants derived from the composited seed were selected for monogerm and were conserved in 1972. Subsequently, this population was randomly mated in an isolation plot by harvesting seed from the male-sterile segregates. After one cycle of mass selection for gross sugar yield from spaced plants that were uniformly inoculated with BYV-BWYV, the population was again randomly mated to produce the line designated C789. In each cycle plants were selected for the monogerm trait and spaced plant types were maintained.

In preliminary tests, C789 was moderately susceptible to virus yellows and moderately resistant to curly top and bolting. It had root yields equal to that of a low-vigor open-pollinated line and had good sucrose concentration. C789 is relatively divergent from the multigerm parental lines currently used in California. It should be useful to breeders in developing monogerm, type-O, bolting-resistant, curly top resistant, inbred lines with some degree of resistance or tolerance to virus yellows. Because germination and other seed traits associated with the monogerm characteristic continue to be a problem for sugar beet breeders and growers, this and other monogerm, random-mating populations may be especially useful for the improvement of such traits as percent and speed of germination, salt tolerance, resistance to mold and freedom from twinning (polyembryony). C789 may also be useful for initiating such population improvement techniques as recurrent and/or reciprocal-recurrent selection. Combinations of the full-sib, half-sib, and testcross family evaluation programs are not practical for self-fertile or self-sterile populations could be used. By using S and testcross family evaluation, the authors showed that a population similar to C789 had appreciable genetic variance for components of sugar yield and impurity (concentrations of NH4-N, Na, and K). C789 should be increased by harvesting seed from randomly mated male-sterile plants.

C789 CMS (Reg. No. GP 15) is a cytoplasmic male-sterile companion line to C789 derived from the fourth backcross to the CMS source. Preliminary tests have shown that it is nearly identical to C789. The plant vigor and seed yield of C789 CMS was equal to or superior to a-a. C789 CMS was used in seed plots at Salinas and in an observation plot at Salem, OR. Therefore, it has sufficient seed yield potential to be used directly as the seed-bearing parent for the production of hybrid seed. In preliminary tests at Salinas and Brawley, experimental hybrids from crosses of C789 CMS with C17 and other multigerm pollinators gave sugar yields that were from 92 to 106% of the yield of the currently recommended hybrid cultivar. C789 CMS should be experimentally tested with pollinators developed by the USDA and sugar companies to determine the feasibility of using broad-based hybrids or essentially synthetic composites for commercial sugar beet production. C789 CMS should also be useful as a tester for the development of pollinators. As the CMS source, C789 CMS should reduce the number of backcrosses required to maintain near equivalency in lines isolated from C789.

REGISTRATION OF 11 GERMPLASM LINES OF SUGARBEETS
(Reg. Nos. GP 20 to GP 30)

R. T. Lewellen, J. S. McFarlane, and I. O. Skoyen

Eleven sugarbeet (Beta vulgaris L) breeding lines were developed by AR-SEA-USDA, in cooperation with the Beet Sugar Development Foundation and the California Beet Growers Association, Ltd. They were released in June 1977. Most of these breeding lines have been tested extensively in California at the Salinas and Brawley research stations and by sugar company researchers. They were released because of their potential value in breeding programs as sources of resistance to virus yellows, infected by beet yellows virus (BYV) and beet western yellows virus (BWYV). Several of these breeding lines also may have potential as parental lines in the production of commercial hybrids. They are continuing to be evaluated as components of hybrids that combine multiple-disease resistance with increased sugar production. Both male-sterile and non-self-sterile lines may obtain small quantities of seed upon written request to R. T. Lewellen, U. S. Agricultural Research Station, P. O. Box 5086, Salinas, CA 93915.

C01 (Reg. No. GP 20) is a self-sterile, multigerm line derived from a composite cross made in 1965 among lines resistant to yellows and susceptible to curly top. The F2 of this composite cross was advanced by four cycles of mass selection (recurrent phenotypic selection) from spaced plants that were uniformly inoculated with severe isolates of BYV and BWYV. Individual plant performance for sugar yield (root weight x sucrose concentration) was used as the selection criterion. C01 has moderate resistance to virus yellows but only fair resistance to curly top and bolting. C01 has shown variability for reaction to other diseases, including powdery mildew, incited by Ervestiphe polygoni DC, and erwinia root rot incited by Erwinia spp. Both C01 and its hybrids have higher root yield and sucrose concentration but slightly less resistance to virus yellows than the parental lines C13 or C17 and their hybrids. C01 has shown promise as a pollinator to produce yellow-resistant hybrids for areas where severe curly top and bolting are not a concern.

C31 (Reg. No. GP 21) is a self-sterile, multigerm line derived from a composite cross similar to C01. After the second cycle of mass selection for resistance to virus yellows, nonselected plants were selected from an overwintered planting. The increase of this selection was followed by an additional cycle of mass selection for high sugar yield with emphasis on sucrose concentration and freedom from soft rot incited by Erwinia spp. C31 is nearly equivalent to C01 for performance, disease resistance, and combining ability; it is significantly improved over C01 for non-bolting tendency and resistance to erwinia soft rot. In several preliminary field tests, experimental hybrids between C31 and curly top resistant seed-bearing parents have shown significantly higher sugar yields than currently used commercial hybrids. Additional tests in hybrid combinations are required to determine the potential of C31 as a commercial pollinator.

C04 (Reg. No. GP 22) is a self-sterile, monogerm line derived from a cross between the two divergent yellow-resistant sources, C13 and C234. C04 was obtained from the second successive cycle of combined mass selection for resistance to yellows and good bolting. C04 has fair to poor curly top resistance, but good bolting resistance. Its combining ability for the components of yield is similar to that of C13.

C22 (Reg. No. GP 23) is a self-sterile, multigerm line derived from a cross between C17 and C04. After a cycle of recombinants, the cross was advanced by two cycles of combined mass selection for resistance to virus yellows, infected by beet yellows virus (BYV) and beet western yellows virus (BWYV). Several of these breeding lines also may have potential as parental lines in the production of commercial hybrids. They are continuing to be evaluated as components of hybrids that combine multiple-disease resistance with increased sugar production. Both male-sterile and non-self-sterile lines may obtain small quantities of seed upon written request to R. T. Lewellen, U. S. Agricultural Research Station, P. O. Box 5086, Salinas, CA 93915.

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