F3:4 seed were produced from resistant plants identified in the previous generation. The F4 seed were evaluated for agronomic characteristics in a field near Athens, GA, in 1992 and for resistance to Mj and soybean cyst nematode [Heterodera glycines (Ichinokoh)] (SCN) races 3 and 4 in a greenhouse. The F4 seed were harvested individually from 15 plants within each of the most agronomically desirable, Mj- and SCN-resistant lines. Seed from each F4 plant were grown in a separate row in Puerto Rico during the winter of 1993.

The F4 seed were harvested from selected rows and grown in yield trials near Athens and Plains, GA, during 1993. The F5 seed from the nine most productive lines were planted in yield trials in 1994 near Athens and Plains. In addition to selected Mj- and SCN-resistant lines, each yield trial contained parental and check genotypes. Across environments, G93-9223 yielded 95% more than PI 230977 and had the same yield as 'Bryan' (7). In two greenhouse experiments, G93-9223 and PI 230977 averaged 10 and 14 Mj galls per plant, respectively, and Bryan, a cultivar possessing the highest level of Mj resistance that is currently available (8), averaged 30 Mj galls per plant. 'CNS' (6), the Mj-susceptible check, averaged 114 galls per plant. G93-9223 is a Maturity Group VII germplasm that matures about the same day as Bryan and 6 d earlier than PI 230977. It is 5 cm shorter than Bryan and has similar lodging resistance. G93-9223 has white flowers, tawny pubescence, tan pod walls, and a determinate growth habit. The seeds have a yellow coat and a black hilum. G93-9223 is resistant to the southern [M. incognita (Kofoid & White) Chitwood] and peanut [M. arenaria (Neal) Chitwood] root nematodes; Race 3 and Race 14 of SCN, and bacterial pustule [caused by Xanthomonas campestris pv. glycines (Nakano) Dye].

Seed of G93-9223 will be maintained by the Dep. of Crop and Soil Sciences, Univ. of Georgia, Athens, GA 30602. Small quantities of seed for research and breeding can be obtained from the corresponding author. It is requested that appropriate recognition be made of the source of this germplasm when it contributes to the development of a cultivar or germplasm.

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References and Notes
9. B.M. Luzzi, Dep. of Crop Science, Univ. of Guelph, Guelph, ON N1G 2W1, Canada; H.R. Boerma, J. Tamulonis, and E.D. Wood, Dep. of Crop and Soil Sciences, and R.S. Hussey and S.L. Finnerty, Dep. of Plant Pathology, Univ. of Georgia, Athens, GA 30602; and D.V. Phillips, Dep. of Plant Pathology, Georgia Exp. Stn., Griffin, GA 30223. Contribution from the Georgia Agric. Exp. Stations, Athens, Ga. Research supported by state and Hatch funds allocated to the Georgia Agric. Exp. Stations and grants from the Georgia Agric. Commodity Commission for Soybeans. Registration by CSSA. Accepted 31 Aug. 1996. *Corresponding author (rboerma@uga.cc.uga.edu).


Registration of Four Sorghum Germplasm Random-Mating Populations

Four grain sorghum [Sorghum bicolor (L.) Moench] random-mating populations, AD9B(MS1C2, AD11B(MS1C2, AD12R(MS)C2, and AD13R(MS)C2 (Reg. no. GP-401 to GP-404, PI 595205 to PI 595208), were developed by the Aula Dei Experimental Station of the Higher Council for Scientific Research (CSIC), Zaragoza, Spain, and were released in 1996. These materials were developed from released populations NP12B(S1)C2 (1), RP2B(S1)C2(ECB) (2), NP21R(MC4) (1), and RP1R (3), respectively.

These populations were improved in Spain by recurrent selection methods under a limited irrigation schedule. First, they were subjected to a cycle of mass selection on male-sterile plants in 1987 as follows. Seed from the original populations was planted in large plots (450 m²), where a selection pressure of 30% was applied on the male-sterile plants (to select about 150 plants per population). Selection was based on visual estimations of grain yield, plant health, and other agronomic characters, such as combine-height, stalk diameter (plants with too thin stalks were not selected), and maturity (late maturity plants were not selected). Seed from the selected male-sterile plants was bulked and was sown in 1988 to allow recombination through random-mating, producing Cycle 1M populations. Concurrently, SI progeny from 150 fertile panicles, bagged in the 1987 selection plots, were evaluated in yield trials, and the top 25 lines were selected from each population based primarily on yield and secondarily on other agronomic traits (as in Cycle 1 M).

In 1989, each population was grown in isolation. Plants derived from remnant SI seed of the 25 selected lines per population were used as pollinators, and male-sterile plants from Cycle 1M populations were used as females. The seed obtained from these crossings was sown in 1990 (AD12R and AD13R) or in 1991 (AD9B and AD11B) for further recombination (by open pollination in isolation). The seed harvested from male-sterile plants constituted the Cycle 1M populations, as the effects of mass- and SI-selection were confounded. All selection trials were grown under a limited irrigation schedule, which consisted of receiving half the number of flood irrigations (4 or 5 irrigations, 80 mm each) given to a standard maize crop in the region (10 irrigations). In general, water stress was more severe pre- than post-anthesis.

Gain from selection was evaluated in a series of yield trials (4). Bulks of Cycles 0, 1 M, and 1 MS1 of the four populations were evaluated for 2 yr at three locations. The six resulting environments were a representative sample of sorghum growing conditions in the region, including normal sowing date with either optimum or limited irrigation, and late sowing with optimum irrigation. Cycle 1M populations showed a significant 10% grain yield gain over Cycle 0 populations. The percentage of emerged seedlings was also significantly improved, as the selection environments always presented some degree of soil crustng, and plant height increased significantly. Gains in grain yield were larger in environments with conditions resembling the selection environments.

A further cycle of selection based on SI progenies was carried out between 1993 and 1995. SI progenies (90, mainly from Cycle 1 MS1, but also some from previous cycles) were evaluated in replicated yield trials under limited irrigation for 2 yr. Cycles 2 MS2 were formed in 1995 by recombination of remnant SI seed from the top 15 progenies per population.

All populations segregate for m35 genetic male sterility, and are sources of tolerance to water stress. No selection for seed size or color was practiced, so the populations exhibit a range of variability for these traits. All original populations had many plants presenting symptoms of foliar diseases; young plants were removed before pollination in the Cycle 1 M selection plot and in all recombination plots. The health of the populations was clearly improved after selection, though they have not been selected or