ALFALFA GRAZING SYSTEMS IN ARGENTINA

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Relative to confined systems, direct grazing has some advantages, particularly lower operational costs, better use of alfalfa quality compared hay or silage, and healthier animal products for human consumption compared to feed-lots (lower total cholesterol content, less intramuscular fat content, and higher unsaturated fatty acids omega-3/omega-6 relationship). However, there are some disadvantages: risk of bloat, longer fattening period, and lower milk production on an individual cow basis.

Correct alfalfa grazing management that complements high animal production with high levels of pasture yield and persistence, must be based upon the growing pattern of the plant in which new stems arise in series that come from axillary as well as crown buds, keeping a balance between active and dormant buds. From the grazing viewpoint, alfalfa has two important features: i) it can reach high values of leaf area index (LAI) without losing photosynthetic capacity in the lower leaves; and ii) speed regrowth after grazing depends primarily on reserve carbohydrate and protein content on crown and root rather than on remnant leaves. Based on the previous remarks, the best way to use alfalfa is under **rotational grazing** in which the main objective must be to combine adequate levels of grazing intensity with appropriate resting time. Alfalfa can tolerate intensive grazing periods as long as they are not frequent. Repeated interruption of the reserves cycle leads to loss of stand and the subsequent decrease in animal production.

Forage quality also plays a very important role in animal performance. Grazing alfalfa at 10% blooming integrates acceptably high forage yield with adequate levels of forage quality and root and crown carbohydrate reserves. For those months in which temperatures and day length are not high enough to allow blooming, alfalfa should be grazed when the regrowth from the crown is about 5-cm tall. More recently, research results in Argentina (3, 7) suggested to initiate grazing -during periods of pasture active growth- when the main stem has 8 to 10 nodes. As an alternative, the same authors proposed the utilization of cumulative number of grade-days [which is estimated as mean daily temperature – base temperature (5° C)] to define grazing frequency: 350-450° C in spring/summer and 550-600° C in fall/early winter.

When implementing a rotational grazing system, three fundamental issues must be defined: 1) **Grazing Frequency (GF)**, also defined as pasture resting period. GF depends on environmental conditions (season, temperature, moisture, etc.) and fall dormancy (FD), i.e. the more non-dormant the shorter the resting period. In general terms, across the Pampa Region, GF ranges from 23 days (FD 7-10 in spring/summer) to 42 days (FD 4-6 in middle-fall/winter); 2) **Grazing Period (GP)**, or number of days in which animals graze on a particular strip of pasture. GP

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depends on the type of operation (dairy or beef) and fall dormancy (the more non-dormant the cultivar the shorter GP in order to avoid consuming regrowth from crown buds). For the Pampa Region GP goes from 1 day (dairy production) to 7 days (beef production on FD 4-6 cultivars); and 3) **Degree of Pasture Utilization (PU)**, a concept related to grazing pressure that results from the interaction between forage availability and stocking rate, which –in turn- produces different levels of animal intake. The combination of all of the above three factors impacts on beef or dairy production on an individual as well as per area-unit basis.

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Beef production - As mentioned before, the most important parameters that define a rotational grazing system are GF and GP. For the FD grades (5 to 10) of alfalfa cultivars used in the Pampa Region (temperate climate and no irrigation), many studies conducted by INTA for beef production stated an average GF from 35 to 42 days and an average GP of 5 to 7 days. The negative effect of continuous grazing on pasture productivity and persistence were pointed out by Romero *et al*. (6). Under the appropriate GF for each time of the year, using an optimal stocking rate is critical in determining individual live weight gains and/or beef production per unit area.

In the Pampa Region the most popular alfalfa grazing system for beef production is the so called "**7x35**" because it results from a combination of an average of 7 days of grazing (GP) and 35 days of resting (GF), which means a total grazing cycle of 42 days. The 7x35 system is simple, effective and cheaper than others that are based on higher number of paddocks. To organize the system, the pasture is divided into 6 grazing strips o paddocks, which are grazed in turns, following a regular schedule. During spring and the beginning of summer, when alfalfa is growing very rapidly, succession of paddocks can be altered in order to maintain forage quality sufficiently high. The escaped paddocks are generally used for hay production.

