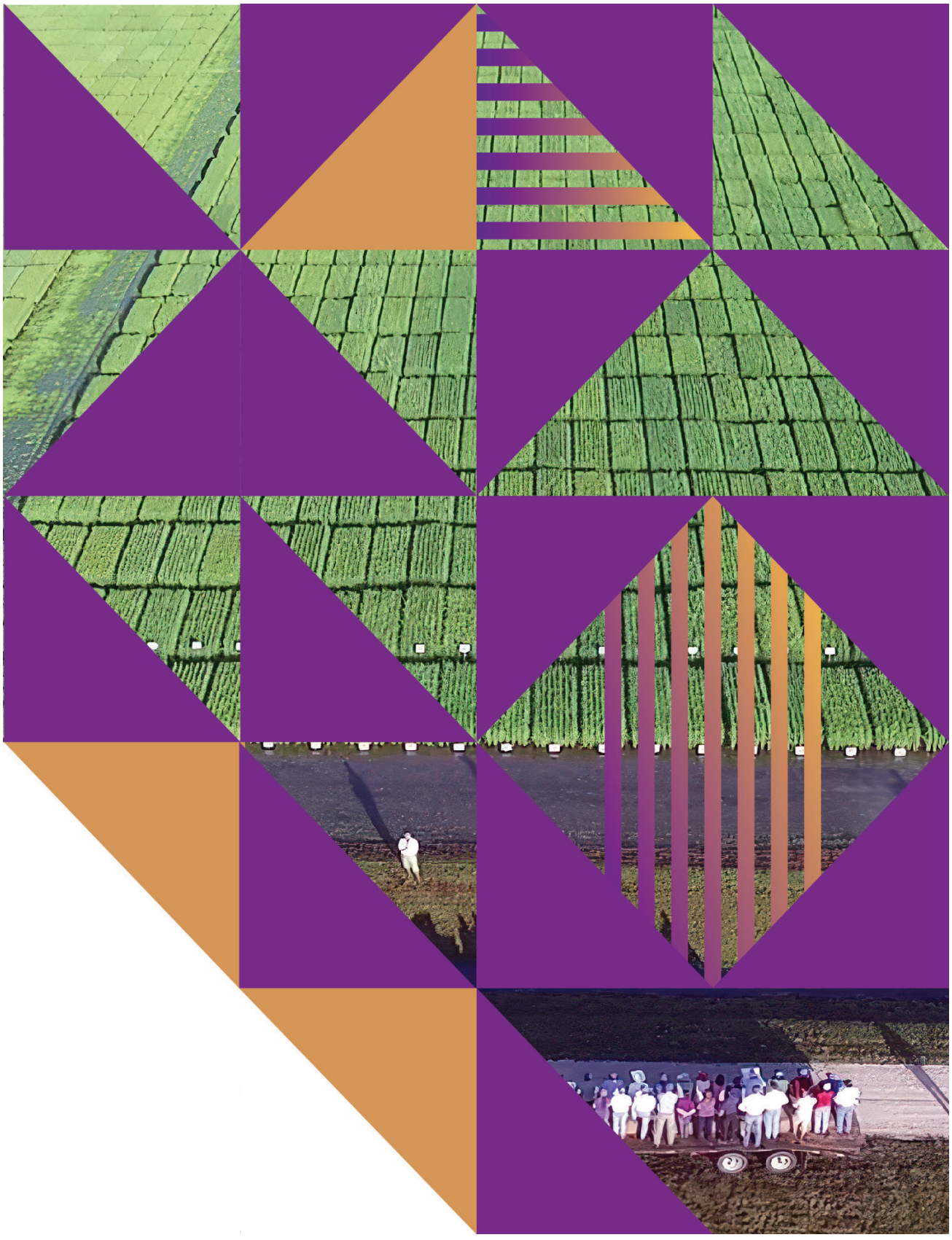
2024 INTERNATIONAL TEMPERATE RICE CONFERENCE



Rice Productivity and Stability in a Long-Term Rotations Experiment in Temperate South America

Aguirre, M., Macedo, I., Roel, A., Bonilla, C., and Terra, J.A.

In Uruguay, flooded rice historically rotated with perennial pastures (mix of grasses and legumes) for livestock production. Business as usual consisted basically in two years of rice crops followed by two to four years of grazed pastures. This allowed increased yields, diversified incomes, preserved natural resources, and minimized the use of pesticides and fertilizers. However, there is a growing trend in the last decade to avoid the second rice on rice straw, introduce other crops like soybeans and reduce or eliminate the perennial pastures from the systems. There are some concerns about the design and sustainability of new intensified rice systems.

We evaluated the rotation and predecessor effects on rice productivity and stability for nine years (2015-2023) in a long-term experiment initiated in 2012 in Uruguay. Six no-till rice systems were established in an Argiaboll in a field with a 34-year-old rice-pasture rotation. Treatments were: 1) Rice-Rice-Long Pasture of *Festuca arundinacea, Trifolium repens,* and *Lotus corniculatus* (R-LP, 5 yrs); 2) Rice-Short Pasture of *Lolium multiflorum* and *Trifolium pratense* (R-SP, 2 yrs); 3) Rice-Soybean-Soybean-Rice-Pasture of *Festulolium spp.* and *Lotus corniculatus* (R-Sy-LP, 6 yrs); 4) Rice-Soybean-Rice-Sorghum (R-Crops, 4 yrs); 5) Rice-Soybean (R-Sy, 2 yrs); and 6) Continuous Rice (CR, 1 yr). Cover crops of *Lolium multiflorum* and *Trifolium alexandrinum* L. were grown in the winter between cash crops in all rotations. A randomized complete block design with three replications and all rotation phases simultaneously was used.

Previous crop effects on rice yield were higher than rotation effects. The highest productivity was observed in rice following soybeans, secondly after pastures, and the lowest following rice. Rice yield differences between predecessors were magnified in growing seasons with high solar radiation during reproductive stages. In low radiation seasons, rice productivity after pastures or soybeans were similar but both were greater than rice after rice. While in high radiation seasons, rice yield following pastures was lower than soybean but higher compared with rice as a previous crop. Pastures length showed positive effects on rice yield only in high radiation years. Independently of predecessor, maintaining pastures in rotation improved the rice yield stability. There was no chance to achieve high yields on rice straw. Soybeans as a previous crop had significant impacts on rice yield in all systems and climatic conditions, particularly complementing and diversifying rice-pasture rotations to avoid the second rice on rice straw frequently used by farmers.

For Mollisols under rice-pasture systems in temperate-subtropical climates like those prevalent in South America, there are rotation intensification design alternatives (excluding CR) that allow sustainable rice productivity increases even in high yielding potential conditions.