New insights into the nutritional value of grass

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Key points

1. The rumen environment in cattle grazing high quality forage is different to that reported for cattle fed indoors with diets based on processed feedstuffs.
2. Temperate pasture is an excellent source of nutrients for ruminants but a high energy:protein imbalance can occur when it is offered at the stage of optimal digestion.
3. Beef and milk produced on grass in temperate regions have a composition with nutritional advantages over beef or milk produced in indoor systems based on concentrate.
4. Increasing water soluble carbohydrate content of grasses would diminish environmental contamination by reducing the excretion of urea through the urine.
5. Increasing the digestibility of the forage would reduce methane production per unit of animal product.

Keywords: grazing, temperate pasture, pasture quality, environment

Introduction

Animal productivity on grazing is not always satisfactory and individual performance expressed as body weight gain or milk yield is generally lower than that obtained on intensive systems based on conserved forage and concentrate feeding. Pasture availability and forage quality are the main constraints affecting animal productivity. The nutritional limitation occurring on grazing depends on the activity involved in the ruminant production process. In the cow-calf systems where the main objective is to produce calves efficiently, forage availability from pasture and natural grassland are the main limitation. Nutritional limitations are generally a consequence of a poor forage budgeting program, drought, or a limited amount of conserved forage as hay or silage, more than to forage quality.The situation is totally different in cattle rearing and fattening systems and for grazing dairy cows where nutrient requirements are generally high and cannot always be satisfied by the nutrient content of available forage.

In temperate pasture, grazing management is an important tool to maintain pasture in a vegetative stage for as long as possible. As soon as pasture becomes mature, cell wall content and ligninfication increase affecting forage digestibility and consequently forage intake. Even when high quality temperate pastures are an optimum and cheap source of nutrients for ruminants they not always supply the correct amount of nutrients that high performance cattle require.

Dry matter and organic matter (OM) digestibility, cell wall content, fiber degradability and concentration and degradability of protein are the main parameters used to define the nutrient value of temperate pasture, but these do not always explain the production response obtained. For a better understanding of cattle performance on temperate pasture new insights into the nutritional value of fresh forage will be discussed.

Nutritional value of grasses

Pasture quality has always been considered a limiting factor for animal production in grazing systems. Nutritive value of pasture depends mainly on its chemical composition but other factors may also alter its quality, affecting animal productivity. Quality of pasture in temperate regions is influenced by management, environment and by species and cultivars (Sheaffer *et al.,* 1998). Stage of growth at grazing is very significant due to the negative relationship between grass maturity and forage quality (Cherney *et al.,* 1993). Grazing management becomes an important tool to maintain forage quality, however, factors such as sward height, fertilization program and mixture composition and stability are also important in determining forage quality.

Grass and legume species and cultivars differ in chemical composition therefore, their contribution to the pasture mixture will affect forage quality. This generally occurs because the quality of legumes is superior to grasses, which is attributable to the lower cell wall and higher CP concentrations of legumes compared with cool-season grasses (Buxton, 1996). Nutrient content of forage from temperate pasture is generally higher when grazed than when offered to the animals in conserved form as hay or silage (Glenn, 1994). Ruminal digestibility of dry matter and ruminal degradability of protein are also normally high in grazed forage relative to non-pastured forages.

For years nutritive value of pasture was defined as the product of the dry matter intake, digestibility, and efficiency of utilization of end products of rumen digestion. Even when that definition is maintained new parameters on nutrient composition should be considered. Due to the proved negative relationship between fiber content of the forage and dry matter intake and digestibility, concentration of fiber expressed as NDF or ADF has been the main parameter to define temperate pasture quality. Protein is also an important nutrient provided by pasture to grazing ruminants but generally only subtropical pastures are considered to be limiting in this nutrient. Temperate pasture grazed at an immature stage is generally high in protein, and its degradability in the rumen may be more important than its total content as a measure of nutrient availability. Even when fiber digestibility is still the main factor limiting animal productivity on most grazing systems throughout the world, other nutritional limitations may appear when feeding cattle with higher requirements.