There are also some other systems based on the use of slightly different combinations of GF and GP, like for instance **2**GP **x 34**GF (18 paddocks) or the one called "**leaders**" (L) and "**followers**" (F), in which two groups of animals are formed in order to alternatively graze the same paddock: group L enters first and consumes the upper half of the canopy, after which enters group F and grazes the remaining forage in the paddock. In spite of some eventual and slight increases in beef production, these alternative systems did not produce any consistent improvement over the 7x35 system that compensates the higher labor intensity they require.

Whatever the chosen combination between GF and GP, the main goal for any grazing system must be to reach a high degree of forage utilization (PU) through an adequate grazing pressure. As a general rule, systems that include high stocking rates produce more beef per unit area, and very often justify the decrease on individual live weight gains. However, losing some degree of individual gains may delay the fattening process and negatively influence the profitability of the operation and/or the returning speed of investment.

Dairy production - When formulating diets for dairy cows, especially for those with high milk potential, the first criteria to be considered should be animal intake (AI). Total amount of consumed DM depends upon animal characteristics (weight, age, level of production, lactation time, etc.) as well as forage nutritional value. Under grazing conditions, three other components

must be included: i) pasture structure (height, stand density, etc.); ii) environmental conditions; and iii) grazing management (forage allowance, grazing system, level of supplementation, etc.).
In dairy operations solely under direct grazing, forage allowance (FA) has a direct effect on milk production. In operations in which pasture is just one of the diet components, like in the vast majority of dairy farms in the Pampa Region, FA also has incidence on addition and substitution effects among feeds in the diet. Even though FA can be expressed as g DM kg live weight^{-1} or as % or live weight. Comeron *et al.* (2) concluded that the minimum level of FA in order to obtain maximum values of AI and milk production is equivalent to 1.75*MEI (maximum expected intake, expressed as kg DM cow^{-1} day^{-1}). The value of MEI can be calculated from the equation proposed by Neal *et al.* (4):

$$MEI\ (kg\ DM\ cow^{-1}\ day^{-1}) = (0.025 * live\ weight) + (0.2 * liters\ of\ milk\ cow^{-1})$$

Using this equation, a cow of 550 kg of live weight that produces 25 liters of milk day^{-1}, would have a MEI value of 18.75 kg DM day^{-1} (or 3.4% of its live weight). So, FA for that particular cow should be 1.75*18.75 = 33 kg DM day^{-1} (or 60 g DM kg of live weight^{-1}).

If the goal is to maximize animal response under grazing conditions alone, the best way to achieve it is to use high levels of FA, i.e. low stocking rates. In such a context, pasture use efficiency (PUE = AI/FA) will be low, with values no larger than 50-55% (5), implying wasting a large amount of forage and, consequently, obtaining low milk production per unit area. If the objective is to increase individual cow productivity under high PUE, some level of supplementation with conserved forages and/or concentrates must be used. In obtaining a compromise between milk production per cow and milk production per unit area, results in Argentina (1) indicate that FA should be around 20 to 22 kg DM cow^{-1} day^{-1} (or about 4% of the live weight) with an average PUE ≥ 70% (with a range of >80% in winter to 55% in spring or <50% in summer).

The most popular system for dairy production is the use of **daily grazing strips** (daily paddocks) with a resting period (GF) of 35 days. An alternative is the utilization of **paddocks with variable time of grazing**, where the main objective is to improve alfalfa persistence through the reduction of the instantaneous stocking rate but without reducing the average stocking rate. Another one is the use of **daily strips with sectors of restricted access**, which basically consists in subdividing the daily strips into sectors so that cows can have access to a new one throughout the day. However, none of these alternatives were more effective than the daily strips. There has also been some research on adapting the **leaders and followers** (LF) system to dairy production. The key point is how both groups (L and F) are conformed. When group L was formed by cows in the first third (40 days) of their lactating period and the F group was composed by cows in the second third (160 days), Romero & Comeron (1) did not detect differences in average milk production between both groups because the decrease in the F group could not be compensated by the increase in the L group. As an alternative, Comeron *et al.* (3) proposed a system in which the L group was composed by milking cows and the F group was composed by dry cows, each group having sequentially access for 1 or 2 days to the same grazing strip.

To keep a balance between milk production and operational costs, it is recommended a combination of direct alfalfa grazing and strategic supplementation. By doing so, it is possible to obtain >10,000 liters of milk ha^{-1} year^{-1}, as a consequence of individual production levels of

7,000 to 7,500 liters cow^{-1} $lactation^{-1}$ and stocking rates of over 1.7 cow ha^{-1}. Direct grazing of alfalfa reduces both operative costs and losses of quality due to forage conservation.

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