

Rotational grazing in the Flooding Pampa, Argentina

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About the authors

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Description: Grass-fed beef production at El Amanecer farm

Argentine beef cattle production is located in many agro-ecologically distinct areas, including the Pampa Prairie. 16 percent of the Pampa Prairie is occupied by grazing pastures, and these lands contain 57 percent of the country's total cattle stock. Within the Pampa Prairie, the Flooding Pampa sub-region receives an average rainfall of 900 mm/year, including alternating periods of drought and flooding. The Flooding Pampa is characterised by poor quality soils. Breeding beef cattle on continuously grazed and set stocking grasslands is the typical production system with an average annual meat production of about 70 kg/ha, a weaning of 80% and 0.6 cow equivalent per hectare (CE/ha)^{1 2} stocking rate.

El Amanecer farm is a 254 ha property, located in the Flooding Pampa. It is owned and operated by the Universidad Nacional de La Plata (UNLP) for beef production, researching and demonstrating farming practices. For the last 16 years the farm has been producing grass-fed beef. It currently has 358 heads of Aberdeen Angus cattle that have been adapted to the ecological conditions of the Flooding Pampa. The average annual meat production of El Amanecer is about 126 kg/ha, weaning is

¹ Cow Equivalent (CE) represents the average requirements of a pregnant and lactating cow of 400 kilos of live weight while they are rearing a calf of 160 kilos of live weight until weaning at six months of age.

² 1 CE/ha is approximately 0.88 Animal Units/ha

about 80% and global stocking rate is 1 cow equivalent per hectare (CE/ha). These figures show an improved production efficiency of the grazing system compared to elsewhere in the Flooding Pampa. The products of the farm are weaning calves, cull cows, heifers with pregnancy warranty and yearling bulls (or less than one year old). The latter are differentiated according to genetic selection (BREEDPLAN Angus Argentino), providing a higher market price when its semen or animals are sold at the market. Mesophyte wet grassland occupies 88 percent of the farm's surface, 4 percent is tall fescue pasture and 8 percent of the land is used for winter forage. Grass based forage is the only food for animals and no grain feed is used. Mating takes place from October to December which coincides with the period of highest forage availability.

El Amanecer has two main sectors. The first sector consists of multiparous cows which graze at a stocking rate of 0.7 CE/ha on wet grasslands. Winter and summer grasses (with green biomass throughout the year but a deficit in winter) build the basis for fresh and conserved feed in this sector. These grasses consist of 20 to 40 species, with an average vegetation cover of 80 percent and high above-ground net primary productivity, which varies between 3,000 and 6,000 kg DM/ha according to annual rainfall. The stocking rate is adjusted as a function of the balance between forage offered and the nutritional requirements of the cow (18.5 Mcal/day).

The second sector of production is for the replacement females only. The stocking rate for the sector is 1.5 CE/ha (a highest stocking rate compared to the global stocking rate of the farm which is about 1 CE/ha). From May to October, rearing heifers graze on a "winter species promotion" (WSP³). Rearing heifers and first-calf heifers rotationally graze, in a 5 year cycle, on tall fescue and white clover pasture (7,000 to 10,000 kg DM/ha above-ground biomass productivity) from November to April. Winter species are promoted annually, in paddocks with at least 3 to 7 grass species, an average vegetation cover of 70 percent and productivity between 8,000 and 12,000 kg DM/ha. Controlled continuous grazing and/or rotational grazing are used from May to October in this resource.

Land and grazing management

In the last thirty years, an expanding agricultural frontier has negatively affected the status of Pampa's ecosystems and the environmental services that they provide through habitat alteration, changes in biodiversity, increasing resistance to pesticides, altering nutrient cycles, changes in physical-chemical soil properties, and contamination of surface and underground water with nutrients and biocides (Montico, 2010). In addition, the Flooding Pampa faces further challenges that are specific to the environmental conditions of the sub-region.