Rumen digestion of temperate pasture

Forage digestibility depends not only on its stage of maturity, its mean fiber and lignin contents, but also on the digestion process that occurs in the rumen. Fiber digestion in the rumen will depend on the digestion rate, which will be affected by bacterial activity, and the retention time in that compartment. Because of that, the rumen environment generated by a specific pasture is fundamental to the study of the nutritional value of that forage.

Crawford *et al.,* (1983), working with conserved forage, reported an optimum rumen fluid pH of 6.6-6.8 for maximum fiber digestion and bacterial yield in the rumen. When rumen pH decreased from the optimum, fiber digestion could be affected. Hoover *et al.,* (1984) pointed out that cellulolytic activity was reduced at pH values lower than 6.0 and fiber digestion ceased at pH values less than 5.0. Efficiency of microbial protein synthesis (MPS) would also be reduced at low pH values (Strobel & Russell, 1986). Studies carried out at INTA Balcarce, in Argentina proved that the rumen environment in cattle grazing high quality forage is different to that reported for cattle fed indoors with diets based on processed feedstuffs like hay, silage and concentrate (Rearte & Santini, 1993). Similar results were obtained by other authors working also with cattle grazing high quality pasture (van Vuuren *et al.,* 1986; Carruthers *et al.,* 1996). Only on pasture of lower quality like wheatgrass (*Agropirum elongatum*), tall fescue (*Festuca arundinacea*), or ryegrass (*Lolium perenne*) at the mature stage, rumen pH was 6.3-6.4. On forages of higher quality like oats or perennial ryegrass in the early vegetative stage, rumen pH was 5.9-6.0. Legumes like alfalfa, even when they are supposed to have a higher buffering capacity, have also caused low rumen pH when grazed at the vegetative stage. In addition to a low rumen pH, a high concentration of volatile fatty acids (90-120 mmol/l) with a low acetate:propionate ratio were measured in rumen fluid of cows grazing high quality pasture. Carruthers *et al.* (1996) and other studies reported a lower pH in animals grazing high quality pasture than the optimum mentioned earlier even though there was no evidence that a depression in fiber digestion or a lower microbial efficiency resulted.

De Veth & Kolver (2001) studying the effect of rumen pH on fiber digestion in temperate pasture observed that digestion and microbial protein synthesis were largely insensitive to pH across a broad range (5.8 to 6.6), and a large reduction in both occurred only when pH was 5.4 or lower. These authors concluded that short periods (4h) of suboptimal pH (5.4) reduced the digestibility of DM, OM, and NDF by approximately 4 percentage units. Longer periods (>8h) of suboptimal pH were required before microbial protein synthesis was compromised. These results suggest that the period of time that pH is below optimal pH may be more critical for digestion than the relationship between mean daily pH and optimal pH. The low ruminal pH in grazing cattle is not consistent with the fiber content of pasture but it could be associated with the high ruminal concentration of VFA or the high buffering capacity of fresh pasture (Erdman, 1988). It is also possible that with grazing, salivation rate is lower than expected due to the low content of physically effective fiber in high quality pasture (Allen, 1995).

