Dynamics of rooting patterns for wheat cultivars of different cycle lengths.

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The rainfall pattern in the wheat-growing areas of the Pampas region is monsoonal, with most of the rain falling before May and after August. In years of heavy, late summer rains, a significant store of water may remain below the rooting depth of the previous crop. Under these conditions, cultivar differences in root growth may be critical in determining the ease with which the wheat crop tolerates droughts between emergence and the commencement of spring rains. Two groups of cultivars (termed short (S) and intermediate (I) cycle length) are widely grown in the area. The two types are sown about a month apart and both reach heading at about the same time. We tested the hypothesis that the intermediate cycle types are more likely to extract water stored deep in the profile because of the longer interval between sowing and the cessation of root growth.

Methods

Wheat crops of cultivars Las Rosas INTA (I) and Marcos Juarez INTA (S) were sown on 12 July and 30 July 1990, respectively, into an argiudoll at the University of Buenos Aires (34?25'S, 58?25"W, 25 m asp. Two levels of water availability were applied: (i) with rain plus irrigation during the growing season and (ii) with a rain shelter from 27 August to 25 October. Soil core samples were taken at the terminal spikelet, booting, anthesis and mid-grain-fill stages and used to determine root density distribution. Rooting depth was determined in trenches excavated close to the sampling points for the cores. Soil water content was determined using a neutron probe.

Results and discussion

Since the cultivar x water availability interaction was not significant for any measured variable, the averages of both water regimes are presented for each cultivar. The hypothesis that the I cultivar extracts water stored deep in the profile because of greater root growth was rejected. There were no differences between cultivars in rooting depth at any developmental stage (Table 1). The water consumption was slightly higher in the I cultivar when compared at the same developmental stages, but when compared at the same calendar time, consumption was always higher in the I cultivar. Total root length did not differ between cultivars at any stage other than at terminal spikelet initiation, when the S crop showed a higher value (Table 1). In earlier studies these cultivars showed the same thermal time from emergence to terminal spikelet initiation and in this study the maximum and minimum temperatures during their respective vegetative periods were similar. Therefore, the differences in total root length at terminal spikelet could be due to the fact that during this period the incident radiation was 15% higher in the S than in the I cultivar. We suggest that cultivars of different cycle lengths have similar ability for using the available soil water. However, these cultivars could differ in total water use mainly due to their different length of growing season.

Table 1. Total root length and rooting depth at different developmental stages for Las Rosas INTA (LR) and Marcos Juarez INTA (MJ) wheat crops

Development stage	Total root length (km/m^2) LR	MJ	s.e.	Rooting depth (cm) LR	MJ
Terminal spikelet	3.5	6.3	0.57	51.0	52.0
Booting	27.5	26.3	3.72	94.2	90.8
Anthesis	17.7	17.6	1.74	108.4	102.0
Mid-grain-fill	19.6	18.5	1.09	110.0	106.0