MANAGEMENT OF TALL WHEATGRASS BASED ON THE LEAF APPEARANCE DURING SPRING

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ABSTRACT
The objectives of this study were to determine the date of transition from vegetative to reproductive stage at different defoliation frequencies in tall wheatgrass (*Thinopyrum ponticum*). In addition, we assessed the relationship between the spring temperatures and the rate of leaf appearance. To meet both objectives we had defoliated and undefoliated plant plots at Balcarce Experiment Station, Argentina. The different defoliation treatments (every 7, 14, 21 and 28 days) delayed or avoided the manifestation of the reproductive stage. The apexes of undefoliated plants began to rise on October 12, while defoliated ones slowed that elevation or the same did not register. The appearance of a leaf required 42 days at the end of winter, but it need only 25.5 days in spring. Our results show that a frequency of defoliation of approximately 28 days fitS the frequency of defoliation to control the losses of forage produced and to improve the forage quality.

KEYWORDS
Tall wheatgrass, *Thinopyrum ponticum*, leaf appearance, phyllochrone, spring management

Introduction

According to Briske (1991) the design and evaluation of grassland grazing management strategies must be based partially on the development morphology and physiological function of the dominant plant species. In recent years, the physiological implications of the transition from vegetative to reproductive stage, and the rates of tillering and leaf appearance have been considered to develop criteria of pasture management (Lemaire, 1987).

Growth and development of plants are strongly controlled by the environmental conditions. Temperature is one factor to which plants respond instantaneously. The knowledge of the dynamic of leaf appearance and the phenological development as function of temperature allows to fit the frequency of defoliation to control losses and to get high forage quality.

The objectives of this study were: (1) to determine the moment of transition from vegetative to reproductive stage at different defoliation frequencies, and (2) to assess the relationship between the spring temperatures and the rate of leaf appearance in tall wheatgrass.

MATERIALS AND METHODS

The transition from vegetative to reproductive stage was established in defoliated and undefoliated plants. Defoliated plants came from a simultaneous study developed to establish the digestible dry matter yield of tall wheatgrass (*Thinopyrum ponticum*) under defoliation frequencies of 7, 14, 21 and 28 days (see Brizuela et al., 1997). In addition, two plots were established to monitor this transition in undefoliated plants. Each week, from September 15 to December 23, 1992, a group of tillers were randomly collected from each treatment. In ten tillers from each group, we determined: number of leaves (number of leaves / tiller), height of apex from soil level (mm); phenological stage of the apex (vegetative, double ó wrinkle of transition, and reproductive).

To assess the rate of leaf replacement, 30 tillers were marked with plastic rings in undefoliated plant plots on September 3. In each tiller the number of leaves, and total and live tissue lengths of each leaf blade were measured every 7 days. Length of senescent tissue was calculated from the last two measurements. The mean temperature was weekly recorded to calculate the phyllochrone (Lemaire, 1987). Results are reported in 7 periods of 14 days each.

RESULTS AND DISCUSSION

Defoliation affected the number of leaves and the moment of the apex elevation. The number of leaves for tiller remained constant (2.5 leaves per tiller) under any defoliation frequency, while this number was higher (3.5) in undefoliated plants at the end of the experimental period.

With the advance of the growth season, the tillers of undefoliated plants began to manifest changes in their stage of development. Floral induction is produced as an answer to photoperiodic stimulis (Murphy and Briske, 1992). The transition from vegetative to reproductive stage was detected in 10% of the analysed tillers at the beginning of October, while the total analysed tillers reached this stage at the end of November. In contrast, the tillers from the higher defoliation frequencies (7 and 14 days) remained in vegetative stage. Under the less severe frequencies (21 and 28 days) only 6 and 40% of the tillers, respectively, reached the reproductive stage at the end of December. While the apex began to rise starting since November 12 in the undefoliated plants, in those with lower defoliation frequencies the elevation was delayed until December 23 or it did not occur in those tillers cut more frequently (Fig. 1). The apex elevation in undefoliated plants was decrypted as y= 0.48+9.92E-08*X^4.59 (r^2=0.98); where X= days since September 9. On contrast, the apexes of defoliated plants remained at heights lower than 3 cm. The beginning of stem elongation can vary among years depending on temperature, intensity of light, and fundamentally of the previous management. Nevertheless the evidences indicate that wheatgrass is the last species of the cool forage species to do that in the southeast of the Buenos Aires province (González *et al*., 1974).

