Research Notes : United States : SG1 -A recently constructed random-mated soybean population possessing the ms2 gene for genetic male sterility

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SG1 - A recently constructed random-mated soybean population possessing the ms2 gene for genetic male sterility

Soybean breeders and geneticists may be interested in a soybean population that we constructed and recently released on 1 February 1985. This population, called 'SG1', originated from 156 parental matings and has been random-mated for three generations. SG1 segregates for male-fertile (MF) and male-sterile (MS) plants due to the presence of the ms2 gene (genetic male sterility) in the population (Bernard and Cremeens, 1975; Brim and Stuber, 1973). The parental matings, the F1 selfing generation, and the first random-mating of F2 plants were accomplished at the Nebraska Agriculture Experiment Station. SG1 was then randomly divided into five sub-populations for the second and third random-matings, conducted cooperatively but independently by the Agriculture Experiment Stations of Nebraska, Maryland (Dr. W. J. Kenworthy), Minnesota (Dr. J. H. Orf), and Missouri (Dr. D. G. Helsel), and the Ohio Agricultural Research and Development Center (Dr. S. K. St. Martin).

The initial synthesis of SG1 was accomplished by making all possible two-way crosses between 39 female parental lines and four male parental lines. The pollen donors were Ms2ms2 plants that were selected from near-isogenic, male-sterile, maintainer lines of the adapted cultivars 'Beeson' (maturity Group II), 'Wells' (II), 'Williams' (III), and the genetic type 'T259H' (III). T259H was the original source of the ms2 gene and was a progeny selection from the mating SL11 x L66L-177, where the latter was (essentially) the cross: Wayne X [Hawkeye X Lee]. The ms2 gene had been previously introduced into the other three cultivars by backcrossing methods (Bernard and Cremeens, 1975).

Of the 39 female parents, 31 consisted of 29 ancestral plant introductions and two obsolete cultivars ('Capital' and 'Lincoln'). These 31 strains were chosen on the basis of their frequent occurrences in the pedigrees of public soybean cultivars developed in hybridization programs during the period 1939 to 1980 (Specht and Williams, 1984). Six of the 39 parents were near-isogenic lines of two cultivars ('Harosoy' and 'Clark'). These isolines possessed genes conditioning morphological traits of purported agronomic worth (Hartung et al., 1980), namely Dt2 (semideterminate stem habit), S (short main stem internodes), Pd1 (dense plant pubescence), and pa1 pa2 (appressed plant pubescence). The remaining two female parents were two other plant
introductions ('Manchuria 13177' and PI 360.844) that were unrelated to the other parents. The latter PI strain (also known as 'Raiden') is purported to have a faint floral fragrance attractive to honey bees (Erickson, 1975). The 39 female parents (with respective maturity groups) are listed below:

<table>
<thead>
<tr>
<th>Manitoba Brown</th>
<th>(00)</th>
<th>Korean</th>
<th>(III)</th>
<th>Aoda</th>
<th>(IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI 194654</td>
<td>(00)</td>
<td>Mukden</td>
<td>(II)</td>
<td>Clark-Dt2</td>
<td>(IV)</td>
</tr>
<tr>
<td>Capital</td>
<td>(0)</td>
<td>Richland</td>
<td>(II)</td>
<td>Clark-Pd1</td>
<td>(IV)</td>
</tr>
<tr>
<td>Mandarin (Ottawa)</td>
<td>(0)</td>
<td>Seneca</td>
<td>(II)</td>
<td>Clark-pa1</td>
<td>(IV)</td>
</tr>
<tr>
<td>PI 180501</td>
<td>(0)</td>
<td>PI 65338</td>
<td>(II)</td>
<td>Midwest</td>
<td>(IV)</td>
</tr>
<tr>
<td>Habaro</td>
<td>(I)</td>
<td>A.K. (Harrow)</td>
<td>(III)</td>
<td>Patoka</td>
<td>(IV)</td>
</tr>
<tr>
<td>Mandarin</td>
<td>(I)</td>
<td>Dunfield</td>
<td>(III)</td>
<td>Peking</td>
<td>(IV)</td>
</tr>
<tr>
<td>Sac</td>
<td>(I)</td>
<td>Illini</td>
<td>(III)</td>
<td>Sato-3</td>
<td>(IV)</td>
</tr>
<tr>
<td>Bansei (Ames)</td>
<td>(II)</td>
<td>Jogun (Ames)</td>
<td>(III)</td>
<td>Arksoy</td>
<td>(VI)</td>
</tr>
<tr>
<td>Harosoy-Dt2 S</td>
<td>(II)</td>
<td>Lincoln</td>
<td>(III)</td>
<td>Haberlandt</td>
<td>(VI)</td>
</tr>
<tr>
<td>Harosoy-Pd1</td>
<td>(II)</td>
<td>Manchu</td>
<td>(III)</td>
<td>Hahto</td>
<td>(VI)</td>
</tr>
<tr>
<td>Harosoy-pa1 pa2</td>
<td>(II)</td>
<td>Manchuria 13177</td>
<td>(III)</td>
<td>Ogden</td>
<td>(VI)</td>
</tr>
<tr>
<td>Kanro</td>
<td>(II)</td>
<td>PI 360844</td>
<td>(III)</td>
<td>Roanoke</td>
<td>(VII)</td>
</tr>
</tbody>
</table>

