Modelling the digestibility decrease of three grass species during spring growth according to the age of the grass, the thermal age and the yield

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Introduction The nutritive value of forage changes during growth. For the protein content, a general evolution curve was found with the yield increase (Salette & Lemaire, 1984). The digestibility of the organic matter decreases during growth as cellulose and lignin content increase. Regrowth age is the main factor, which explains the digestibility decrease (Demarquilly & Jarrige, 1981). The crop age can be expressed in number of growth days but also in thermal age (cumulated temperature). We compared the digestibility change of three grass species during spring growth for two years as a function of yield increase, thermal age or number of days. Relationships were computed and compared to find the best one for predictive use.

Material and methods Digestibility and yields were measured (4 replicates) at different times during an uninterrupted spring growth on three common grass forage species (*Dactylis glomerata* cv Baraula; *Lolium perenne* cv Bastion; *Phleum pratense* cv Erecta) for two years. Nitrogen fertiliser was applied in one dressing of 100 kg N/ha in March. Digestibility was then plotted as a function of yield, temperature sum and days since the beginning of yield accumulation after winter. The beginning of yield accumulation was determined by the intercept with the X axis of the linear regression between yield and temperature sum (Lemaire & Salette, 1982). Digestibility of organic matter was determined *in vitro* by pepsin-cellulase digestion (Hayward & Jones, 1975; Rihs, 1985). Digestibility changes were compared between species and years with tests of equality of the slope (parallelism) and tests of equality of the constant (Dagnelie, 1986). A model of digestibility change is proposed.

Results Digestibility decreases linearly with yield, temperature sum or days whatever the species or the year, but for *Dactylis* and *Phleum*, linear relations are not parallel between years when digestibility is expressed as a function of yield or temperature sum. When the digestibility is expressed as a function of the number of growth days, linear relations established for each species individually are parallel between years (Table 1). The mean daily rate of digestibility decrease (slope) is -0.34 %/day for *Dactylis*, -0.35 %/d for *Lolium* and -0, 36%/d for *Phleum*. These daily rates are not significantly different. We also compared the constants of linear regression of digestibility as a function of days between species. Maximum digestibility value of *Dactylis* is 76.0 %. It is significantly lower than the digestibility of *Phleum* (80.3 %) and *Lolium* (81.8%).

Table 1 Linear relationships between digestibility (Y) and days since the beginning of the growth (X)

Species	Digestibility = fct (days since beginning of growth)	R^2	n
Dactylis glomerata	Y = 76.012 - 0.3415 X	0.7568	10
Phleum pratense	Y = 80.263 - 0.3587 X	0.7742	10
Lolium perenne	Y = 81.787 - 0.3514 X	0.7806	10

Conclusions Digestibility decrease of grass species during an uninterrupted growth period in spring is better modelled as a function of the number of days since the beginning of biomass accumulation (linear relation) than as a function of thermal age or yield. Maximum digestibility value is lower for *Dactylis glomerata* than for *Phleum pratense* and *Lolium perenne*. Daily rates of digestibility decrease are not significantly different between years or between the three species and are around –0.35%/day.

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