Related to dietary N metabolism occurring in grazing cattle, ammonia (NH_3) concentration in rumen fluid is high, well above the minimum required for an optimum microbial synthesis owing to the high protein content and degradability of fresh forage. When NH_3 production rate in the rumen is higher than the rate at which it is utilized by the microbial population, its concentration at ruminal level increases, a high proportion is absorbed through the rumen wall, part of it is recycled to the rumen via saliva, and the remainder is converted into urea in the liver and finally excreted in the urine (Siddons *et al*., 1985). This would be expected to reduce the efficiency of utilization of the dietary N. Studies with growing cattle consuming fresh forage carried out by Beever *et al*. (1986), showed that seasonal changes in N content can lead to different efficiencies for microbial utilization of ruminally degraded protein affecting the non-ammonia N (NAN) flows to the duodenum. Much of the N consumed by cows grazing high quality temperate pasture never reaches the duodenum because of high losses of degraded N due to NH_3 absorption from the rumen, conversion to urea in liver and excretion through urine (Beever, 1993). In a trial carried out at INTA Balcarce (Elizalde *et al.,* 1994; Elizalde *et al*., 1996), the efficiency of microbial protein synthesis in cows grazing winter oats (WO) (*Avena sativa*) at five different maturity stages, autumn, early winter, winter, spring and late spring, was studied. The effects of date of harvest on N metabolism showed that microbial N production was 24.6 and 32.6 g/kg organic mater digested in the rumen and N loss was 44 and 7% of total N intake for autumn and spring pasture, respectively. These differences were associated with differences in the total protein and soluble carbohydrate contents of the forage at different times of the year. While in autumn the CP content of grass is very high, the amount of soluble carbohydrate is low compared to the concentration that temperate grasses have in spring. It is clear that an imbalance of energy:protein occurs in the rumen of cattle grazing WO in autumn. This imbalance is reflected in a higher NH_3 concentration in the rumen, well above the minimum required for optimum bacterial activity.

Sugar and protein imbalance

The water soluble carbohydrate (WSC) content of temperate grasses is variable but normally too low to balance the high content of highly degradable protein. Consequently, the sugar:protein ratio has become very important in defining the nutritional value of fresh forage in temperate pasture. Supplementation with starchy concentrate could be a way to increase the energy content of the diet but it is not the ideal energy source because its energy, in the form of adenosine triphosphate (ATP), is not liberated in the rumen at the same time that maximum rate of protein degradation occurs. The optimal energy source to balance pasture protein would be WSC contained within the forage.

Conventional plant breeding techniques and gene manipulation have been applied lately to improve the energy: protein ratio of temperate grasses (Miller *et al*., 2001; Moorby *et al.,* 2001). Promising results obtained through grazing management and grass production techniques could also be alternatives to improve the nutritive value of grasses. Nitrogen fertilization, regrowth age, and time of the day at grazing, were observed to affect the chemical composition of grasses especially those components related to its energy: protein ratio. Several trials have proved that lowering N fertilization level decreased the protein content of pasture, increased its WSC content and improved dietary N utilization by animals (Peyraud *et al*., 1997; Delaby *et al*., 1996; van Vuuren *et al*., 1992). The increase in WSC content by lowering N fertilization can be attributed to a lower use of WSC for protein synthesis and plant growth, which would be influenced in turn by the levels of N available to the plant. Other studies have shown that nutritive value of grass could also be affected by age of regrowth. Delagarde *et al.* (2000) observed that biomass and DM content were increased by increasing regrowth age from 21 to 28 and 35 days, while CP content fell sharply and WSC increased strongly in the same period. The decrease in CP content with ageing may be linked directly to the increase in total WSC content mentioned above.

The chemical constituents of grass also vary at different times of the day due mainly to changes in the photosynthesis and gas exchange rates with the atmosphere. Delagarde *et al*. (1997) and Orr *et al*. (2001) observed that WSC content increased from morning to evening due to the accumulation of photosynthesized simple sugars (especially saccharose), and then fell during the night due to respiration, protein synthesis and export towards storage organs. However, even when the level of N fertilization, days of regrowth at grazing or time of the day at which pasture was offered to the animals have been managed to increase the sugar content of the grass and improve efficiency of N utilization by the animals, responses in animal productivity were not consistent.

