Registration of HWSA(FG)C1 and HWSB(FG)C1 White Endosperm Food-Grade Maize Germplasm

Maize (Zea mays L.) synthetic populations HWSA(FG)C1 (Reg. no. GP-322, PI 587034) and HWSB(FG)C1 (Reg. no. GP-323, PI 587035) were developed by the Purdue University Agricultural Research Programs, West Lafayette, IN. HWSA(FG)C1 and HWSB(FG)C1 were released in March 1995 for their potential as germplasm sources in development of white endosperm food-grade corn with improved grain quality, hybrid yield potential, and agronomic value. Both HWSA(FG)C1 and HWSB(FG)C1 were developed by intercrossing released and unreleased inbred lines selected for hybrid grain yield potential or hard endosperm kernels.

HWSA(FG)C1 was derived from 19 inbred lines, 2 previously released (H124w, H126w) and 17 experimental (inbreeding S1). Germplasm sources of these parental lines were H White Synthetic D (9 lines), H Colus White (5 lines), H Synthetic Lancaster—Oh43 White (2 lines), H Synthetic 99 White (1 line), and Mo17 White Composite (2 lines). H-designation germplasm sources were previously released by the Purdue Agricultural Experiment Station (AES). H White Synthetic D was derived from 18 public and 8 commercial white endosperm lines, representing mostly southern United States germplasm. H Colus White is a white endosperm version of H Colus, derived by crossing 6 public yellow U.S. inbred lines with 8 yellow and 4 white endosperm midlatitude tropical lines from Columbia. H Synthetic Lancaster—Oh43 White was derived by crossing 10 public yellow U.S. Corn Belt lines with 24 commercial white sources, mostly related to the Lancaster—Oh43 complex. H Synthetic 99 White is a white endosperm version of H Synthetic 99, derived from crosses of inbred line H99 with 6 other public yellow inbred lines. Mo17 White Composite is a white endosperm population with Mo17 parentage released by the University of Missouri AES, Columbia, MO, and the USDA-ARS (1). Twelve of 19 lines in the parentage of HWSA(FG)C1 were chosen for hybrid grain yield potential based on performance trials with three replicates in a minimum of two locations over 2 yr. These included Purdue AES released lines H124w and H126w, and an unreleased sister line of H126w. The remaining 7 of the 19 parental lines were chosen for endosperm hardness based on visual ratings of kernel translucence when viewed on a light box. High translucence was associated with an increased degree of endosperm hardness. Lines with smaller than normal kernel size were not selected, regardless of degree of translucence. HWSA was initiated by combining 12 parental lines in row-pair crosses, each pair consisting of 1 line selected for yield potential and 1 line selected for grain hardness. The resulting F1 families and 7 additional lines were then included in a bulk-pollen crossing block for random mating to form HWSA Cycle 0.

HWSB(FG)C1 was derived from 12 inbred lines, 1 line previously released (H122w) and 11 experimental (inbreeding S1). H122w is a white endosperm backcross version of B73. Germplasm sources for the remaining lines were H Synthetic 73 White (3 lines), HSSS White (2 lines), BS17 White (3 lines), and white endosperm conversions of inbred line B89 (3 lines). H Synthetic 73 White is a white endosperm version of H Synthetic 73, derived from crosses of inbred line B73 with 8 other public yellow inbred lines. HSSS White was developed from commercial germplasm by crossing a yellow elite synthetic related to inbred line B14 with 12 white endosperm lines recovered from germplasm in the Stiff Stalk Synthetic heterotic group. BS17 White is a white endosperm version of the synthetic BS17, developed by the Iowa Agriculture and Home Economics Experiment Station and the USDA-ARS (2). All germplasm sources except B89 White and BS17 White conversions have been previously released by the Purdue AES. Six of the 12 lines in the parentage of HWSB(FG)C1 were chosen for hybrid grain yield potential, and the remaining 6 lines were chosen for grain endosperm hardness using the same criteria as outlined for HWSA. HWSB was initiated by combining 12 lines in row-pair crosses, each pair consisting of 1 line selected for yield potential and 1 line selected for grain hardness. The resulting F1 families were then included in a bulk-pollen crossing block for random mating to form HWSB Cycle 0.

Cycle 1 of recurrent selection in HWSA Cycle 0 and HWSB Cycle 0 involved mass selection for rind thickness, leaf blight tolerance, and kernel density, followed by full-sib reciprocal recurrent selection for grain yield. For each synthetic, 50 progeny rows were planted and approximately 350 plants were self-pollinated. Rind puncture resistance was measured on all pollinated individuals 3 wk post pollination at the first fully elongated internode above the ground using a modified digital penetrometer (3). The 2 plants with the highest penetrometer readings in each row (excluding end plants) were selected, while also taking into account severity of disease lesions resulting from artificial inoculation for northern corn leaf blight [caused by Exserohilum turcicum (Pass.) K.J. Leonard & E.G. Sugel], southern corn leaf blight [caused by Bipolaris maydis (Nisikado & Miyake) Shoemaker], and northern corn leaf spot [caused by Bipolaris zeicola (G.L. Stout) Shoemaker]. Plants exhibiting low tolerance to leaf blight were excluded from selection. Penetrometer readings averaged 7.6 load-kg per plant (SD = 1.5) for HWSA selections, and 8.8 load-kg per plant (SD = 1.7) for HWSB selections. After harvest, grain from each selected plant was analyzed for grain hardness using a digital pycnometer (4). The 50 S1 ears with the highest kernel density were selected in each synthetic, excluding ears with abnormally small kernel size as judged by visual evaluation. Pycnometer readings averaged 13.6 g cm"-3 (SD = 0.01) for HWSA selections, and 13.3 g cm"-3 (SD = 0.01) for HWSB selections. Progeny rows of selected S1 ears from HWSA Cycle 0 were paired at random with those from HWSB Cycle 0, and reciprocal full-sib families were produced by making plant-to-plant crosses among row-pairs using each of 5 plants row"-1 as both male and female. The 10 cross-pollinated ears from each row-pair were then shelled in bulk. The resulting 50 full-sib families were evaluated using a randomized complete block design with three replicates at Wanatah and West Lafayette, IN. Selection of 20 full-sib families was based primarily on highest grain yield. Stalk lodging and grain moisture at harvest were considered during selection, but not included as part of a formal index. Cycle 0 S1 progenies corresponding to selected full-sib families were then grown from remnant seed and intermated within each synthetic to form HWSA(FG)C1 and HWSB(FG)C1. Intermating was accomplished by partitioning S1 progeny rows into two blocks of 10 rows each, bulking pollen from all rows per block (5 plants row"-1) and crossing onto 5 ears row"-1 in the opposite block. Individual plants were never used as both a male and female when making reciprocal bulk pollinations.

Both synthetics are vigorous, with intermediate to tall plant height and ears at midplant or above. Both synthetics are variable in kernel type (degree of dent) and kernel color (degree of whiteness). Average time to 50% pollen shed was 64 to 65 d (702 to 716 GDD, base 10°C) with a maturity range of AES700 to 800.

Breeder seed stocks are maintained by the Purdue Agricultural Research Programs and can be obtained in 500-kernel samples by writing to the corresponding author. Recipients of seed samples are encouraged to make appropriate recognition of the source when the germplasm is used in development of new cultivars, parental lines, germplasm, or genetic stocks.


References and Notes