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DIFFERENTIATION OF URUGUAYAN WEEDY RICE AND CULTIVARS USING MARKER-ASSISTED CLASSIFICATION

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Accurate genetic differentiation of weedy rice from true-to-type modern cultivars could be a valuable tool towards keeping high seed quality standards for the Uruguayan rice industry. Genetic diversity from 26 accessions of weedy rice and 6 Uruguayan cultivars was assessed using AFLPs. The objectives of this study were: i) to explore genetic relationships among weedy rice and Uruguayan cultivars, and ii) to provide insights into weedy-cultivated rice differentiation in Uruguay. Using multivariate methods of analysis three main clusters were detected among weedy rice accessions and cultivars. Associations between clusters and morphological descriptors were also detected. One group had black hull, purple apex and long awn (wild type traits) while another group had straw hull and apex, and short or no awn (domestication traits). The third group included mostly cultivars and some weedy rice samples, presumed to closely mimic cultivated rice. Accessions from the later group may be difficult to differentiate from cultivars using only morphological traits. Consequently, AFLP data was used to evaluate a classification algorithm (k-Nearest Neighbor) based on markers selected by discriminant analysis to differentiate between weedy types and rice cultivars. More than 98 % of correct classification was achieved using a reduced set of informative markers. A marker-assisted classification procedure could be useful for assessing basic seed stocks from different cultivars in order to prevent weedy rice genetic contamination. The use of marker-assisted classification models could be further extended to differentiate groups of cultivars or breeding lines of economic value.

Keywords: AFLPs, weedy rice, genetic diversity, discriminant analysis, marker-assisted classification

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DESARROLLO DE CULTIVARES EN EL PROGRAMA DE MEJORAMIENTO GENÉTICO DE ARROZ DE INIA - URUGUAY BLANCO, P.H.; GAGGERO, M.T.; PÉREZ DE VIDA, F.B.; ÁVILA, S.; ZORRILLA, G.; LAVECCHIA, A.; MARCHESI, C.; CAPDEVIELLE, F.; CASTILLO, A. Instituto Nacional de Investigación Agropecuaria (INIA), Treinta y Tres, Uruguay

El mejoramiento público de arroz comenzó en Uruguay en 1971, dentro del Ministerio de Ganadería Agricultura y Pesca (MGAP), continuando en la órbita de INIA, a partir de 1991. Enmarcado en un sector orientado a la exportación, se enfatizó, desde el comienzo, en el desarrollo de cultivares precoces de grano largo, de tipo Japónica tropical, y en la calidad de grano. Mediante cruzamientos y selección, se obtuvieron siete variedades de calidad culinaria similar a los granos largos del sur de EEUU, estando actualmente en cultivo INIA Tacuarí, INIA Caraguatá e INIA Zapata. INIA Tacuarí ha sido la más exitosa, ocupando 25 a 30% del área de cultivo, destacándose por su tolerancia a fríos en la etapa reproductiva. Temperaturas nocturnas entre 12 y 17°C, en el período de 10 días previos a floración, resultaron en esterilidad superior a 70% en cultivares susceptibles e inferior a 25% en INIA Tacuarí. También se trabaja en el desarrollo de cultivares tropicales (Indica), introduciendo germoplasma de centros internacionales; del Fondo Latinoamericano para Arroz de Riego (FLAR), y realizando cruzamientos y selección localmente. Como resultado, fueron liberadas las variedades El Paso 144 (MGAP, 1985), INIA Cuaró y, recientemente, INIA Olimar (2002). El Paso 144 alcanzó a ser la variedad más sembrada en América del Sur, ocupando 60 a 70% del área de cultivo de Uruguay. El rendimiento de INIA Olimar supera al de El Paso 144 en 12%, destacándose también por su gran estabilidad y baja incidencia de granos Yesados. En un análisis de estabilidad (1998/99 a 2001/02) la nueva variedad mostró un rendimiento promedio de 8855 kg/ha con un coeficiente de regresión $b=0,91$, y El Paso 144 de 8163 kg/ha con $b=1,14$. También se trabaja en el desarrollo de cultivares de grano corto y de líneas Clearfield en acuerdo con BASF.

Palabras clave: Arroz, Mejoramiento, Resistencia a frío, Análisis de estabilidad

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CULTIVAR DEVELOPMENT AT THE RICE BREEDING PROGRAM OF INIA - URUGUAY

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Public rice breeding started in Uruguay in 1971, under the Ministry of Livestock, Agriculture and Fisheries (MGAP), continuing under INIA after 1991. With local rice production oriented to exportation, the breeding program emphasized, from the beginning, in the development of long-grain short-season cultivars, of Tropical Japonica type, and in grain quality. Seven varieties were obtained from local crossing and selection, all of them having cooking quality similar to Southern US long grains. Currently, INIA Tacuarí, INIA Caraguatá and INIA Zapata are grown in the country and the first one has been the most successful, with 25-30% of rice acreage. INIA Tacuarí has good cold tolerance during the reproductive phase and high milling yield. Average night temperatures between 12 and 17°C, during a 10 days period before heading, resulted in grain sterility higher than 70% in susceptible varieties and below 25% in INIA Tacuarí. Another area of work is the development of Indica cultivars, by introducing germplasm from international centers and from the Latin American Fund for Irrigated Rice (FLAR), and by local crossing and selection. As a result, the varieties El Paso 144 (MGAP, 1985), INIA Cuaró and, recently, INIA Olimar (2002) were released. El Paso 144 was the most widely grown variety in South America in the 90's, with 60-70% of rice acreage in Uruguay. Grain yield of INIA Olimar is 12% higher than that of El Paso 144, showing also good yield stability and low incidence of chalky grains. In a stability analysis (50 trials from 1998/99 to 2001/02), the new variety showed an average yield of 8855 kg/ha, with a regression coefficient $b=0,91$, while grain yield of El Paso 144 was 8163 kg/ha, with $b=1,14$. Other areas of work include the development of short-grain cultivars and of Clearfield lines, in agreement with BASF.

Keywords: Rice, Breeding, Cold tolerance, Stability analysis

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DOUBLED HAPLOID BREEDING OF SOUTHERN U.S. LONG-GRAIN RICE (*ORYZA SATIVA L.*)

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Doubled haploid (DH) production in rice is a fast and highly efficient technology in varietal improvement, especially in *japonica* germplasm. Initially, U.S. long-grain populations showed low anther culturability similar to *indica* rice (0.5%). By optimizing culture medium and using bridging parents with high regeneration ability, thousands of DH plants have been regenerated, and the mean anther culturability of U.S. long-grain crosses has increased from 0.5 to 8%. Annually, thousands of DH lines have been planted in progeny rows for evaluation, and hundreds of elite DH lines were selected based on agronomic performance, including high grain yield, good grain quality, and stress tolerance. Superior DH lines were advanced to preliminary yield (PY) tests, the Uniform Regional Nursery (URN), and the Commercial-Advanced yield (CA) tests based on high breeding and commercial value. These DH lines were used as bridging parents, and recombinations among the elite DH lines were obtained to further improve target traits. Therefore, the DH breeding is a complementary component in current breeding efforts. Efforts in the breeding program at the LSU AgCenter's Rice Research Station have resulted in the development of several leading long-grain rice varieties, such as Cypress, Cocodrie, and Cheniere, that are currently grown on over 65% of acreage in the southern U.S. rice growing region.