Rearte *et al*. (2003) obtained high sugar grass by combining low N fertilization (40kg vs 80kg N), a long regrowth period (28 vs 21 days) and evening instead of morning grazing. Crude protein degradability was reduced on the high sugar grass in line with values reported by Delaby (2000), Peyraud *et al*. (1997) and Delaby *et al*. (1996) for grasses receiving different levels of N fertilization. Dry matter intake was not affected by the sugar:protein ratio of the grass but cows on high sugar grass consumed more soluble carbohydrate and less protein than cows on control grass. However milk yield was not improved by feeding high sugar grass and averaged 22.3 kg/day. Digestion data may explain the lack of a production response. Rumen fluid pH was not affected by the different diets but fluctuation of pH throughout the day was higher in cows fed high sugar grass. Ammonia concentration was far lower in that diet with a relatively constant concentration throughout the day at between 1 and 3 mmol/l. There was no significant effect of treatment on OM digestibility but total tract digestibility and ruminal digestibility of NDF and ADF were significantly lower on cows offered the high sugar grass. Cellulolytic activity was numerically five percentage units lower in cows on high sugar grass. A low NH_3 concentration in rumen fluid would have decreased the capacity for fiber digestion in those cows. Similar results were reported by Delagarde *et al.* (1997) when feeding cows with low N fertilized grass.

Fiber degradation measured in-situ in dry cows fed a standard hay:concentrate diet was similar in both grasses; therefore, the rumen environment would appear to have been responsible for the observed NDF digestibility depression with the high sugar grass. The NH_3 concentration measured in the rumen with high sugar grass was 2.06 mmol/l. This value would not be at the limit suggested by several authors for depressing the digestion rate of forage cell-wall (Orskov, 1992; Satter & Slyter, 1974). However, there is still some ambiguity about the minimum NH_3 concentration required and data on fiber digestibility in dairy cows consuming highly fermentable feeds and with low ruminal N are scarce. Most of the information on reduced fiber digestion caused by ruminal N deficiency was obtained with low quality forage lacking available ruminally degradable carbohydrates (Orskov, 1992). In the early in-vitro trial of Satter and Slyter (1974), the optimal NH_3 concentration to support maximal microbial growth was estimated to be 50 mg/l (2.94 mmol/l) and the addition of non protein N (NPN) to ruminant rations would be justified only if ruminal NH_3 was lower than that concentration. However, Ruiz *et al.* (2002) reported an improvement in ruminal NDF digestibility by increasing ruminal NH_3 concentration from 45 mg/l to 100 mg/l (2.64 to 5.88 mmol/l) by the addition of urea to the ration of dairy cows containing highly degradable carbohydrates. Delagarde *et al.* (1997) also reported a low NH_3 concentration in the rumen (2.7 mmol/l) and a depression in fiber digestion when feeding cows grasses containing 106 g/kg of CP. Similar results were obtained Elizalde *et al.* (1994) evaluating autumn versus spring grazed reygrass. In their trial NDF digestion in cows offered spring grass containing 117 g/kg DM of CP and 205 g/kg DM of WSC, was 10 percentage units lower than that measured on autumn grazing cows consuming pasture containing 230 g/kg DM of CP and 38 g/kg DM of WSC. Ruminal NH_3 concentrations were 3 and 19 mmol/l in cows grazing spring and autumn grass, respectively. It seems that the NH_3 concentration for optimal fermentation and bacterial yield depends on the substrates and the minimum required to maximise digestion is a function of the fermentability of the diet. High quality forage with high digestible fiber would support a greater growth of fiber-digesting bacteria that require NH_3 resulting in the minimum required for the optimal fermentation being greater. In Rearte (2003) the higher ingestion of WSC with the high sugar grass, would compensate for the decrease in ruminal fiber digestion thus maintaining the total quantity of OM that was fermented.