Soil properties of the Flooding Pampa

The soils of the Flooding Pampa have a clay profile, low permeability and high salt content. They experience cycles of excess winter rainfall with slow drainage, alternating with summer droughts. In these conditions, annual crops can have a negative impact on soil physical properties. While soils

³ WSP: Involves the modification of wet grasslands into a winter grasses resource either by using a high stock density (mostly cow-calf pair), a grass mower (mechanically), or herbicides (chemically). All three methods intend to promote germination and establishment of winter annual species mainly *Lolium multiflorum*, *Bromus catharticus* and *Gaudinia fragilis* that are present in this grassland, and give the resource its high nutritive value.

have a phenomenal ability to "absorb" land use changes, this can lead to accelerated degradation or a decrease in production capacity. Throughout the Flooding Pampa, waterlogging, surface or sub-surface alkalinity and sodicity are the major limitations for agriculture. Within Flooding Pampa's toposequence, there are soils with better physicochemical characteristics that allow more "intensive" management than for the rest of the alkaline lowlands. These micro-regions tolerate process technologies (continuous monitoring of forage availability, evaluation of forage structure, stocking density/stocking rate, grazing management, etc.) and the application of technology inputs such as herbicides for weed control and fertilization. It is also possible to include winter or summer annual crops that can be grazed with set or variable stocking rates (providing a balanced supply and demand relationship) and with different grazing methods (continuous and rotational grazing) for maintaining structural stability of grass, improving the sustainability of land use in the medium and long term.

Rotational grazing

While breeding beef cattle in the Pampa Prairie are typically managed on continuously grazed grasslands, rotational grazing in the Flooding Pampa is a way of minimizing negative impacts on the land and environment.

Rotational grazing (Allen *et al.*, 2011) has two important implementation aspects: the stocking period and the resting period, which vary according to the rate of growth of winter and summer grasses and the weather situation. The stocking and resting periods allow grasses to regrow and accumulate carbohydrates in their roots. Growth of the root system allows grasses to absorb more water and nutrients which results in higher biomass productivity. It also ensures species persistence and increases their tolerance during adverse periods such as droughts. Through rotational grazing, the continuous use of pastures is possible, allowing cattle to be fed without supplementation strategies. Further optimization strategies include the practice of early weaning, adjusting the timing of selling cattle, management of stocking rates and hay supplementation during fresh feed shortages.

No supplementation strategies

The supplementation strategies used at El Amanecer are based on the availability and quality of fodder. The nutritional requirements of the animals, and forage production (canopy height, tiller density, forage mass, above-ground biomass, chemical composition of the forage, harvest index, etc.) are constantly monitored in order to establish the stocking rate that optimizes these factors. The main aim of El Amanecer's management is to balance these variables so that the system does not require extra feed other than grass.

Using this information, El Amanecer's management strategies can be adjusted to cope with climate variability. For example, lower rainfall during 2008 affected forage growth. As a consequence, cows' body condition scores decreased and they were supplemented with hay during the winter. Early weaning was carried out in December because the drought had continued through spring. Calves were fed with corn grain and ad-libitum hay. In March, after pregnancy testing (rectal palpation), empty cows were sold. Due to the lower growth of the winter species promotion and tall fescue pasture replacement female calves, had to be supplemented from July to September with 1 kg/day of corn grain. Again in 2011, water deficit affected the productivity of forage resources. The lack of rainfall in June and July and excesses water in the spring of 2012 caused a lower average body

weight gain in the rearing heifers. Stocking rates were decreased accordingly with fewer heifers available for early mating.

Management of stocking rates

Managing the stocking rate and grazing pressure is an important strategy for rearing heifers in this farming system (Agnelli *et al.*, 2011; Eirin *et al.*, 2011). The core variables that directly affect animal production are the quality of pastures (as the only source of forage) and the stocking rate. Two strategies have been developed at El Amanecer. Firstly, a stocking rate that optimizes the performance of beef rearing heifers for early mating has been established. For this strategy, an average stocking rate of 1.5 CE/ha is used to achieve the threshold weight (two-thirds of the average mature live weight, or approximately 260 kg) for early mating (at 15 months) in a high percentage (50-70 percent) of rearing animals. Alternatively, if a stocking rate of 2 CE/ha is used, it is possible to sustain high stocking rates in winter, allowing for more efficient use of spring forage and high production of meat (as much as 246 kg/ha compared to the average annual meat yield of 126 kg/ha). Both of these strategies have been shared with local farmers.

