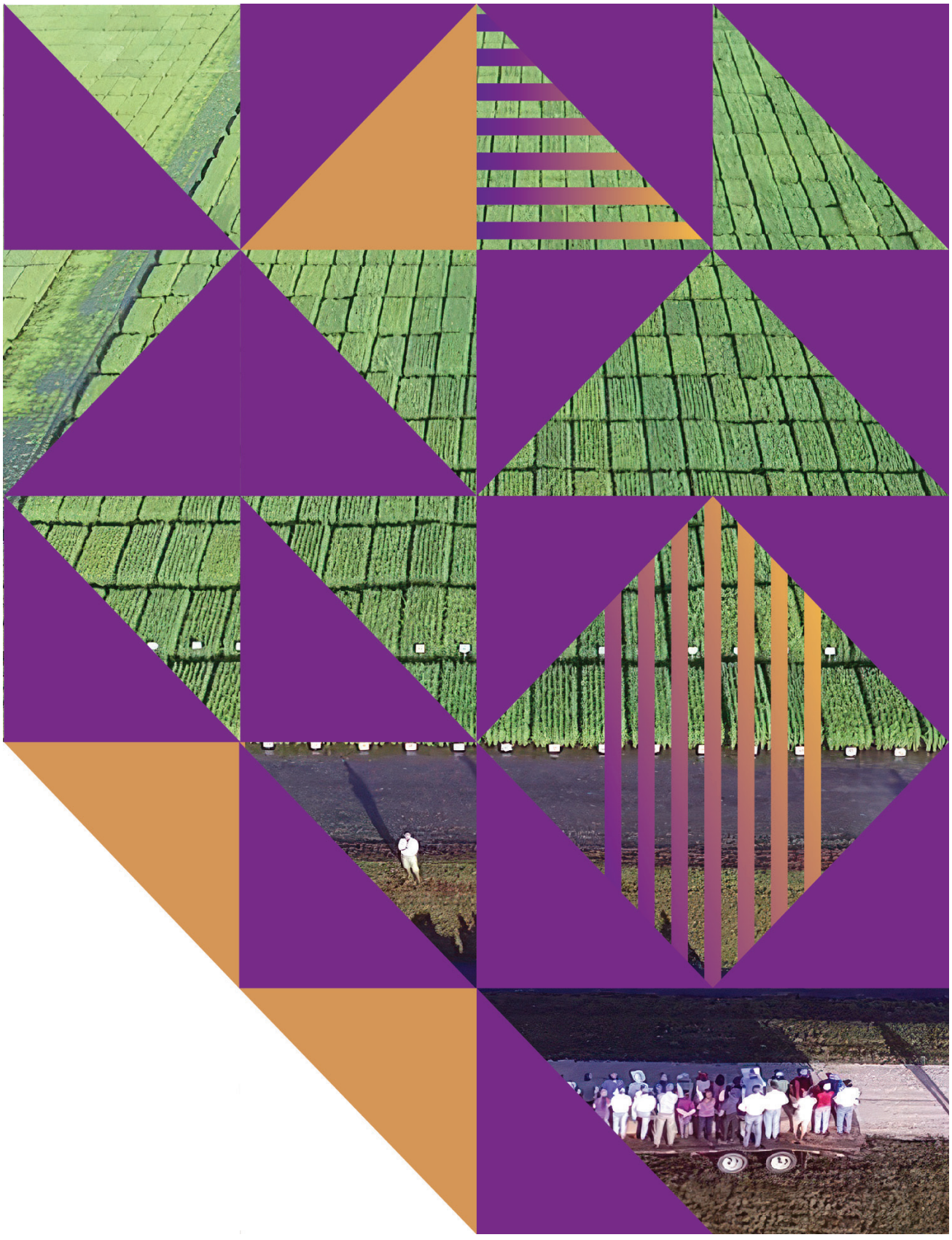
2024 INTERNATIONAL TEMPERATE RICE CONFERENCE



genetic research with many getting registered in the USDA-ARS World Rice Collection. Over the years several have secured U.S. Plant Variety Protection, U.S. utility patents, and trademarks.

Many of these rice mutants have seen little or no use and impact. Some like the sd_1 from Calrose 76, after an initial significant varietal contribution, have just blended into the germplasm. M-401, a direct induced mutant selection with a different sd_1 allele, continues in commercial production in California after four decades. BASF's Clearfield®, a non-GMO herbicide-resistant trait for rice weed control, developed at the LSU H. Rouse Caffey Rice Research Station, has achieved global impact. It delivered financial rewards to BASF, LSU, inventor T.P Croughan, and the breeding programs and breeders developing the rice varieties with the trait. It has set the stage for RiceTec to develop and market similar herbicide resistant rice technologies with the Full Page® and Max Ace® Rice Cropping Solutions that include other mode of action herbicides. The California Rice Experiment Station is launching its own grower-owned trait (ROXY®) providing non-GMO herbicide tolerance in a partnership with Albaugh LLC, the ROXY® Rice Production System (ROXY® RPS). These herbicide tolerance traits are transforming the funding and activities of U.S. rice breeding programs. The arrival and market acceptance of "gene editing" providing "directed mutagenesis" in combination with the knowledge of the rice genome, portends an electrifying future for rice variety development.

Speed Up the Develop of Rice Varieties in Temperate Regions - Uruguay

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Speed up the breeding prosses is crucial for small programs, new techniques are essential to shorten the variety development time and obtain genetic gain. The right combination of tools can reduce cost and time. INIA's rice breeding program's target location in the south of South America is a temperate region where only one crop per year is cultivated. Uruguay average yield of the last 3 years was 9.3 t/ha, rice is grown in a crop pasture rotation, 95% of the varieties are indica types and 25-30% of the area is planted with imidazoline- resistant varieties.

Traditionally, variety development using conventional methods and a crop per year takes 12-13 years, with 6 years from F1 to F6 panicle-rows, 4 years from F7 to F10 yield plot trials and 2-3 years for seed purification and multiplication. The objective of this work was to reduce the length of the variety development process for at least 5 years (40%). To achieve that goal, we used a combination of strategies: from F1 to F4 the process was shorten in 2 years with shuttle breeding and field phenotypic selection in Northern Italy, where genotype by environment interaction with Uruguay is neglectable. The yield trials started at F5, and the seed multiplication of selected lines began at F7. The lines were genotyped with the RiCA v4. 1K SNP panel for background selection and recovery of the recipient germplasm genome. This reduced the number of lines to be tested in experimental plots. After two years of yield trials at least two cultivars were selected to begin the early seed purification.

This approach allowed us to test a greater number of lines and to reduce the variety development process in at least 5 years compared to traditional breeding.