The lack of response to increasing the WSC content of grasses in the efficiency of microbial protein synthesis is in contrast to what numerous authors suggest with respect to supplying extra readily available energy to the rumen microbial population (Nocek & Russell, 1988; Rooke *et al*., 1987). Stern *et al*. (1978), in contrast to our finding, reported that readily fermentable carbohydrates are more effective than other energy sources in increasing microbial growth at similar VFA production and digestibility for a range of diets. It is important to note that in all the reported studies (Elizalde *et al*., 1996; Beever *et al*., 1978;

Peyraud *et al*., 1997; Lee *et al*., 2002) grasses with high WSC had a CP content no higher than 110 g/kg DM and the NH_3 concentration in the rumen was always less than 3 mmol/l. Even when Clark *et al*. (1992) suggested that a mean value of 1.4 mmol/l of NH_3 was the minimum required for maximizing microbial protein synthesis in dairy cows, this value could vary with the fermentable energy of the diet. If a deficiency of N from the diet or recycling occurs, which could be the case in our and the other studies, carbohydrate fermentation and microbial growth will become uncoupled leading to a futile cycle of bacterial energy metabolism and a consequent reduction in the efficiency of microbial protein synthesis.

Effect of pasture composition on product quality

As well as production efficiency, product composition and quality may also be affected by the nutrient composition of pasture offered to grazing ruminants. An excess of highly degradable protein in the diet could affect milk processing quality due to the decrease in the casein fraction and the increase in urea and NPN in milk. Rearte & Santini (1993) reported a lower secretion of urea-N in the milk of cows consuming high sugar grass than would be explained by a lower intake of highly degradable protein. Also the nutritional value of milk and beef is a very important aspect to consider because consumers are becoming more concerned about healthy diet and there is a consensus against the consumption of animal fats. Ruminant products have become unpopular foods due to their high levels of saturated fat and cholesterol, which has been seen by most medical opinion as increasing the risk of the development of certain coronary heart diseases.

But not all beef and milk have the same fat content and composition. Milk from cows fed high sugar grass of longer regrowth had a lower fat content than cows on control grass (Rearte, 2003). This lower milk fat agrees with the findings of Gonda *et al*. (1992), Bauchart *et al*. (1984) and Dewhurst *et al*. (2001) who reported a decrease in milk fat content and a greater degree of fatty acid saturation with longer regrowth periods. Not only is the fat content of milk affected by pasture composition but also its fatty acids (FA) composition is affected. Milk fat of cows fed high sugar grass contained a higher proportion of short chain FA and a lower proportion of long chain FA than milk fat from control cows. It can be seen that the milk fat reduction occurring in cows fed high sugar grass is due to a decrease in the quantity of long chain FA absorbed by the mammary gland and secreted in milk which could not be compensated for by the increase in the quantity of short chain FA and palmitic acid synthesized within the mammary gland.

High quality temperate pasture at the vegetative stage is a rich source of long chain unsaturated FA (up to 30 g/kg of FA on a dry matter basis), of which proportionally about 0.9 are unsaturated C18 acids (Murphy *et al*., 1995). As the growth stage of grasses advance the lipid content decreases and FA become more saturated (Bauchart *et al.,* 1984). Dewhurst *et al.* (2001) reported a decrease of proportionally 0.17, 0.25, 0.34 and 0.45 in the concentration of C18:0, C18:1, C18:2 and C18:3, respectively as regrowth length of perennial rye grass increased from 20 to 38 days. The amount of long chain unsaturated FA consumed was therefore, much higher for cows fed normal control grass harvested at an earlier vegetative stage than for high sugar grass. Long chain unsaturated FA could affect fatty acid synthesis, by their inhibitory effect on Acetyl-CoA carboxylase, a key enzyme involved in the metabolic pathway for de-novo synthesis of short chain FA from acetate and 3-hydroxybutyrate in the mammary gland (Barber *et al.,* 1997). Thus, a higher contribution of long chain unsaturated FA from normal grass compared to high sugar grass, would increase their concentration in milk fat but simultaneously would inhibit de novo synthesis decreasing the percentage of short chain (< C14) and C16:0 FA in milk fat.

