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# RELEASE OF FOUR RICE GENETIC STOCKS

The Agricultural Research Service, US Department of Agriculture announces the release of four rice (*Oryza sativa* L.) genetic stocks: a giant embryo mutant of a long grain rice, designated Genetic Stocks-*Oryza* (GSOR) 25; albino segregating mutant, GSOR 26; and two indica doubledwarfs, GSOR 27 and 28. These mutants, which may have value as genetic and/or breeding tools, were added to the Genetic Stocks – *Oryza* (GSOR) Collection at the Dale Bumpers National Rice Research Center, Stuttgart, Arkansas.

GSOR 25, the giant embryo mutant, was selected from a gamma-ray mutagenized M2 population of the long grain cultivar Drew grown at Stuttgart in 2000. The Arkansas cultivar Drew is protected by PVP Certificate no. 9700138; on June 9, 2006, permission was granted by the University of Arkansas Agricultural Experiment Station to release the mutant. Seeds of Drew were treated with 250 Gy of gamma rays in 1999. In the M1 generation grown in the 1999/00 Puerto Rico winter nursery, 840 random panicles were harvested in order to establish a panicle-to-row M2 generation. In the M2 generation, 8 random panicles were taken from each panicle row. Panicles were threshed and dehulled in order to search for visible kernel mutants. In one row 7 plants with normal kernels and 1 plant with giant embryo kernels were observed. The mutant plant subsequently was crossed back to the parent Drew. Kernels on the F1 plants, grown in the greenhouse in 2004 appeared normal, while the F2 plants, grown in the field in 2005, segregated 135 normal:60 giant embryo, a satisfactory fit ($0.05<P<0.10$) to a single recessive gene ratio. Thousand brown rice kernel weight of the mutant was 13.75 grams compared to15.84 for the parent, Drew. Embryo weight of 50-kernel samples of the mutant was 0.0370 grams, compared to 0.0258 for the parent, a 43% increase in embryo weight. The whole-kernel brown rice oil content of the mutant was 3.69%, compared to 2.70% for the parent. Because of its increased oil content, the mutant may have value as a whole grain brown rice product. It also should have value as a genetic stock in a long grain background, since other reports of giant embryo mutants have been in short grain rices.

GSOR 26, the albino segregating mutant, was selected from a gamma-ray mutagenized indica M2 population grown at Stuttgart in 2005. The mutagenized line was the previously released germplasm indica-12 which itself was an early flowering mutant selected from the late maturing IRRI parent, IR53936-60-3-2-3-1. Seeds were mutagenized in late 2004 with 250 Gy. The M1 generation was grown in the 2004/05 Puerto Rico nursery, where approximately 700 M1 panicles were taken. Twenty seeds from each M1 panicle were planted panicle-to-row in the M2 generation, at a single seed per hill, in hills spaced 30 cm apart, in 30 cm wide rows. The albino mutant was

found a single M2 row segregating 10 green: 4 albino plants. In subsequent testing in the greenhouse of the 10 surviving plants, 3 heterozygous families were identified which segregated 95 normal: 29 albino, a satisfactory fit to a single recessive gene ratio ($0.50 < P < 0.75$). Residual seeds from the 3 heterozygous M2 plants were composited to provide a genetic stock which will segregate 3 normal: 1 mutant. Since the albino plants become visible immediately upon emergence, this material could be a useful tool for a 7-10 day classroom science lesson in genetics.