About 5 to 10 F1 seed from the 156 parental matings were generated by hand-pollinations during the period 1978 to 1981. Female parents were emasculated only for those matings where genetic markers were not available to verify F1 authenticity. The F1 plants (genotypically $1Ms_2 M s_2 :1Ms_2 m s_2$) were selfed and individually threshed to obtain F2 seed.

For the first random-mating of SGI in 1982, two randomly selected F2 seeds from each of the 156 matings were composited for planting into a 2-row field plot (12-m length, 76-cm row spacing) in an isolated intermat ing nursery. There was sufficient F2 seed to plant a total of 240 plots. This seed-compositing procedure ensured that F2-plant representatives of each of the 156 parental matings would be in close proximity (within each field plot). This was done to minimize possible spatial limitations imposed on random-mating as a consequence of short-distance, insect-mediated, pollen transfer from MF plants to MS plants. One-half of the 240 field plots were planted in a north-south row direction, with the remaining 120 field plots planted about three weeks later over the top of the first planting in an east-west row direction. This dual-date planting procedure was used to provide a possibly greater overlap in the flowering periods of plants differing in maturity, since large differences in flowering dates can impose temporal limitations on random-mating early- and late-maturing plants. A honeybee hive was placed in the nursery to promote pollen transfer from MF to MS plants (Erickson, 1975).
The F2 plants in the 1982 intermating nursery segregated 7MF:1MS (5Ms2 ms2:2Ms2 ms2:1ms2 ms2). The reduced seed set of MS plants distinguished them from MF plants at maturity, but as a precaution, a large number of MS plants were identified and tagged at flowering for later identification at harvest (Brim and Kenworthy, 1977). MS plants bearing outcrossed seed were gathered at maturity and threshed in bulk. The bulked seed was then randomly subdivided into five equal portions for use by the five cooperating researchers in conducting the subsequent random-matings of SGI.

In the 1983 intermating nurseries, the plants segregated 6MF:1MS (6Ms2 ms2:1ms2 ms2). Each cooperator gathered and threshed in bulk the MS plants in their nurseries, using this bulked seed for advance to the third random-mating generation in 1984. Each cooperator also harvested seed (in bulk and/or by single-seed-descent) from the MF plants growing in the 1983 intermating nurseries, placing this seed in cold storage for subsequent distribution purposes.

In the 1984 intermating nurseries, the plants segregated 1MF:1MS (1Ms2 ms2:1ms2 ms2). The harvest of MS and MF plants in 1984 was identical to that performed in 1983. No seed was exchanged among cooperators during any of the SGI intermatings.

The seed obtained from the 1983 and 1984 harvests of MF plants in the SGI sub-populations will be made available to interested soybean researchers after February 1, 1985. In both years, this seed was derived from heterozygous Ms2 ms2 plants. Therefore, it should result in plants that segregate 3MF:1MS (1Ms2 Ms2:2Ms2 ms2:1Ms2 ms2). The cooperators avoided imposing any artificial selection during the intermatings; however, natural (and inadvertent artificial) selection at each cooperator location may have had different effects on each subpopulation, particularly with respect to the maturity range within these subpopulations.

The unique parental composition of the SGI population (Specht and Williams, 1984), coupled with the facilitation of intermating by means of genetic male-sterility (Brim and Stuber, 1973), may make this population of interest to soybean breeders for use in empirical investigations of soybean response to recurrent selection (St. Martin, 1981). Furthermore, by inter-planting recently released cultivars or elite breeding strains with SGI in a common nursery, many natural matings of SGI MS plants with these cultivars can be accomplished, thereby generating progeny that can be evaluated in
conventional breeding programs (Burton and Brim, 1977). Researchers interested in obtaining seed of any of the SGI subpopulations (identified as NBSGI, MDSGI, MNSGI, MOSGI, OHSGI) should address written requests for seed to the authors or respective cooperators. Requests for reasonably large amounts of seed can be accommodated. We plan to continue random-mating SGI without selection for several more generations; thus, seed from 1985 and later harvests may be used to honor future seed requests.

References


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