Among the unsatured FA in milk the concentration of conjugated linoleic acid, (cis-9 trans-11 CLA, referred to as CLA subsequently) has become an important matter in the last few years due to its proved nutraceutical properties, including anticarcinogenic activity (Ip *et al*., 1991) and some inhibition of the development of atherosclerosis in animals (Lee *et al*., 1994). It is well known that milk produced in temperate regions by grazing cows is higher in CLA content compared to that produced on intensive systems based on conserved forage and concentrate (Jahreis *et al*., 1997; Kelly *et al*., 1998, Dhiman *et al*., 1999; Stene *et al*., 2002). In Rearte (2003) cows fed the high sugar grass produced milk with a lower content of CLA than cows on the normal grass diet with values that were similar to those reported by Chilliard *et al*. (2000), Dhiman *et al*. (1999), and Kelly *et al*. (1998), for cows consuming fresh young grasses as the main component of the diet. The concentration of trans-11 C18:1 fatty acid (vaccenic acid) in milk was higher in cows fed the normal grass. Conjugated linoleic acid is an intermediate product in the biohydrogenation of linoleic acid, after lipolysis of dietary lipid has occurred. Initial isomerisation is followed by the saturation of the cis-9 double bond resulting in the production of vaccenic acid, the major trans isomer of ruminant tissues. Vaccenic acid is important not only because of its high concentration in ruminant tissues but because of its positive correlation with CLA concentration in milk. Conjugated linoleic acid is not an intermediate in linolenic acid biohydrogenation pathways but vaccenic acid is one of the final products. Corl *et al.* (2000) reported that approximately 0.75 of CLA in milk comes from endogenous synthesis in the mammary gland via the desaturation of vaccenic acid by the action of hepatic microssomal Δ^9-desaturase (Griinari *et al*., 1997). Considering the increase in lipid intake with normal grass and assuming that approximately 0.5 consists of FA a much higher CLA concentration in cows fed that grass compared to high sugar grass could be expected. Here again a compensatory effect of both diets on CLA content in milk could be occurring. A higher Δ^9-desaturase activity in mammary gland of cows fed high sugar grass could be compensating for the favorable effect of the higher supply of CLA precursor with the normal grass. A trend for a lower trans-11 C18:1/CLA ratio observed in milk produced with high sugar grass (2.08 vs 2.34) would support this hypothesis. Nutritional and hormonal control of Δ^9-desaturase activity, involving insulin as the main positive agent, was reported by Ntambi (1995); therefore, it is possible that the higher WSC intake of cows fed high sugar grass increased circulating insulin levels, which would explain the observed increase in Δ^9-desaturase activity. Although intake of unsaturated FA and Δ^9-desaturase activity in mammary gland seem to be the main variables determining the CLA content of milk, production of CLA and CLA precursors in the rumen is also important. The rate of CLA and vaccenic acid production depends on the rumen environment and microbial fermentation, which could be affected by changes in the dietary carbohydrate source. It was suggested that the high content of sugar and soluble fiber found in young immature pasture may create a rumen environment favorable for CLA production or reduced bacteria utilization compared to more mature grasses or conserved forage (Kelly *et al*., 1998).

Effect of pasture composition on environment pollution

For years plant breeders tried to improve pasture quality aiming only to improve the production response. The objective was to maximize milk yield, daily weight gain and feed conversion efficiency without taking the environment into account. Actually, production systems on grazing still aim to satisfy the nutrient requirements of high producing animals but now also try to minimize negative environmental impact. Temperate pasture is a good source of nutrients for ruminants but its high content of highly degradable protein and the excessive use of N fertiliser with intensive grazing have made N excretion higher than desired. The high NH_3 concentration in the rumen as a result of the high degradability of pasture protein not only affects the efficiency of N utilization and animal performance, but also contributes to environmental pollution due to N excreted in the urine. Reducing degradation of dietary protein in temperate pasture has become a new goal for plant breeders and advances in this are expected to be achieved in the near future. In the meanwhile the use of varieties with high sugar:protein ratios achieved by plant breeding and gene manipulation or using appropriate grazing management and grass production techniques may contribute to the reduction of N excretion to the environment.

