

Water-use efficiency in two flood management systems

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Water is the most valuable renewable natural resource. Irrigation water management is becoming critically important worldwide. As freshwater for agriculture becomes increasingly scarce, greater efficiency of water use is essential. Rice (*Oryza sativa*), like any other crop, requires an adequate supply of water to grow and develop. Unlike other crops, rice is usually grown in flooded soil.

Rice irrigation management in Uruguay normally consists of a dry period after emergence of about 45 days. During this period, flushing is required to prevent water stress (average 2 flushes). Following 45 days after emergence (DAE), a flooding is established until at or near harvest.

The study was conducted at the National Institute of Agricultural Research (INIA) at Treinta y Tres, Uruguay, during the 1996-97 and 1997-98 growing seasons. Two macroplots, each 2.5 ha, were seeded with cultivar INIA Tacuarí (an early maturing, high-yielding, long-grain variety). Water use and yield were measured and water-use efficiency [yield (kg ha⁻¹)/total water use (m³ ha⁻¹)] was calculated for the traditional flood timing at 45 DAE and an early flood timing at 15 DAE in both years.

The planting dates were 17 and 8 October and emergence was established on 6 November and 26 October for the 1996-97 and 1997-98 growing seasons, respectively. Management practices (seeding rate, fertilization, herbicides, fungicides) were the same in both treatments. Both treatments were harvested with a commercial combine on 19 and 23 March in the 1996-97 and 1997-98 growing seasons, respectively.

The water supplied in each irrigation treatment was divided into three components: the water that was needed to flush the plots (flushes), the water necessary to flood the plots (flood), and the water needed to maintain the flood (flood maintenance).

The total amount of water supplied to each treatment was 6,220 m³ ha⁻¹ and 8,062 m³ ha⁻¹ in 1996-97 and 3,383 m³ ha⁻¹ and 4,531 m³ ha⁻¹ in 1997-98 for the early and traditional flooding treatment, respectively.

Since the early flooding treatment was flooded 15 DAE, flushes were not required. With traditional flooding, three flushes were necessary in the 1996-97 growing season and two flushes in the 1997-98 growing season. The amount of water needed for flood maintenance was higher in the early flooding treatment than in the traditional flooding treatment in both years because of a longer flood period. In spite of this, the difference in these totals (flood maintenance) between treatments was smaller than the amount of water needed to flush the traditional flooding treatment during the “dry” period.

Rice yields were similar for both treatments: 7,340 and 7,065 kg ha⁻¹ in 1996-97 and 6,297 and 6,435 kg ha⁻¹ in the 1997-98 growing season for early and traditional flood timing, respectively. Water-use efficiency, defined as kg of rice produced per m³ of total water use, was higher in the early flood timing than in the traditional flood timing treatment in both years, mainly because of the lower amount of water received in the first treatment, since yields were almost the same.