Each tiller had 2.3+1.0 live leaf through the experimental period. The average life of a leaf was 46.6$\pm$17.3 days. The synchronization between initiation and senescence of leaves determines that the maximal number of leaves by tiller is a relatively constant feature. Even though the pattern of leaf longevity has a marked seasonal influence (Briske 1991). In our study 42 days were required for the apparition of a new leaf at the end of winter, while only 25.5 days were requiered in spring (Table 1).

The average phyllochrone during the spring period was 350½C days. This means that with a mean temperature of 14½C it is necessary 25 days for the apparition of a new leaf in spring. Bertín et al. (1987) found that this lapse averaged 14,5 days for vegetative tillers at the end of summer. They founded that the apparition rate of leaves was not affected by defoliation. Values of 110, 123 and 220½C for perennial ryegrass, orchard grass and tall fescue, respectively (Lemaire, 1987) have been reported. Because wheatgrass grows year around, the phyllocrone should be calculated through time to assess its variation between the warmest and coldest seasons of the year. In this study this estimate was focused in the spring when the rates of growth are the highest, determining high dry matter yield (Brizuela et al., 1996). From a morpho-phenological point of view, our results confirm that a frequency of defoliation of approximately 28 days allows a more efficient harvest of live leaves with high digestibility. This frequency is similar to that suggested for other wheatgrasses (Undersander and Naylor, 1987).

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Figure 1

Apex elevation (cm) in delotiated and undefoliated tillers of tall wheatgrass (*Thinopyrum ponticum*) throughout the spring season.

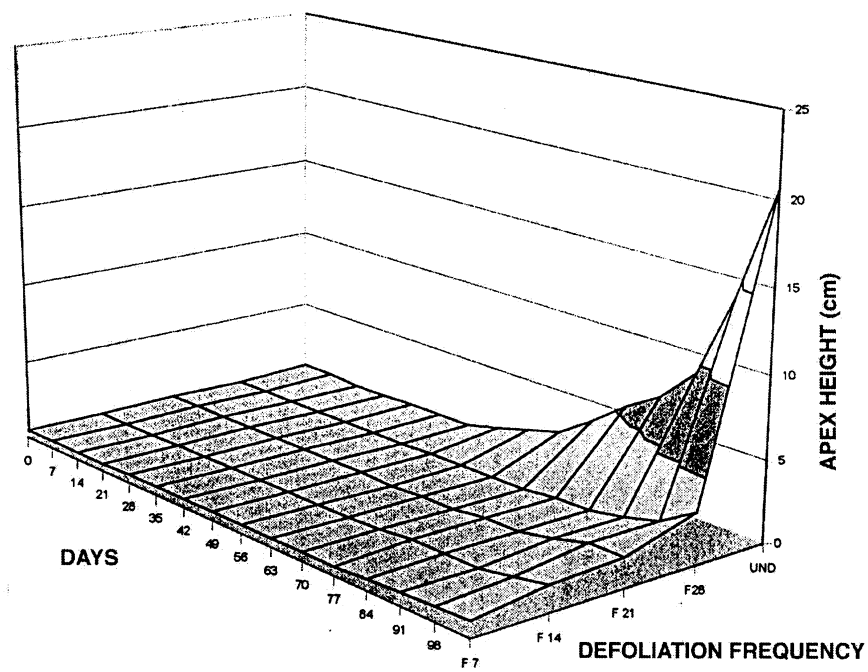

Table 1

Mean temperature, number of produced leaves and days between apperance of leaves of tall wheatgrass (*Thinopyrum ponticum*) in seven 14 day periods from September 15 to December 23.

	Periods						
	1	2	3	4	5	6	7
Mean temperature (°C)	11.9	11.5	13.4	14.4	14.0	14.3	18.1
Produced leaves (number)	10	18	24	13	23	19	19
Leaf appearance (days)	42.0	23.3	17.5	32.3	18.2	22.1	22.1