Studying N balance in cows fed grasses of different sugar:protein ratios, Rearte *et al*. (2003) observed that faecal N excretion and N secretion in milk were similar with both grasses but urine N output was significantly lower in cows on high sugar grass. Of the total N excreted in urine, urea N was the main N component affected by diet, being significantly higher in cows fed normal grass of low sugar content. Considering the proportion of digestible N that is not excreted in urine as a measure of biological value (BV) of ingested N, high sugar grass had a N component of higher BV than control normal grass. Expressed as a proportion of N intake, cows on high sugar grass had a higher excretion of N through faeces and milk and a lower excretion through the urine than cows fed normal grass. In that study N in milk of cows on high sugar grass was proportionally 0.52 higher and N in urine was proportionally 0.42 less than cows on control grass. The gross efficiency of use of dietary N for milk production by animals offered the high sugar grass (proportionally 0.35 of dietary N excreted in milk) and the control grass (proportionally 0.23 of dietary N excreted in milk) were similar to values quoted by Miller *et al.* (2001) and Peyraud (1997). The lower excretion of urea-N in urine with high sugar grass may reflect a difference in net N balance across the rumen together with protein catabolism. Protein catabolism was apparently hardly modified in this study but the difference in ruminal N balance between the two diets was in line with the difference in urea-N output which was actually reduced by 131 g/day with the high sugar grass compared to normal control grass.

Beside N contamination of the environment, methane (CH_4) production is another ruminant byproduct of concern in relation to the environmental impact of different production systems. Methane and CO_2 are the main gases contributing to the warming of the atmosphere and ruminants are identified as one of the main sources of methane gas. This gas is a byproduct of the enteric fermentation occurring in the rumen and its production is highly correlated with diet digestibility. Increasing the sugar content of grass improves its digestibility and therefore the production of CH_4 per production unit (kg of beef or l of milk) is reduced. Rearte (2003) estimated that production of CH_4 could be reduced from 644 to 379 g /kg of beef or 24 to 15 g /l of milk by improving diet digestibility by 8 percentage units.

Conclusion

Improvement of the nutritive value of temperate pasture continues to be a priority in grazing systems, but new quality parameters should be incorporated in the aims and objectives of plant breeders and pasture management specialists. Dry matter content, fiber digestibility, metabolizable protein and mineral content, among others, are still important parameters to consider but new analysis should be incorporated for a better understanding of the process that explains animal performance. Temperate pasture is an excellent source of nutrients for ruminants but a high energy:protein imbalance can occur when it is offered at the stage of optimal digestion. Increasing WSC content by breeding or grazing management could potentially not only improve animal performance but could also diminish environmental contamination by reducing the concentration of NH_3 in the rumen and consequently the excretion of urea through the urine. Increasing the digestibility of the forage would also reduce CH_4 production per unit of animal product.

Even when animal productivity, expressed as weight gain or milk yield, is still the main objective of using high quality pasture, ruminant product composition has to be considered in order to satisfy the present market demands. Beef and milk produced on grass in temperate regions have a composition with nutritional advantages over beef or milk produced in indoor systems based on concentrate. Beef and milk produced on temperate pasture have a lower content of saturated FA reducing the incidence and risk of arterial coronary diseases. It has also been proven that beef and milk from pasture are the richest natural dietary sources of CLA, which has been shown to have anti-cancer properties. Milk and beef quality and nutrient composition with potential health benefits will be the main characteristics demanded by the consumer in the near future. Grass breeding and grazing management should be applied in a way that will maintain or even improve the benefits and the properties of the product obtained from cattle grazing temperate pastures.

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