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Phenotypic and genotypic analyses of edamame soybean provide valuable germplasm for U.S. breeding programs

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Representative diversity in seed size, shape, and seed coat color among large-seeded soybean accessions evaluated for edamame breeding. A conventional soybean accession

is shown in the lower-right corner for comparison, highlighting the larger seed size of the edamame germplasm. Photo courtesy of Chengjun Wu, Rafael Marmo, and Caio Canella Vieira, University of Arkansas.

Edamame is a nutrient-rich food valued for its protein, essential amino acids, vitamins, minerals, and dietary fiber. The global frozen edamame market was valued at $200 million in 2023 and is projected to grow by 34% over the next decade, yet roughly 70% of frozen edamame in the United States is imported from East Asia.

A major challenge to expanding domestic edamame production is the limited availability of locally adapted varieties that meet consumer expectations for appearance, taste, and nutritional quality. To broaden available genetic and genomic resources, researchers evaluated 223 diverse accessions from the USDA Soybean Germplasm Collection in Arkansas over two years.

Thirty diverse accessions with desirable trait combinations were identified as valuable genetic resources for improving locally adapted edamame varieties. Phenotypic correlations revealed a trade-off between bean size and moisture retention, identifying an important breeding target for preserving quality while increasing flexibility in harvest and processing. Genome-wide association analysis identified 33 single-nucleotide polymorphisms associated with appearance traits, while genomic prediction models achieved moderate to high accuracies across most traits, supporting their use in selecting superior genotypes.

These findings provide preliminary genetic and genomic resources to support the development of regionally adapted, high-quality edamame varieties for the expanding

U.S. market.

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Wu, C., Goncalves Marmo, R., Florez-Palacios, L., Acuña-Galindo, A., Harrison, D., Rogers, D., Tischler, A. L., Lee, D., Zhang, B., & Canella Vieira, C. (2026). *Phenotypic and genotypic analyses of large-seeded soybean germplasm for vegetable soybean breeding*. *Crop Science*, *66*, e70307. https://doi.org/10.1002/csc2.70307

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