GSOR 27, also known as I9s-dd (dd=doubledwarf), was derived from a gamma-ray mutagenized indica M2 population that was originally selected for early flowering. The mutagenized line, I9s (indica-9 sister line16-5-1), was a sib to the previously released germplasm line indica-9 (PI 634583) derived from the cross ZHE733/IR64. Seeds were mutagenized in late 2002 with 250 and 300 Gy. The M1 generation was grown in the 2002/03 Puerto Rico nursery. Reduced seed set, an indication that mutagenesis had occurred, was observed in the 300 Gy treatment, so approximately 1000 M1 panicles were taken from that dosage. Twenty seeds from each M1 panicle were planted panicle-to-row in the M2 generation in 2003, at a single seed per hill, in hills spaced 30 cm apart, in 30 cm wide rows. One M2 row segregated for 4 early plants and 7 late plants. The 4 early plants and 5 of the late plants were harvested for progeny tests in 2004. The M3 progenies of the 4 early plants were early and tall, as were progenies of 3 of the late plants. Progenies of the other 2 late plants unexpectedly segregated for a doubledwarf type which was about 20 cm shorter than the semidwarf parent. At this point it was decided that the doubledwarfs were more important than the possible early flowering plants, so emphasis was shifted to the doubledwarfs. The 2004 M3 segregation, deduced from 2005 M4 progeny tests of the 2 late plants, was 17 semidwarf plants:15 heterozygous plants:14 doubledwarf plants, a satisfactory fit with these small numbers to a 1:2:1 ratio ($0.05<P<0.10$). Within the M4 progenies of the 15 heterozygous plants, segregation was 359 semidwarf:101 doubledwarf, a satisfactory fit to a 3:1 ratio ($0.10<P<0.25$). Seeds of progenies of 4 doubledwarf plants were composited for 2006 yield tests, as well as for the genetic stock itself. In the 4-replicate yield test in 2006, GSOR 27 headed 69 days after planting, compared to 65 for its parent, was 82 cm tall compared to 102 for its parent, and yielded 7317 kg $ha^{-1}$ compared to 9303 for its parent. The principal value of GSOR 27 is that its 20% reduction in plant height can be used in crossbreeding to reduce lodging potential, since lodging has been a problem in semidwarf indica germplasm grown in the US.

GSOR 28, also known as I12-dd, was selected at Stuttgart in 2005 as a doubledwarf mutant of indica 12, from the same gamma-ray mutagenized indica M2 population as GSOR 26. One M2 row was observed to be segregating 4 semidwarf like its parent:12 doubledwarf. The M3 generation of the 12 doubledwarf plants was grown in the 2005/2006 winter nursery where all progenies appeared uniformly doubledwarf. Parallel M3 tests of the 12 doubledwarf plants in the 2005/2006 greenhouse also gave only doubledwarfs. In the M3 greenhouse progeny test of the four semidwarfs, one gave only semidwarf plants, one gave only doubledwarf plants, and two segregated 23 semidwarf:13 double dwarf, a satisfactory fit to a single recessive gene ratio of 3

semidwarf:1 doubledwarf (0.10<P<0.25). In a 2006 field planting of the M4 generation of the 23 M3 semidwarfs all were lost due to poor stand, but sufficient residual seed was available for greenhouse progeny test of 18 M3 semidwarf plants. One plant proved to be a homozygous doubledwarf, i.e., it had been misclassified as a semidwarf. The remaining 17 segregated 4 homozygous semidwarf:13 heterozygous semidwarf, providing a satisfactory fit to the expected 1 homozygous semidwarf:2 heterozygous semidwarf ratio (0.25 <P<0.50). Within the 13 heterozygous families, the pooled M4 segregation was 184 semidwarf plants:73 doubledwarf plants, a satisfactory fit to a single recessive gene ratio of 3 semidwarf:1 doubledwarf (0.25<P<0.50). In the 4-replicate yield test in 2006, the M4 generation of GSOR 28 headed in 72 days compared to 91 for its parent, was 85 cm tall compared to110 for its parent, and yielded 5113 kg $ha^{-1}$ compared to 5777 for its parent. Yield was compromised by low seed set in GSOR 28, which averaged only 48% compared to 88% for its parent. Even lower seed set was observed, but not measured, in the M3 winter nursery. Thus this doubledwarf mutant appears to have pleiotropic effects both for early maturity (19 days) and reduced seed set. To realize full breeding value of this doubledwarf mutant it will be necessary to "clean it up" by backcrossing to its parent or other indica lines. Otherwise, like the GSOR 27 doubledwarf, the 23% height reduction can be used to reduce lodging potential in crosses to semidwarf indica germplasm, assuming the sterility problem can be cleaned up.

No viruses are known to be present in this genetic stock.

Genetic stock amounts (about 1 g) have been placed in the Genetic Stocks – *Oryza* Collection and are available for distribution to geneticists, breeders and other research personnel upon written request to: J. Neil Rutger, Dale Bumpers National Rice Research Center, USDA-ARS, and P.O. Box 1090, Stuttgart, AR 72160. Emailed requests may be sent directly to gsor@ars-grin.gov. Requests from outside the US must be accompanied by an import permit. Genetic stocks also will be deposited in the National Center for Genetic Resources Preservation, 1110 S. Mason Street, Ft. Collins, CO 80521-4500. Seeds are available for research purposes, including development and commercialization of new cultivars. If this genetic stock contributes to the development of new genetic information, germplasm, or cultivars, it is requested that appropriate recognition be given to the source.

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