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Frequency Distribution for Soybean Seed Size in F_2 and F_3 Generation

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Abstract

Seed size ia a important yield components in soybean (*Glycine max* L.). The seed size frequency distributions in the mating between two *G. max* parents possessing quite different seed size exhibited a continuous distribution in the F_2 and F_3 generations. A progeny seed size equal to that of either parent was not observed in either generation. The population mean seed size in each generation was less than the mid-parent, with the distribution of lines skewed toward the small seeded parent

Key words : *Soybean, seed size, frequency distribution*

Introduction

Seed size is a primary consideration in the development of many types of specialty cultivars in soybean, ranging from the small- seeded types used for the natto and sprouting markets, to the large- seeded types, used for tofu, miso, and vegetable markets. Ting[1)], Williams[2)], Weber[3)] and Carpenter and Fehr[4)] reported the frequency distribution for seed size in the progenies of *G. max* and *G. soja* crosses. It is thus not known on frequency distribution for seed size in a mating between two *G. max* parents possessing quite different seed size. In the study reported here, we derived a population from the mating of two *G. max* parents that had substantial extremes in seed size. Our objective was to observe the frequecncy distribution for seed size in F_2 and F_3 generation.

Materials and Methods

The study was conducted with a population derived from a mating between the *G. max* cultivar Mercury (female parent) and the *G. max* plant introduction PI 417.468 (male parent). Mercury, a recent specialty cultivar released by Specht et al.[5)] has small seed, with an average seed size of 7.5 g/100 seed. Conversely, PI 417.468 has large seed with an average size of 36 g/100 seed. During the summer of 1993, pollinations were made in a field nursery located on the University of Nebraska-Lincoln, Lincoln, Nebraska, U.S.A. (UNL) East Campus. The resultant F_1 seeds were planted on 7 May 1994 in the UNL East Campus field nursery. F_1 hybridity was confirmed using pod color (i.e., Mercury was the recessive tan female, PI417.468 was the dominant brown male). A random sample of F_2 seeds was

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planted on 17 May 1995 in the UNL East Campus field nursery as a bordered block of six 25-seed plots that consisted of single 0.90 m row spaced 0.75 m apart. The 107 plants were individually threshed. A random sample of 25 F_3 seeds derived from each of the 107 F2 plants planted on 17 May 1996 in the UNL East Campus field nursery in plots 0.90 m long spaced 0.75 m apart. The experimental design for this field test was a randomized complete block, with four replications of the 107 entries (i.e., $F_{2:3}$ lines). When the F_3 plants in each plot reached maturity, they were threshed in bulk. The harvested seed was air- dried to a constant moisture.

Seed sizes (g/100 seed) for the F_2 plant generation were measured by weighing the F_3 seed produced by each F_2 plant and dividing by the number of seeds. In the $F_{2:3}$ families, two samples of 100-seed were weighed from each of the four replicates grown in the field. The eight estimates were averaged to obtain a mean seed size (g/100 seed) for each family.

Results and Discussion

The seed size frequency distributions in the 107 F_2 plants and $F_{2:3}$ lines are shown in Fig. 1. Seed size in the F_2 and $F_{2:3}$ generations exhibited a continuous distribution. Seed size ranged from 10.5 to 22.5 g/100 seed in the F_2 plant generation and from 11.9 to 21.7 g/100 seed in the $F_{2:3}$ lines. A progeny seed size equal to that of either parent was not observed in either generation. The population mean seed size in each generation was less than the mid-parent, with the distribution of lines skewed toward the small seeded parent (Fig.1). In the F_2 and $F_{2:3}$ generations, the population mean was closer to the geometric parental mean $[(P1 \times P2)^{1/2}]$ of 16.0 and 17.4 g/100 seed, respectively. The observed seed size means of F_2 and $F_{2:3}$ generations were substantially less than the mid-parents values, and there was no recovery of parental types in either generation. These observations, which Maughan et al.[6] also noted, are consistent with an additive gene model of many loci whose alleles have small effects. Mian et al.[7] did observe transgressive segregation for seed size in their two soybean populations, but this was not unexpected given the near - similar seed weights of the parents. The frequency distributions of F_2 and $F_{2:3}$ generations suggested a partial dominance of the genetic factors for small seed size. Partial dominance of small seed size has been noted by others (Ting[1], Williams[2], Weber[3], and Bravo et al.[8]).

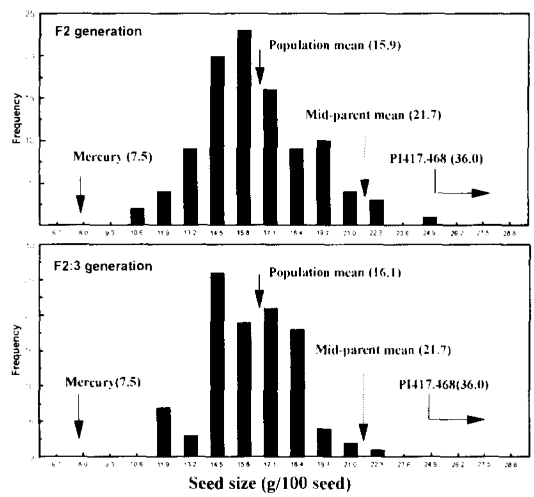

Fig. 1. Frequency distribution of 107 F_2 and $F_{2:3}$ generations for seed size.

Conclusion

The seed size frequency distributions in the mating between two *G. max* parents possessing quite different seed size exhibited a continuous distribution in the F_2 and F_3 generations. A progeny seed size equal to that of either parent was not observed in either generation. The population mean seed size in each generation was less than the mid-parent, with the distribution of lines skewed toward the small seeded parent

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초록 : F_2와 F_3 세대에서 대두 종자크기에 대한 빈도분포

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대립종자와 소립종자의 cross부터 F_2와 F_3 세대에서의 종자크기에 대한 빈도분포는 다음과 같다. 두 세대에서 모본의 크기와 같은 progeny는 나타나지 않았으며 각 세대의 평균치는 양 모본의 평균치보다 낮았다. 소립종자 크기가 대립종자 크기에 비해 우성적인 유전양상을 나타 내었다.