Other coping strategies and monitoring of success

Further strategies for improving the operations on the farm included estimating the palatability of forage resources; estimating above-ground biomass, floristic composition and a harvest index of forage resources; undertaking systematic soil tests and weed control; controlling grazing selection using accurate methods, monitoring animal behaviour and welfare; springtime breeding; complying with the sanitary calendar; selection of animal breeds (genetic selection); and introducing the G3 system (Gestor Agro: an accounting program for management control). Staff training in farm operations improvement was another aspect that has been important for optimizing performance.

Results: Increased meat production and positive environmental effects

The management strategies outlined in this case study have had a positive impact on directly measureable reproductive and productive parameters on the farm (Table 1).

Table 1. Reproductive and productive parameters of the critical years (2008 and 2012) and preceding years (2007 and 2011)

Parameters	2007/08	2008/09	2010/11	2011/12
% pregnancy	93.5	78	90	94
% calving	88.5	75	82	86
% 15 months heifers	72	58	69.5	66.5
Stoking rate CE/ha	1.07	0.85	0.96	0.88
Meat productivity kg/ha/year	141	99	147	105

The management strategies applied at El Amanecer have also had positive environmental impacts for the farming system. Rotational grazing has led to the accumulation of above-ground dead

material, which has a positive effect through decomposition, benefiting microorganisms and increasing the organic matter content. This in turn makes nitrates available for plants. Rotational grazing has enhanced water infiltration, improving vegetation cover, leading to better water utilization and slowing weed invasion. Through these pathways, rotational grazing can improve the chemical and physical properties of soils and enhance the distribution of animal excreta.

Rotational grazing has also promoted the establishment of native grass species. Vegetation surveys show the presence of 20-40 forage species, mostly consisting of native grasses. Their seasonal growth is strongly linked to annual rainfall. Introducing rest periods has encouraged flowering and fruiting in certain seasons and their germination and establishment in others.

Through 15 years of studies and training, Agnelli and colleagues have been able to determine the species of key grasses that allow the design of methods or grazing strategies in this agro-ecosystem. Rotational grazing strategies have helped to reduce the selection of higher nutritive value species by animals, avoiding overgrazing and promoting a balanced floristic composition. Managing grazing intensity and leaving a remnant to appropriate and fast grasses recovery helped to achieve the balance between available forage and livestock requirements. Adjusting the stocking rate helped to promote a productive system, while making the performance and structure of grasslands more sustainable (Ansin *et al.*, 2004). As a result, a stable long term stocking rate has been achieved with 80 percent higher meat production compared to the zonal average in the Pampa grasslands.

Lessons learned

The El Amanecer case study demonstrates that land management and optimization strategies can increase production while preventing harm to the environment. Rotational grazing has allowed the continuous use of pastures and led to persistence of key forage species by minimising negative impacts on the land. Optimising stocking rates and management strategies has improved the sustainability of grass-fed meat production. The following lessons have been learned in establishing and adopting the management strategies described in this case study:

- Knowledge of grassland ecosystem functioning and production is important to establish strategic rest intervals in grazing to favour the persistence of key forage species and develop a sustainable agro-ecosystem management;
- Selecting animal breeds that are adapted to environmental conditions and can utilize available feed resources in a sustainable way is an important strategy;
- By planning and adjusting stocking rates it is possible to achieve grazing with no supplementation of grain except for hay;
- The grazing strategy developed for breeding cattle on El Amanecer works successfully and it can be replicated by other producers with a minimum financial investment and process technologies.

Evaluating forage species and adjusting livestock management accordingly can help improve the sustainability of agro-ecosystems. Therefore, an improved knowledge of grassland plant communities and their seasonal dynamics in accordance with the annual precipitation is important, alongside information on key indicators of Above-ground Net Primary Production, growth rates of key species, percentage of plant canopy cover, tiller density and nutritional requirements of

livestock. Applying this knowledge of agro-ecosystems to land management practices and process technologies can enhance resilience in response to a range of situations that could arise, including floods, droughts, sanitary problems, low prices and economic crisis.

In the near future, El Amanecer aims to make further improvements to farm infrastructure. These include introducing drinking trays, shade installation and shelter trees on paddocks as well as new farm buildings for interacting with different stakeholders and exchanging experiences and knowledge. In this way, the lessons learned at El Amanecer can be shared with others.

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